INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE

IFPRI

RESEARCH PROGRAM ON Policies, Institutions, and Markets

CGIAR

Led by IFPRI

IFPRI Discussion Paper 02140

October 2022

How do Quantitative Gender Indicators Compare to Qualitative Findings in the Analysis of Gender Differences in Agricultural Productivity?

Evidence from Uganda

Lukas Welk

Christine Bosch

Elizabeth Bryan

Edward Kato

Greg Seymour

Regina Birner

Environment and Production Technology Division

INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE

The International Food Policy Research Institute (IFPRI), a CGIAR Research Center established in 1975, provides research-based policy solutions to sustainably reduce poverty and end hunger and malnutrition. IFPRI's strategic research aims to foster a climate-resilient and sustainable food supply; promote healthy diets and nutrition for all; build inclusive and efficient markets, trade systems, and food industries; transform agricultural and rural economies; and strengthen institutions and governance. Gender is integrated in all the Institute's work. Partnerships, communications, capacity strengthening, and data and knowledge management are essential components to translate IFPRI's research from action to impact. The Institute's regional and country programs play a critical role in responding to demand for food policy research and in delivering holistic support for country-led development. IFPRI collaborates with partners around the world.

AUTHORS

Lukas Welk (lukas_welk@web.de) was a MA student at University of Hohenheim as well as an intern at the International Food Policy Research Institute (IFPRI), supported by Arbeitsgemeinschaft für Subtropische und Tropische Agrarwirtschaft e.V.

Christine Bosch (christine.bosch@uni-hohenheim.de) is a postdoctoral researcher at University of Hohenheim, Germany.

Elizabeth Bryan (e.bryan@cgiar.org) is a senior scientist in IFPRI's Environment and Production Technology Division, Washington, DC.

Edward Kato (e.kato@cgiar.org) is a senior research analyst in IFPRI's Environment and Production Technology Division, Kampala, Uganda.

Greg Seymour (g.seymour@cgiar.org) is a Research Fellow in IFPRI's Environment and Production Technology Division, Washington, DC

Regina Birner (Regina.Birner@uni-hohenheim.de) is head of the chair social and institutional change in agricultural development at University of Hohenheim.

Abstract

In sub-Saharan Africa, female-managed plots often show a significant gap in productivity compared to men's plots. To examine these differences, a variable to determine who in the household controls agricultural plots is needed. There is variability in the ways in which gendered control over agricultural plots is defined and measured across studies. Many studies show that an in-depth analysis of intra-household relationships is necessary, as this is often a major unexplained factor in productivity differences. To contribute to filling this methodological gap, we estimate the productivity gap among male and female farmers in Uganda using three different identification approaches and conduct complementary qualitative research to investigate the underlying causes of these differences. The three approaches to define control over plots are: (1) gender of the plot manager, (2) gender of the main plot-level decision-maker and (3) on gender of decision-maker over income from the sale of crops. Results show significantly different gender productivity gaps of 16% (1), 43% (2) and 60% (3). Qualitative results confirm the variability in the way that households defined plot management, including multiple ways in which decisions are made or activities are distributed within households on jointly managed plots. Mixed-method research designs and improved gender variables for econometric models can contribute to a better understanding of gender productivity differences and better policy making aiming to reduce gender inequalities.

Keywords: Gender productivity gap, plot management, Uganda, mixed methods, gender variable

Acknowledgements

This work was funded by the German Federal Ministry for Economic Cooperation and Development (BMZ) through the Fund International Agricultural Research (FIA) project of the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH under the project 'Reaching Smallholder Women with Information Services and Resilience Strategies to Respond to Climate Change' (grant number 8123525). Lukas Welk also received support from ATSAF e.V. under the Junior Scientist Program internship, and data collection was undertaken under the CGIAR Research Program on Policies, Institutions, and Markets (PIM).

The authors are grateful to Dr. Patience Rwamigisa and Butele Cosmas Alfred, as well as the extension officers and drivers from the Ministry of Agriculture, Animal Industry and Fisheries of Uganda for their help in organising the focus groups and support in Uganda. They are equally grateful to Herbert Kamusiime and his team from Associate Research Trust- Uganda for collecting the intra-household survey data. We are indebted to all the women and men farmers who had provided their time to talk to us about their climate change and agricultural productivity challenges and solutions. The analysis is the sole responsibility of the authors and does not reflect the views of any funding agency or organization mentioned here.

1. Introduction

Although agricultural productivity substantially increased around the world, and particularly in developing countries in the past decades, a significant gap between men's and women's agricultural productivity persists. Based on limited data, this gap is roughly estimated at 4 to 28% (Puskur et al. 2022; FAO 2011; Mukasa 2015; World Bank 2014). The reasons for this difference are manifold. Women have less access to productivity-enhancing technologies and practices as well as information compared to men, which limits their adoption (Kosec et al. forthcoming). Social and cultural norms further limit women's participation in household decision-making on agricultural production (Kristjanson et al. 2017, Quisumbing et al. 2019). In addition, women suffer from time constraints due to childcare and other domestic responsibilities (World Bank 2014; Bowen et al. 2015). Besides access to information and norms, gendered differences in land ownership as well as in access to financial services and differences in input use (FAO 2011) and lower quality land (Quisumbing 1996) are paramount in explaining the yield gap. Closing these gaps would increase the agricultural output in Uganda by 2.8 percent (Puskur et al. 2022), and, at the same time, reduce the number of undernourished people by 12-17 percent (FAO 2011). This is because women are more likely to spend a larger share of their income on food, health, and education, which, in the long run, has positive implications for human development (FAO 2011).

To examine gender differences of crop productivity, a variable is needed to determine which gender manages which plot. In this paper, productivity means yield output per unit. There is variability across studies regarding the ways in which gendered control over agricultural plots is defined and measured. Numerous studies examine gender differences in agricultural productivity using various measures of gendered plot management. Some studies use only the household level to examine gender differences due to lack of adequate data (De la O Campos 2016). Other studies use only male and female managed plots as indicator (Mugisha et al. 2019; Mukasa et al. 2015, Oesni et al. 2015). Few studies also use additional information to determine plot management. For example, De la O Campos et al. (2016) use parcel owners and parcel managers next to a household level variable. Diiro et al. (2018) create three possible plot manager variables (female-managed plots, male-managed plots and jointly managed plots) based on two questions: "Who in the household makes decisions on crops to be planted, input use and timing of crop activities?" and "Who in the household manages the plot? Some of these approaches also show that different indicators for measuring women's plot management lead to different results (La O Campos et al. 2016; Doss 2015; Peterman et al. 2011). For instance,

De la O Campos et al. (2016) find a 10% gender productivity gap if they use when using female plot manager as the gender variable but no gender gap for other variables.

There also is evidence that typical gendered plot management variables are not sufficient for identifying how gender and decision-making of household members play a role in productivity as simple plot management variables do not capture the nuances in how gender roles in decision-making influence productivity (La O Campos et al. 2016; Doss 2015; Quisumbing and Doss 2021).

To measure gender productivity differences, the majority of studies uses quantitative approaches. The most common approach is Kitagawa-Oaxaca-Blinder (KOB) decomposition. This method decomposes gender differences into differences in the mean values of the endowments of the two groups and the group differences in the returns to these endowments (Aguilar et al. 2015; Mugisha et al. 2019; World Bank 2014; Bowen et al. 2015; Joe-Nkamuke et al. 2019; La O Campos et al. 2016). However, the aforementioned method does not examine intra-household relationships or decision making. Only few studies (Akram-Lodhi and Komba 2018; Mugisha et al. 2019) incorporated qualitative methods to examine these relationships. For instance, using mixed methods, Akram-Lodhi and Komba (2018) identified that the main reason for low productivity was the lack of female labor to work on their own plots, as women have many domestic and social responsibilities – and not, as hypothesized, the lack of male family labor, which the same authors had found in an earlier quantitative analysis.

Moreover, in quantitative approaches, plot yields are either assigned to one respondent via IDs that can be linked to certain plots (Diiro et al. 2018; La O Campos et al. 2016) or to the household (Wouterse 2019). Both approaches have their advantages and disadvantages. On one side, the single respondent variable allows comparisons of male- and female-managed plots. On the other side, it is often hard to disentangle and assign yields to one gender (Doss 2014, 2015; Quisumbing and Doss 2021). Doss (2014) also points out that it is important to clarify who to identify and how, which individuals are involved in the various activities as owners, managers, workers, and decision makers, and not to assume that a particular person performs these activities based on social norms, to capture how gender patterns in agriculture are changing.

Specifically in Uganda, the findings of Doan and Hoffmann (2021) show that women spend a lot of time working on coffee. However, root crops, which only contribute a small proportion to the household income compared to cash crops, are more prominent among women. The income from these staple crops is also mostly controlled by women while they hardly have

control over the income from cash crops such as coffee. As growing high value crops usually requires a certain investment, women are often also hindered by structural factors such as lack of money. In addition to this, women are also known to hardly own land and own fewer assets than men (World Bank Group 2019; Doss et al. 2014). Moreover, the evidence from Niger shows that lack of plot ownership limits their decision-making power regarding inputs and their control over the income (McGee and Backiny-Yetna 2015). Findings from Tanzania show that plots women are assigned by men within their households are usually smaller (Slavchevska 2015; Akram-Lodhi and Komba 2018) and less fertile (Akram-Lodhi and Komba 2018). In addition, while men are more likely to freely decide to spend time on productive activities, women first and foremost have to spend time on reproductive activities (World Bank 2014; World Bank Group 2019) which may also restrict them to plots near the house. This time constraint is often increased, as women in some contexts are expected to work on men's plots additionally as found as well in Tanzania (Akram-Lodhi and Komba 2018). Furthermore, Akam-Lodhi and Komba (2018) found that underlying social norms may determine women's roles as food provider for the household which leads them to planting diverse food crops. However, considering that they may still be involved a lot in working on cash crops, the distinction between plot managers is particularly complex.

All this shows that there is no generally valid concept for the management of a plot. Rather, the management of a plot is an overall concept that is used as a general term but can also be broken down into different components (see Figure 1). Basically, plot management includes two major aspects: Who works on a plot and who decides over what is produced or how the income earned with it is used. These aspects are determined by additional factors. Ownership plays an important role in having authority in decision making, however, other factors such as social norms or which crop is planted may also be relevant in many contexts. In addition, decision-making is highly subjective – men can perceive that women have control over a certain plot while women may perceive that they do not. Inputs such as labour or agrochemicals, however, can be objectively measured.

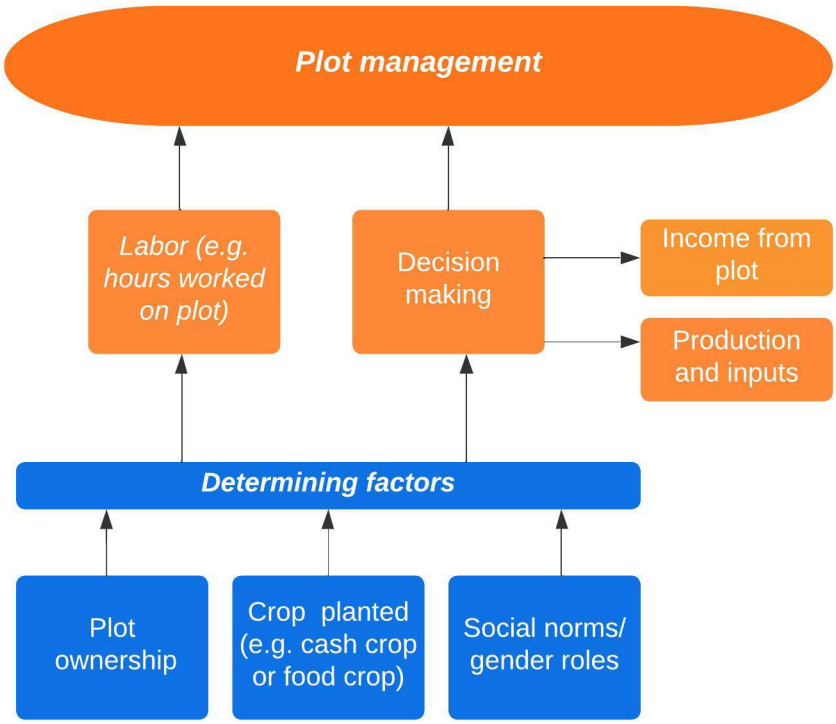

Figure 1: Conceptual framework of plot management (Source: Authors)

Hence, the measurement issue is that using simple variables to define plot-level management and often misses the complex underlying complex household decision-making processes regarding agricultural production (Doss 2015). Additionally, the literature shows that it is important to consider the fact that there are many forms of joint plot management in crop cultivation (Doss 2018; Doss and Quisumbing 2020; La O Campos et al. 2016). Some authors argue that only examining productivity on plots, while ignoring the relationships at the household level, may not lead to exact results (Doss and Quisumbing 2020). In addition there is evidence that mixed methods can contribute to a more holistic picture of complex gender relationships (Behrman et al. 2014, Puskur et al. 2022).

This paper contributes to the literature by exploring complex agricultural decision-making processes with qualitative methods and by using these findings to explain significant differences in gendered productivity outcomes using different quantitative measures. By exploring the productivity differences quantitively and qualitatively, the study aims to identify which quantitative measures of women's plot management are relevant. Finally, this study has implications for how quantitative gender indicators can be defined to better capture the complexity of household dynamics by comparing quantitative and qualitative data.

The next section of the paper describes the study area, the sampling approach, and the data sources. This is followed by a discussion of the methods used in the analysis, including the various ways in which gender differences in crop productivity are defined using the quantitative

and qualitative data. After presenting and discussing the results, we derive implications for developing gender indicators and analysing productivity gaps.

2. Data and Methods

To learn more about previous approaches, the first step was to conduct a literature review as given in section 1. As a second step, a quantitative dataset (described in the next section) was analysed. Descriptive statistics were compiled to compare the productivity of plots or gardens managed by female and male farmers using the various measures to define plot management and time use data for various activities. As a third step, focus group discussions were conducted in Uganda to collect data on the underlying reasons for productivity differences and on gendered plot management. In addition, extension officers were interviewed to triangulate the findings.

2.1 Study area and sampling

The study area is the central region of Uganda, coloured in yellow in the map below (see Figure 2). Of the 24 districts in Central Uganda, 6 districts (Rakai, Nakasongola, Mubende, Bukomansimbi, Kiboga, and Kalungu) were targeted for the research project 'Reaching Smallholder Women with Information Services and Resilience Strategies to Respond to Climate Change'[1] led by IFPRI, and an intra-household survey was carried out in October 2020.

[1] https://www.ifpri.org/project/grassroots-women-information-on-adaptation (access date: 22.03.2021)

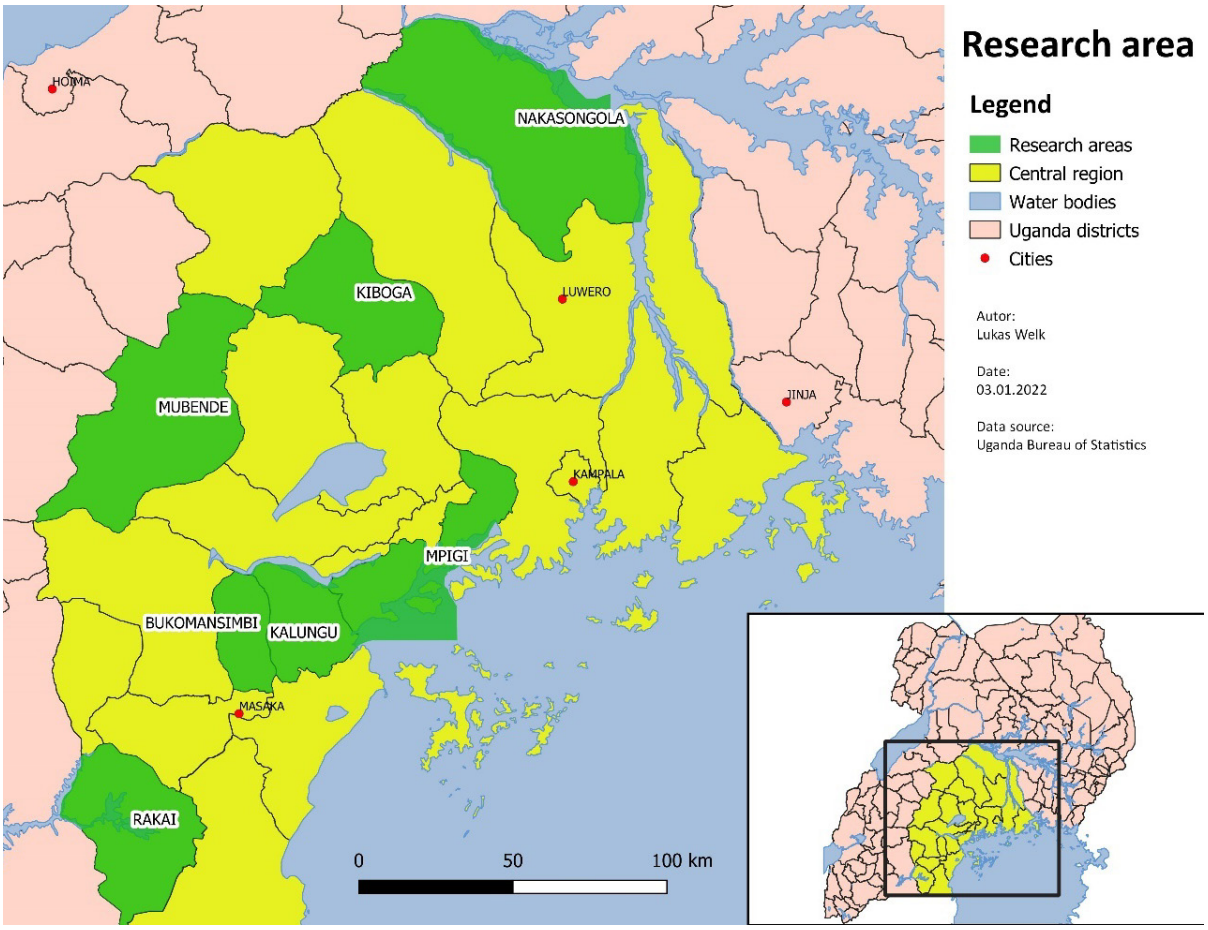

Figure 2: Research area in Uganda

The districts were selected based on the percentage of farming households and poverty levels, using data from the Ministry of Agriculture, Animal Industry and Fisheries (MAAIF). Districts with more than 50% of their total number of households as farming households were considered agricultural districts and were eligible for selection. Among the agricultural districts identified in the study area, the three richest (Rakai, Nakasongola and Umbanda) and three poorest (Bukomansimbi, Kiboga and Kalungu) were selected for the survey. In consultation with the District Production Officer (DPO) in each target district, one sub county was selected, and in each sub county, one village was randomly selected to participate in the project. The selection of villages as well as the participants for the focus group discussions (FGDs) was random.

2.2 Quantitative data sources

To identify the productivity differences quantitively, we used primary household and intra-household survey data obtained by IFPRI. Together with partner institutions, a quantitative baseline survey was conducted in the central region of Uganda in October 2020. The dataset contains responses from 1,443 individuals (723 women and 720 men) from 720 households. Data were elicited on individual and household characteristics, including employment, access to services, resources, food security, plot management, and production and sales of crops and

livestock. To capture issues related to women's empowerment, we calculate the Abbreviated Women Empowerment in Agriculture Index (A-WEAI), developed by IFPRI and partners (Malapit et al. 2020; Malapit et al. 2017), which includes a sub-set of questions from the original WEAI (Alkire et al. 2013). The index captures women's agency and intra-household relations, aspects which are often missing in studies according to Doss (2018). The A-WEAI asks the same set of questions to the main male and female decision-maker within each household, including questions about their participation in decision-making around crop and livestock production and income generation, access to and control over productive capital and credit, time burden and group membership. The time allocation module, in particular, is examined in detail in this paper with descriptive statistics.

2.3 Determination of the plot management and analysis

Before gender differences can be investigated, a variable must be developed for the plot manager to assign plots to a specific gender. Existing evidence mentioned in the background section show that considering joint plots is important to avoid misleading results based on the simple division of plot management by solely male or female (Doss and Quisumbing 2020). Thus, additional approaches that have an option for a joint plot management indication were used. Three different approaches were included that measure different definitions of plot management (see Table 1). Approach 1 is based on a direct survey question asking who in the household manages the plot. This approach assumes, that a single household member manages the plot, whereas approaches 2 and 3 follow previous methods used by World Bank (2014) and require more substantial assumptions as they are based on a combination of decision making and plot-level data. In these approaches the plot manager is defined as 'the individual(s) within the household who decide(s) which crop(s) to plant on the plot' (approach 2), and the 'individual within the household who is reported to control output from the crops planted on that plot' (approach 3). The latter two approaches are defined using the intra-household WEAI questionnaire module which asked the same questions of one female and one male household member. Plots were classified as female-managed, male-managed, or jointly managed based on the crop type (i.e. whether food or cash crop). Most households in this study have one to three plots per household.

Table 1: Design of approaches to determine plot manager

Approach 1: Plot manager	
Question:	*'Who manages this plot?*
Male if answer:	Male
Female if answer is:	Female
Comment:	The sex of the plot manager is determined by the ID obtained from the household roster section. Therefore, there was no option to answer whether the plot was managed jointly. Only the men were asked about crop production and answered this section for their whole household, men's responses thus determined who managed the plot.
Approach 2: Plot manager by plot decision-maker	
Questions:	*'When decisions are made regarding [Activity], who is it that normally takes decisions?'* *'How much input did you have in making decisions about [ACTIVITY]?*
Male if answer:	If respondent is male and answer = 'self' If respondent is female and answer = 'spouse'
Female if answer:	If respondent is female and answer = 'self' If respondent is male and answer = 'spouse'
Jointly if answer:	If answer is 'both' If answer is 'other household members' and 'Input into most/all decisions'
Comment:	Only the answers for the activities 'food crop farming' and 'cash crop farming' were considered. We merged the information of approach 2 and 3 to the crop production dataset by classifying the crops cultivated into two groups: **Cash crops:** Banana, Coffee, Timber trees, Tobacco, Cashew, Eucalyptus trees, Sugarcane **Food crops:** Maize, Beans, Cassava, Irish potato, Sweet potato, Tomato, Groundnut, Finger millet, Cow peas, Eggplant, Onion, Watermelon Sorghum, Pepper, Mango We are aware, that some of these crops are used for both sales and household consumption, as for instance maize or banana (matoke). Only the main crop of the plot was considered, so a plot can only be food or cash crop.

Approach 3: Plot manager by income decision-maker	
Question:	*'How much input did you have in decisions on the use of income generated from [Activity]?'*
Male if answer:	If respondent is male and answers = 'Input into most/all decisions' If respondent is female and answers = 'No input/input into few decisions'
Female if answer:	If respondent is female and answers = 'Input into most/all decisions' If respondent is male and answers = 'No input/input into few decisions'
Jointly if answer:	If respondent is male and answers 'Input into some decisions' If respondent is female and answers 'Input into some decisions'
Comment:	Only the answers for the activities 'food crop farming' and 'cash crop farming' were considered. We merged the information of approach 2 and 3 to the crop production dataset by classifying the crops cultivated into two groups: **Cash crops:** Banana, Coffee, Timber trees, Tobacco, Cashew, Eucalyptus trees, Sugarcane **Food crops:** Maize, Beans, Cassava, Irish potato, Sweet potato, Tomato, Groundnut, Finger millet, Cow peas, Eggplant, Onion, Watermelon Sorghum, Pepper, Mango We are aware, that some of these crops are used for both, earning income and as a staple crop as for instance maize. Only the main crop of the plot was considered, so a plot can only be food or cash crop.

Determination of the productivity differences and crops cultivated

To examine the differences, yield value per ha on a plot was calculated and the three approaches shown in Table 1 were used to determine which plots are managed by males, females or jointly. To calculate the yield value per plot, current market prices of each crop were used. Subsequently, the average value of agricultural crop output produced per unit of land was calculated per hectare to have a comparable measure for productivity as done by World Bank (2014). The yield data (as reported by the male respondent) and yield value data were examined using descriptive statistics and mean comparison tests. In addition to comparing yield value (productivity differences hereafter), data for men and women using the three approaches, we also compare which crops are cultivated by men, women or jointly for each plot management approach.

2.4 Qualitative data collection and analysis

In collaboration with MAAIF and IFPRI, 14 focus group discussions were conducted between November 29 and December 9, 2021, in the 6 Ugandan districts where the quantitative survey was conducted. A pretest of the focus group protocol was conducted on November 26, 2021, in Mpigi district. In total, 141 farmers participated in seven FGDs, including 70 women and 71 men (see Table 2). The participants were selected by the local extension officers, who organized the groups in cooperation with the MAAIF. The FGDs were sex-disaggregated, and all FGDs were facilitated by a female research assistant. Two of the authors (both male) were present at the FGDs with men. The interviews were conducted in the local language, Luganda. The facilitator took notes and recorded the discussions with farmers' consent. The recordings were transcribed and translated from Luganda to English. The FGDs conducted using a semi-structured discussion format and covered the following themes: 1) farm characteristics and livelihood activities, plot management and the differences between male and female farmers; 2) awareness of gender differences in agricultural productivity, reasons for the gap, and how it can be closed; 3) access to information, 4) interventions to reduce the gender productivity gap and relationship between women's empowerment and gender differences in agricultural productivity. All sections included a series of exploratory questions.

Table 2: Focus group discussion locations and number of female and male farmers interviewed

District	Women	Men	Total
Mpigi	12	7	19
Rakai	12	12	24
Bukomansimbi	6	11	17
Kalungu	10	14	24
Mubende	13	12	25
Kiboga	8	7	15
Nakasongola	9	8	17
Total	**70**	**71**	**141**

To triangulate data from the FGDs and to obtain additional information, the respective agricultural extension officer of each district and village where a FGD was conducted was interviewed. Six out of seven extension officers were male. The interview time was approximately 30 minutes. Notes were taken during the discussion and summarized subsequently. During daily de-briefing sessions, notes were discussed among the research team.

The transcripts were analyzed by the first author summarizing and grouping the responses to each of the research questions. The analysis was structured based on the protocol. To obtain a complete answer, relevant information was transferred from questions asked to the same group.

3. Results

3.1 Descriptive statistics of differences in crop productivity and crops cultivated

The descriptive statistics for all three approaches show significantly higher productivity on male-managed plots compared to female-managed plots. This difference increases when, instead of the plot manager, the plots are separated by production decision-maker or income decision-maker (see Table 3). Approach (1) shows a difference of 16%, approach (2) a difference of 43% and approach (3) a difference of 60%. Additionally, there is a productivity gap between jointly managed and female-managed plots in approach two, but the difference is not statistically significant. In approach 3, there is a significant gap of 52% between jointly- and female-managed plots. Moreover, the results show that there is a 19% gap between the yield value of plots women manage according to approach (1) compared to the plots women solely make decisions on (approach 2). Women control only half the income from plots they manage according to approach (1) as there is a 49% gap between approach (1) and (3). The gap between approach (2) and (3) is 38%, so women control the income of about two thirds of the plots they make crop production decisions on.

Table 3: Descriptive statistics of gender productivity differences

Approach	Sex of plot manager	Mean plot yield value per ha (in 1000 UGX)		Difference to female plots
(1) Plot manager by direct question	Male	460[2]	*	16%
	Female	387		-
(2) Plot manager by decision-maker on crop production	Male	553	**	43%
	Female	315		-
	Jointly	400		21%
(3) Plot manager by income decision-maker	Male	491	***	60%
	Female	196		-
	Jointly	409	***	52%

significant at *** p<0.01, ** p<0.05, * p<0.1. Source: Author's calculations based on survey data

[2] 1 USD = 3,713 UGX

In addition to yield, crop type also varies when a different gender indicator is chosen for plot management. Table 4 shows the differences in which sex grows which crops, for the most commonly planted crops. A big difference can be seen especially between the first approach and the other two approaches, as they have the option of joint plot management. Using approach 1, male and female plots do not differ much in terms of the crops they cultivate. The total number of plots farmed is also quite similar. However, looking at the plot decisions using approach 2, it is found that men grow more cash crops, such as coffee and bananas, than women, while most jointly managed plots are planted with both cash and food crops. This trend is even more pronounced using approach 3. For example, 93 male managers and only 1 female manager of coffee plots were found. Again, most of the plots are jointly managed. With approaches 2 and 3, not all plots used in approach 1 could be assigned to a gender due to missing data.

Table 4: Crop cultivation differences for different approaches separated by male, female or joint plot management

Crop	(1) Plot manager by question		(2) Plot manager by input decision-maker			(3) Plot manager by income decision-maker		
	M	**F**	**M**	**F**	**J**	**M**	**F**	**J**
Banana	145	145	64	20	157	102	4	111
Beans	170	192	48	58	245	105	81	169
Cassava	62	51	18	19	70	37	27	45
Coffee	103	155	53	16	165	93	1	119
Groundnut	19	21	-	7	27	-	10	20
Potato	16	18	-	-	2	-	-	2
Maize	258	230	91	70	311	156	88	235
Sweet Potato	52	40	16	14	59	36	18	36
Tomato	9	19	5	1	21	4	4	19
Timber	6	1	3	-	4	4	-	3
Total	**840**	**872**	**298**	**205**	**1061**	**537**	**233**	**759**

Source: Authors, based on survey data

3.2 Descriptive statistics of time spent on activities

The data from the household survey also gives insights on how much time male and female farmers spend on average on certain activities per day (see Table 5). The results indicate that men spend significantly more time on agriculture in general, namely 90 minutes, on average.

However, while men spend significantly more time on cash crop production with an average of 231 minutes per day, women still spend 200 minutes on cash crop production. On staple crop production, men spend 65 minutes which is also significantly more than women, who spend 46 minutes. Time spend on livestock production is also significantly different, with men spending 64 minutes and women spending 25 minutes a day. In turn, women spend significantly more time on non-agricultural work, which includes time spent on off-farm income-earning activities, such as running a shop or craft making, namely 316 minutes, while men only spend 127 minutes on these types of activities. Women also spend significantly more time than men on childcare, namely 719 minutes, while men spend 212 minutes.

Table 5: Time spent on activities by gender

Variable: Time spent on…	Sex	Mean time spent (minutes)		N	SD
Agricultural work	Male	361	***	720	205
	Female	271		723	168
Cash crop production	Male	231	***	720	211
	Female	200		723	173
Staple crop production	Male	65	***	720	141
	Female	46		723	112
Livestock	Male	64	***	720	122
	Female	25		723	52
Non-agricultural work	Male	127	***	720	209
	Female	316		723	175
Childcare	Male	212	***	720	373
	Female	791		723	533

Note: significant at *** p<0.01, ** p<0.05, * p<0.1

Source: Authors, based on survey data

3.3 Results of focus group discussions and interviews

Plot management and activities

Who manages a plot often cannot easily be answered, as tasks overlap, and each spouse plays a specific role on different plot types, such as plots for cash crops or kitchen gardens. For instance, women's tasks in agriculture are mainly planting, weeding, harvesting, threshing, drying and storing harvested crops, whereas men's tasks involve slashing, burning and spraying grass with pesticides, garden preparations like ploughing and digging holes for planting, planting, adding fertilizers, harvesting, transport, packaging and storing, looking for a market and selling (see Table 6). Activities done together are planting, harvesting and sometimes

weeding and threshing. The distribution of these tasks depends on who controls the plot. Most women in all 7 FGDs stated that they conduct these activities on all household plots including ones managed by men, their own plots, and jointly managed plots. Men focus their energy on their own and the jointly managed plots and only sometimes help women on their own plots with activities, such as soil preparation or spraying pesticides. Additionally, women do domestic work and childcare. Moreover, men are likely to sell both theirs and the women's crops. Most households have joint or family gardens, which are used to produce food for home consumption. Family gardens often include banana and are intercropped with coffee, but sometimes also have sections where food crops are grown. Women mostly work under instructions of the men who for instance decide which bunch of bananas is kept for home consumption and which one is sold. The women's task in these gardens, besides the cultivation of crops for home consumption, is the pruning of the banana stems. Women are expected to cultivate these, but gardens are owned by men who are the main decision-makers:

'*The woman and the children have to provide labour in the banana plantation, this garden is for the whole family because that is where we get food from and income for the family. But it is the man who has authority over it'.*

Table 6: Activities in crop production mentioned in the FGDs

Activity	Activity done by men (Number of FGDs)	Activity done by women (Number of FGDs)	Activity done together (Number of FGDs)
Planting	2/14	14/14	7/14
Weeding	0/14	14/14	5/14
Harvesting	2/14	12/14	9/14
Drying	0/14	3/14	-
Threshing	0/14	4/14	1/14
Packaging	1/14	1/14	-
Storing	1/14	3/14	-
Slashing, burning grass	8/14	2/14	-
Garden preparation, ploughing, digging	10/14	0/14	-
Applying agrochemicals	12/14	2/14	-
Adding fertilizers	3/14	0/14	-
Transport	5/15	0/14	-
Looking for market	5/14	0/14	-
Selling	5/14	0/14	-

Source: Authors, based on survey data

Plot ownership and crops cultivated

In all seven districts, the plot management and crop cultivations differences between male and female farmers were found to be similar. Firstly, most of the land is owned by men while only a few women own land themselves. The major difference between men and women is the objective with which male and female farmers approach agriculture, driven largely by social norms. Men overall view agriculture as a business to earn money, while most of the women perceive themselves engaging in agriculture only for subsistence and selling production surpluses when there are any:

'As a woman, although I have separate gardens, they are still for home food. In case I have a surplus, then I sell. But whatever the man plants is for selling.'

As men see themselves as the main income earner and because they own the land, they use the larger plots to produce on a large scale whereas they assign women a smaller parcel in the family plots. These are male-owned plots all household member work on, to produce food for home consumption:

'*Coffee is mainly the crop that belongs to the husbands, but coffee […] is usually intercropped with bananas, which can be for selling or home consumption. The big bunches in the plantations are usually for selling. We mainly eat the small bunches*.'

However, some women lease land themselves to produce more. The above-mentioned roles and circumstances lead to different crop production patterns: Men usually focus on one or a few perennial cash crops like coffee and banana but also maize, while women grow many different crops like maize, sweet potato, cassava, beans, groundnut, vegetables, millet. As women often have smaller plots, they tend to plant annual crops. The extension officers confirmed this assessment of men's and women's roles in production. While men refer to the coffee and banana garden as a common plot of land, women see it as the man's garden, since the income from the sale of coffee and bananas is received, kept, and used by the man. In addition, men often did not know about what or how much women produce.

Crop production and income decision-making

In 12 out 14 FGDs, the respondents indicated that men are the main decision-makers on the land they own and on the jointly managed plots. Yet some men include women in decision-making processes and discuss issues with them regarding crop production. Women only have full decision-making power if they own or lease the land themselves. The same applies for control over income from a plot. Although women work a lot on men's plots, the interviewees

of 12 FGDs responded that mostly men have control over the male- and jointly owned plots. Sometimes men control the output of plots with women's sole production. In all 7 female FGDs, the participants indicated that a main reason why women want to cultivate separated gardens is that there are trust issues, i.e., the women think that the men cheat them out of income:

'*Having my separate gardens is something I started doing when I realized that my husband was not disclosing the income from the crops once we sold, so to avoid exchanging words and sometimes end up being beaten, I started having my own gardens.'*

This was affirmed by some men in two male FGDs. Moreover, insufficient access to household income or income in general leads women to cultivate their own plots so they can satisfy their or their children's needs. Men mainly plant crops to earn money, thus, their yield is more likely to be sold which was stated male and female participants in all 14 FGDs. In comparison, women's crops are largely consumed by the household or saved as seeds and only a smaller portion is sold (stated in all 14 FGDs). Although men insist that they use the income from the family gardens to meet domestic needs, many women say that men do not provide money for domestic needs. According to the men, women do not focus on spending money on pesticides and fertilisers. According to the women, they do not use these resources because they do not have money. Rather, they prioritise spending on domestic needs, such as school fees for the children, medical care, soap, sugar, salt, and clothing. Men stress that much has been done to increase women's productivity through initiatives that expand women's access to credit, group membership, and control over income from individual gardens. However, according to some men, women tend to abuse financial independence and spend the money on needs that the men do not consider useful such as visiting their family or leisure.

4. Discussion

4.1 How do results for different quantitative indicators compare to qualitative findings?

Using approach (1) to define male- and female-managed plots shows a quite even distribution of crops grown by male and female farmers as well as a smaller but significant productivity difference of 16%. The finding that both men and women plan the same crop types is quite different from the FGDs results, according to which men were found to grow one or a few perennial cash crops like coffee and banana but also maize, while women grow diverse crops like maize, sweet potato, cassava, beans, groundnut, vegetables, and millet. Thus, we can conclude that defining plot management by asking the household head who manages the plot may better reflect other attributes than a yield gap—such as who provides the majority of labor

for the plot and may encompass many of the plots where work is done jointly but men tend to have the final decision-making authority and control over income.

The qualitative results are better supported by approach (2), which focused on decision-making in farming, showing a 43% productivity difference between male- and female-managed plots. The separation of jointly managed plots using this approach likely leads to more accurate description of productivity differences between plots managed solely by men and women just as the FGD results suggest as well. Approach (3), which focused on control over income, aligns best with the results of the FGDs, while showing the most significant difference between male- and female-managed plots (60%) and between joint- and female-managed plots (52%). Approach (3) also highlights women's significant level of economic disempowerment, as they only control half the income of plots, they supposedly manage on according to approach (1) and only about one third of the income from plots they make decisions on according to approach (2) (see Table 3 in chapter 3.1). The findings from Doan and Hoffmann (2021) that women in Uganda hardly receive income from coffee production despite working a lot on coffee plots, support the evidence of this paper.

Another main insight is that not considering jointly managed plots produces substantially different results compared to including it (see Table 3 in chapter 3.1). This is quite a critical fact, especially when considering that the majority of the plots examined in this paper are managed jointly. According to Doss and Quisumbing (2020) it is necessary to consider jointly managed plots, as there is evidence that jointly managed plots differ from individual plots regarding inputs (Diiro et al. 2018) and output value by about 10% (La O Campos et al. 2016).

Women were found to carry out a substantial number of activities on joint plots, men's plots and their own plots. In addition, it was found that women spend almost the same time on cash crop farming compared to men according to their own indication in the household survey (see Table 5 in section 3.2). This is consistent with Doan and Hoffmann (2021) who found that women in Uganda reported that they work about as many hours as men on coffee plots, while men report that women work at least more than half the time they work themselves on the coffee plots. The FGDs with women found these three activities as the ones mostly done by women, which indicates their supportive role regarding these activities. Doan and Hoffmann (2021) found the same for weeding and harvesting.. Typical activities that are more likely to be performed by men than women were applying agrichemicals and plot preparation. Based on this jointly plots tend to be plots where women tend to have a lot of labor input, but they are not in control of the final decisions, nor do they have control over income from the sale of crops.

However, the level of women's input in decisions on joint plots is likely to differ across households.

4.2 How can quantitative gender indicators be designed to better capture the complexity of household dynamics?

Considering all the aforementioned aspects it is hard to assign yield or plot management to a gender or individual, especially when there is no information about intra-household decision-making and work distribution. The same is concluded by other studies (Doss 2014; Doss and Quisumbing 2020). Nevertheless, in the data, the approach of considering the decision-making regarding income fits best with the results of the FGDs and interviews when looking at the crops that are cultivated. So, is the approach of using the income decision-making the most accurate one to measure productivity differences? The answer is that it depends on the research objective. Slavchevska et al. (2021) argue that these indicators are not interchangeable as 'knowing who manages land is necessary to understand agricultural production and to develop and monitor interventions to increase agricultural productivity' while the 'control over output is an indicator of women's economic empowerment' and that these aspects 'are often vested in different household members'. Our results, however, suggest that women's economic empowerment is related to agricultural productivity, as women's limited ability to control income from production constrains access to inputs and saving money for other investments that are needed to increase agricultural productivity. Furthermore, if one determines the sex of the plot manager based on decision-making power, one overlooks the fact that women may make some input decisions on men's plots but not derive income benefits from them. On their own plots, women may make input decisions and derive income from them. In order to properly understand plot management, it is necessary to distinguish between types of plots from which women do or do not derive income but perhaps work or decide on. Therefore, considering approaches focusing on both the actual plot management and who controls the income is appropriate when trying to understand productivity differences.

Furthermore, there are additional important factors that quantitative approaches do not consider but which should be considered when assigning plots to individuals. First, in all seven women only FGDs, women stated that men take over control over female plots, output or income against their will. This intra-household violence is not an individual case and the same was found by Akram-Lodhi and Komba (2018) in a study examining gendered yield differences of smallholder farmers in Tanzania. Second, some women stated that their crops are harvested and consumed by the household continuously. Therefore, it is likely that some of these quantities may not be reported in a yield survey. In addition, women are more likely to be the food

providers of the family and supporter of the men who are more likely to practice commercial agriculture. Their endowments differ based on the intra-household resource allocations associated with these objectives. Plots geared towards commercial sale of crops, which tend to be controlled by men, are favoured in the intrahousehold distribution of fertilizer and pesticides.

We identified several aspects that should be considered when designing surveys examining productivity or yield differences between male and female farmers. Which variable is chosen to determine who manages a plot to examine gender differences, is a matter of the research objective. The results and previous discussion showed that the complexity of the topic needs more than one question to reveal productivity differences. Therefore, a multi-dimensional questionnaire design is suggested. This could include for instance: Who owns the plot? Who works on it most of the time? Who makes the majority of decisions related to production on this plot? Which activities do men and women engage in on which plots? Which crops are grown and for what purpose? Who decides over the use of income from the sale of crops from this plot? Are these decisions made jointly or not? Who makes the final decision when there is disagreement?

To capture intra-household decision-making, the WEAI or similar approaches can provide valuable insights. The WEAI already includes several of the questions mentioned above. For even more granular results, similar questions could be asked at the plot level. Another important finding is that a large share of plots are jointly managed, making it difficult to calculate the gender productivity gap as the results and findings from La O Campos et al. (2016) show. Moreover, our results and Behrman et al. (2014) suggest using mixed methods in order to obtain more valid results as this paper and others have done (e.g. Mugisha et al. 2019). A good example is given To further investigate findings of their quantitative-based report of 2015 (UN Women et al. 2015), Akram-Lodhi and Komba (2018) conducted FGDs in Tanzania and found that the statistical methods used in the last report were not sufficient to capture gender-specific aspects. It was also found that the perception of men and women on intra-household processes can be different. Evidence from literature holds examples for instance regarding decision-making or workload and so are their responses, a finding also supported by Doan and Hoffmann (2021).

In addition, most surveys only interview one household member, which is usually a male. Some men in the FGDs stated that they do not know about the crops grown on and yield of the rented plots of their wife. This creates a possible bias due to the fact that the output of women's rented plots might not be accurate or included at all in the analysis. Moreover, spouses may hide assets (Hillesland et al. 2021) or decisions from each other and joint decision-making might be

understood differently by spouses (Acosta et al. 2019). Therefore, for studies on agricultural productivity and gender productivity gaps, it is necessary to interview both male and female farmers regarding crop production (Doss 2014, Kilic et al. 2021). Finally, the findings suggest that knowing about several aspects, such as gendered labor allocation, decision-making in crop production, and control over output or income of a plot or activity, helps to draw a more holistic picture in studies about gender differences in crop productivity.

4.3 Limitations

Our study also has some limitations. As the questions on decision-making for approach 2 and 3 were not asked for all plots but only for food and cash crops more generally, we had to make assumptions regarding the assignment of male-, female-, and jointly managed plots based on crop type. Since some crops are used both for income generation and as staple foods, such as maize and banana, classifying crops as cash crops and staple crops and assigning these to individual plots is prone to error.

Another limitation is that the decision-making questions used for approaches 2 and 3 were asked only of the main male and main female decision makers within the household and not to the person identified as the plot manager. Evidence from Yameogo (2021) suggests, that especially in polygamous households, there might be substantial differences in the decision-making authority between co-wives or other adult women in the household, including mothers-in-law.

In order to accurately define plot management by gender, FGDs can be a helpful tool if conducted before the quantitative survey is implemented. This would provide greater insight on how farmers themselves define agricultural decision-making and what it means to manage a plot. These insights could then be used to design better survey questions that more accurately capture gender differences in agricultural production, outcomes, and benefits. Finally, income from livestock was not considered in this analysis, although this would be important (Doss 2018), as only crop productivity does not represent the total productivity of, for example, a female farmer in a household.

5. Conclusion

By exploring the productivity differences quantitively and qualitatively, the study shows which quantitative measures of women's plot management are relevant in the context of the Central Region of Uganda. Moreover, this study has implications for how qualitative data can be used to inform the identification of quantitative gender indicators that better capture the complexity of household dynamics and plot management. In this study we show how the gender

productivity gap and which crops are assigned to which gender fluctuates depending on which method is used to determine plot management. There is not only a significant productivity gap between the sexes when it comes to which plot they work on, but also on the plots for which women are the sole decision-makers or control the income earned from crop sales.

Despite working a lot on cash crops on male- and jointly managed plots, women often lack the access to the household income derived from cash crop production. Women rather control income from crops like beans, cassava, maize and groundnut. Nevertheless, this study provides evidence that women are involved in multiple aspects of plot management even if they do not manage the plots according to some definitions. The dichotomy between plots managed by men and women ignores the large proportion of plots managed jointly. Women's work is distributed across most plots, including those controlled or jointly managed by men. Women tend to have varying degrees of decision-making power over these plots and much less control over the yields, i.e., income. Women mostly do have control over income from plots they farm themselves, but they are few in number, they are less productive, they tend to be self-consumption rather than sales-oriented, and they lack the resources necessary to close the gender gap. This shows importance of considering jointly managed plots, as plot management cannot be separated in most of the cases. More research is needed to understand the various ways in which decisions are made on jointly managed plots, and the level of agency that women actually have in these decisions—including in how their own labor is allocated. It was also found that women's and men's responses and perceptions in the FGDs differed, and men often do not know details about female agricultural production, therefore both male and female farmers should be included in crop production surveys. The study also found that many women do not know how much was earned by men on plots where women also worked on. In some cases, discussing this issue may lead to women experiencing intrahousehold violence.

This paper also adds evidence that mixed-method approaches can add valuable insights on complex household relationship and processes. Combining the significance of figures with an in-depth analysis on decision-making especially helps to understand the context and the proportion of gender differences that cannot be explained with figures only. There are many nuances in defining gender roles in agricultural production, decision making at the plot level, productivity differences, and control over profits. Qualitative data can help clarify all of these issues and identify better quantitative indicators. An important aspect in understanding this context is, for example, investigating not only who works on a plot and makes decisions regarding the production but also who controls the income as done in this study. Tools like the

WEAI questionnaire module are helpful to collect data on and quantify intra-household relationships and decision-making processes. Moreover, these aspects can also be included in econometric models by creating different gender-specific variables that can be used to examine gender differences in more detail than with a single binary question on plot management.

6. Publication bibliography

Acosta, Mariola; van Wessel, Margit; van Bommel, Severine; L. Ampaire, Edidah; Twyman, Jennifer; Jassogne, Laurence; Feindt, Peter H. (2020) What does it Mean to Make a 'Joint' Decision? Unpacking Intra-household Decision Making in Agriculture: Implications for Policy and Practice, The Journal of Development Studies, 56:6, 1210-1229, DOI: 10.1080/00220388.2019.1650169

Aguilar, Arturo, Eliana Carranza, Markus Goldstein, Talip Kilic, and Gbemisola Oseni. 2015. "Decomposition of Gender Differentials in Agricultural Productivity in Ethiopia." Agricultural Economics 46 (3): 311–34. https://doi.org/10.1111/agec.12167.

Akram-Lodhi, A. Haroon; Komba, Immakulata (2018): What are the Factors Driving the Gender Gap in Agricultural Productivity in Tanzania? UNDP. Available online at https://openknowledge.worldbank.org/bitstream/handle/10986/22770/The0cost0of0th0Tanzania00and0Uganda.pdf?sequence=1&isAllowed=y, checked on 1/28/2022.

Alkire, Sabina; Meinzen-Dick, Ruth; Peterman, Amber; Quisumbing, Agnes; Seymour, Greg; Vaz, Ana (2013): The Women's Empowerment in Agriculture Index. In *World Development* 52, pp. 71–91. DOI: 10.1016/j.worlddev.2013.06.007.

Behrman, Julia A.; Meinzen-Dick, Ruth; Quisumbing, Agnes R. (2014): Understanding Gender and Culture in Agriculture: The Role of Qualitative and Quantitative Approaches, pp. 31–53. Available online at 10.1007/978-94-017-8616-4_2, checked on 2/14/2022.

Bowen, Derick H.; Ali, Daniel; Deininger, Klaus; Duponchel, Marguerite (2015): Investigating the Gender Gap in Agricultural Productivity: Evidence from Uganda. World Bank Policy Research Working Paper 7262. Available online at https://openknowledge.worldbank.org/bitstream/handle/10986/21994/Investigating00evidence0from0Uganda.pdf?sequence=1&isAllowed=y, checked on 10/18/2021.

De la O Campos, Ana Paula; Covarrubias, Katia Alejandra; Prieto Patron, Alberto (2016): How Does the Choice of the Gender Indicator Affect the Analysis of Gender Differences in Agricultural Productivity? Evidence from Uganda. In *World Development* 77, pp. 17–33. DOI: 10.1016/j.worlddev.2015.08.008.

Diiro, Gracious M.; Seymour, Greg; Kassie, Menale; Muricho, Geoffrey; Muriithi, Beatrice Wambui (2018): Women's empowerment in agriculture and agricultural productivity: Evidence from rural maize farmer households in western Kenya. In *PloS one* 13 (5), e0197995. DOI: 10.1371/journal.pone.0197995.

Doan, Miki; Hoffmann, Vivian (2021): How might gender norms mediate the benefits of higher coffee production in Uganda? Project Note December 2021 Washington, DC (https://doi.org/10.2499/p15738coll2.134836).

Doss, C. (2014). Data Needs for Gender Analysis in Agriculture. In: Quisumbing, A., Meinzen-Dick, R., Raney, T., Croppenstedt, A., Behrman, J., Peterman, A. (eds) Gender in Agriculture. Springer, Dordrecht. https://doi.org/10.1007/978-94-017-8616-4_3

Doss, Cheryl (2014): If Women Hold Up Half the Sky, How Much of the World's Food Do They Produce? In Ma. Agnes R. Quisumbing, Ruth Suseela Meinzen-Dick, Terri L. Raney, Andre Croppenstedt, Julia A. Behrman, Amber Peterman (Eds.): Gender in agriculture. Closing the knowledge gap / Agnes R. Quisumbing, Ruth Meinzen-Dick, Terri L.Raney, André Croppenstedt, Julia A. Behrman, Amber Peterman, editors. Berlin: Springer; [Rome] : Food and Agriculture Organization of the United Nations, pp. 69–88.

Doss, Cheryl (2015): Women and agricultural productivity: What does the evidence tell us? Center Discussion Paper, No. 1051, Yale University, Economic Growth. Available online at https://www.econstor.eu/bitstream/10419/147535/1/859453987.pdf, checked on 9/1/2021.

Doss, Cheryl R. (2018): Women and agricultural productivity: Reframing the Issues. In *Development policy review : the journal of the Overseas Development Institute* 36 (1), pp. 35–50. DOI: 10.1111/dpr.12243.

Doss, Cheryl R., Ruth Meinzen-Dick, and Allan Bomuhangi. 2014. "Who Owns the Land? Perspectives from Rural Ugandans and Implications for Large-Scale Land Acquisitions." Feminist Economics 20 (1): 76–100. https://doi.org/10.1080/13545701.2013.855320.

Doss, Cheryl R.; Quisumbing, Agnes R. (2020): Understanding rural household behavior: Beyond Boserup and Becker. In *Agricultural economics (Amsterdam, Netherlands)* 51 (1), pp. 47–58. DOI: 10.1111/agec.12540.

FAO (2011): The state of food and agriculture. Women in agriculture: closing the gender gap for development. Rome: FAO.

Hillesland, Marya; Doss, Cheryl; and Slavchevska, Vanya. 2021. Who claims the rights to livestock? Exploring gender patterns of asset holdings in smallholder households in Uganda. IFPRI Discussion Paper 2098. Washington, DC: International Food Policy Research Institute (IFPRI). https://doi.org/10.2499/p15738coll2.134962

Joe-Nkamuke, Uzoamaka; Olagunju, Kehinde Oluseyi; Njuguna-Mungai, Esther; Mausch, Kai (2019): Is there any gender gap in the production of legumes in Malawi? Evidence from the Oaxaca–Blinder decomposition model. In *Rev Agric Food Environ Stud* 100 (1-4), pp. 69–92. DOI: 10.1007/s41130-019-00090-y.

Kilic, Talip, Heather Moylan, and Gayatri Koolwal. 2021. "Getting the (Gender-Disaggregated) Lay of the Land: Impact of Survey Respondent Selection on Measuring Land Ownership and Rights." World Development 146: 105545. https://doi.org/10.1016/j.worlddev.2021.105545.

Kosec, Katrina, Hidrobo, Melissa, Gartaula, Hom, Van Campenhout, Bjorn, and Lucia Carrillo. 2022. "Making complementary agricultural resources, technologies, and services more gender-responsive." Background paper for Report on The Status of Rural Women in Agri-food Systems: 10 Years after the SOFA 2010-11 of FAO. Nairobi, Kenya: CGIAR GENDER Platform [Unpublished manuscript].

Kristjanson, Patricia; Bryan, Elizabeth; Bernier, Quinn; Twyman, Jennifer; Meinzen-Dick, Ruth; Kieran, Caitlin et al. (2017): Addressing gender in agricultural research for development in the face of a changing climate: where are we and where should we be going? In *International Journal of Agricultural Sustainability* 15 (5), pp. 482–500. DOI: 10.1080/14735903.2017.1336411.

Malapit, Hazel; Kovarik, Chiara; Sproule, Kathryn; Meinzen-Dick, Ruth; Quisumbing, Agnes (2020): Instructional Guide on the Abbreviated Women's Empowerment in Agriculture Index (A-WEAI). Washington, D.C.: International Food Policy Research Institute (IFPRI). Available online at http://ebrary.ifpri.org/cdm/ref/collection/p15738coll2/id/129719, checked on 8/24/2021.

Malapit, Hazel; Pinkstaff; Sproule, Kathryn; Kovarik, Chiara; Quisumbing, Agnes; Meinzen-Dick, Ruth (2017): The Abbreviated Women's Empowerment in Agriculture Index (A-WEAI). IFPRI Discussion Paper 01647 Washington, D.C. Available online at https://www.econstor.eu/bitstream/10419/147535/1/859453987.pdf, checked on 8/24/2021.

McGee, Kevin; Backiny-Yetna, Prospere R. (2015): Gender Differentials and Agricultural Productivity in Niger. Policy Research Working Paper WPS7199. Available online at https://documents1.worldbank.org/curated/en/159921468289531733/pdf/Gender-differentials-and-agricultural-productivity-in-Niger.pdf, checked on 9/30/2021.

Mugisha, Johnny; Sebatta, Christopher; Mausch, Kai; Ahikiriza, Elizabeth; Kalule Okello, David; Njuguna, Esther M. (2019): Bridging the gap: decomposing sources of gender yield gaps in Uganda groundnut production. In *Gender, technology and development* 23 (1), pp. 19–35. DOI: 10.1080/09718524.2019.1621597.

Mukasa, Adamon (2015): Gender productivity differentials among smallholder farmers in Africa: A cross-country comparison. In *Working Paper Series No. 231, African Development Bank, Abidjan, Côte d'Ivoire.* Available online at https://openknowledge.worldbank.org/bitstream/handle/10986/17790/860390WP0WB0ON0osure0date0March0180.pdf?sequence=1&isAllowed=y, checked on 3/20/2021.

Nchanji, Eileen B.; Collins, Odhiambo A.; Katungi, Enid; Nduguru, Agness; Kabungo, Catherine; Njuguna, Esther M.; Ojiewo, Chris O. (2021): What Does Gender Yield Gap Tell Us about Smallholder Farming in Developing Countries? In *Sustainability* 13 (1), p. 77. DOI: 10.3390/su13010077.

Oseni, Gbemisola; Corral, Paul; Goldstein, Markus; Winters, Paul (2015): Explaining gender differentials in agricultural production in Nigeria. In *Agricultural Economics* 46 (3), pp. 285–310. DOI: 10.1111/agec.12166.

Peterman, Amber, Agnes R. Quisumbing, Julia A. Behrman, and Ephraim Nkonya. 2011. "Understanding the Complexities Surrounding Gender Differences in Agricultural Productivity in Nigeria and Uganda." Journal of Development Studies 47 (10): 1482–1509. https://doi.org/10.1080/00220388.2010.536222.

Puskur, Ranjitha, Jumba, Humphrey, Reddy, Bhim, Etale, Linda, Ragasa, Catherine, Mishra, Avni, Mangheni, Margaret Najjingo, Nchanji, Eileen, and Steven Cole. 2022. "Closing gender gaps in productivity to advance gender equality and women's empowerment." Background paper for Report on The Status of Rural Women in Agri-food Systems: 10 Years after the SOFA 2010-11 of FAO. Nairobi, Kenya: CGIAR GENDER Platform.

Quisumbing, Agnes R. (1996). Male-female differences in agricultural productivity: Methodological issues and empirical evidence. World Development, 24, 1579– 1595. https://doi.org/10.1016/0305-750X(96)00059-9

Quisumbing, Agnes R.; Doss, Cheryl R. (2021): Chapter 82 - Gender in agriculture and food systems. Handbook of Agricultural Economics: Elsevier (5), pp. 4481–4549. Available online at https://www.sciencedirect.com/science/article/pii/S1574007221000098, checked on 1/26/2022.

Quisumbing, Meinzen-Dick, and Malapit 2019. Chapter 5: Gender Equality: Women's Empowerment for Rural Revitalization (ifpri.org): https://ebrary.ifpri.org/utils/getfile/collection/p15738coll2/id/133130/filename/133345.pdf checked on 9/3/2022.

Slavchevska, Vanya (2015): Gender differences in agricultural productivity: the case of Tanzania. In *Agricultural Economics* 46 (3), pp. 335–355. DOI: 10.1111/agec.12168.

Slavchevska, Vanya; Doss, Cheryl R.; La O Campos, Ana Paula de; Brunelli, Chiara (2021): Beyond ownership: women's and men's land rights in Sub-Saharan Africa. In *Oxford Development Studies* 49 (1), pp. 2–22. DOI: 10.1080/13600818.2020.1818714.

Sraboni, Esha; Malapit, Hazel J.; Quisumbing, Agnes R.; Ahmed, Akhter U. (2014): Women's Empowerment in Agriculture: What Role for Food Security in Bangladesh? In *World Development* 61, pp. 11–52. DOI: 10.1016/j.worlddev.2014.03.025.

Udry, Christopher (1996): Gender, Agricultural Production, and the Theory of the Household. In *Journal of Political Economy* 104 (5), pp. 1010–1046. DOI: 10.1086/262050.

UN Women; UNDP; UNEP; World Bank Group (2015): The Cost of the Gender Gap in Agricultural Productivity in Malawi, Tanzania, and Uganda. Available online at https://openknowledge.worldbank.org/handle/10986/22770, checked on 2/11/2022.

World Bank (2014): Levelling the Field: Improving Opportunities for Women Farmers in Africa. In *World Bank, Washington, DC. © World Bank; ; One Campaign. https://openknowledge.worldbank.org/handle/10986/17790 License: CC BY 3.0 IGO,* checked on 3/20/2021.

World Bank Group (2019): Profiting from Parity : Unlocking the Potential of Women's Business in Africa. World Bank, Washington, DC: License: CC BY 3.0 IGO. Available online at https://openknowledge.worldbank.org/handle/10986/31421, checked on 1/30/2022.

Wouterse, Fleur (2019): The Role of Empowerment in Agricultural Production: Evidence from Rural Households in Niger. In The Journal of Development Studies 55 (4), pp. 565–580. DOI: 10.1080/00220388.2017.1408797.

Yameogo, Guesbeogo Viviane (2021): Collective action in crop-livestock farming systems: A case study from Burkina Faso [Unpublished doctoral dissertation]. University of Hohenheim.

ALL IFPRI DISCUSSION PAPERS

All discussion papers are available **here**

They can be downloaded free of charge

INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE
www.ifpri.org

IFPRI HEADQUARTERS
1201 Eye Street, NW
Washington, DC 20005 USA
Tel.: +1-202-862-5600
Fax: +1-202-862-5606
Email: ifpri@cgiar.org