ADDRESSING GENDER GAPS IN AGRICULTURAL PRODUCTIVITY IN AFRICA: COMPARATIVE CASE STUDIES FROM TANZANIA, MALAWI AND UGANDA+

Asa Torkelsson*
Francis Onditi**

ABSTRACT

This article examines why, in most African countries, women farmers achieve lower productivity in agriculture than men. It contributes to this debate by interrogating whether or not addressing gender gaps in agricultural production significantly contributes to socio-economic well-being (resilience) of women as well as the gross domestic product (GDP). The Living Standards Measurement Studies-Integrated Survey for Agriculture projects was adopted to produce estimates for three countries in Sub-Saharan Africa (Malawi, Tanzania and Uganda). The article draws from a research report and collaborative study by UN Women with UNEP and World Bank. The result shows that although female farmers individually manage slightly more than 25 per cent of all plots in Malawi and Uganda and about 20 per cent of all plots in Tanzania, Malawi shows the largest difference in mean productivity where women's plots are, on average, 28 per cent less productive than men's

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* PhD, Country Representative, United Nations Population Fund (UNFPA), in Dhaka, Bangladesh.

** PhD, Senior Lecturer & Head of Department, School of International Relations & Diplomacy, Riara University, Nairobi Kenya. He specializes in African Affairs in International Relations.

+ This article expresses the views of the authors and not the institutions to which they are affiliated. This article draws from a research report and collaborative study by UN Women Eastern and Southern African Office (ESARO) with UNEP and World Bank. The findings and policy options have been published in UN Women, UNEP and World Bank (2015), but this is the first specific focus on access to land and other factors of agricultural production. One of the authors of this article (Dr Asa Torkelsson) was part of the lead team of investigators on the original research report. We have collaborated very closely with UNDP-UNEP-PEI and World Bank on this assignment. Authors of this article wish to express special acknowledgements to Moa Westman and David Smith of UNDP-UNEP-PEI and Niklas Buehren and Markus Goldstein of the World Bank. We are also indebted to UN Women Country Representatives, Ms. Clara M. Anyangwe (Malawi), and Hodan Addou, Uganda/Tanzania for inputs.

while Tanzania and Uganda reported 16 per cent and 13 per cent gender gaps, respectively. This result implies that the importance of other productive resources other than access to land may be key – for instance, the need to tackle constraints related to women's access to "household male labour" and policies that help women farmers to access labour-saving technologies.

Keywords: Keywords: Land Access, Gender, Agricultural Productivity, Malawi, Tanzania, Uganda.

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1. INTRODUCTION

Despite recent positive economic trends, many African countries face multiple and interlinked resilience challenges which force livelihoods to organize in a context of scarcity and high degree of uncertainty. Market variability, such as dramatic increases in the prices of staple food and generally weak public institutions, further constrain the ability of poor rural households to meet their needs.[1] Previous studies have shown that repeated shocks and chronic stresses challenge development gains and overwhelm coping mechanisms, leading to a cycle of fragility, which further depletes resources. Owing to the patriarchal nature of African societies, these cyclic traps upset livelihoods and, ultimately, may limit women's aspirations; hence lowering their economic productivity.[2] The lower productivity of women compared to their male counterparts in important sectors such as agriculture has often been attributed to labour issues, culture and policy incongruence.[3] However, similar studies conclude otherwise, saying that systemic factors do not necessarily explain the low productivity among female farmers.[4] The

1 Richard Kangalawe, Claude G. Mungongo, Agnes G. Mwakaje and Pius Z. Yanda, "Climate Change and Variability Impacts of Agricultural Production and Livelihood Systems in Western Tanzania"(2016) 9 (3) *Climate & Development* 210. Also, see Gautam Hazarika & Basudeb Guha-Khasnobis, *Household Access to Microcredit and Children's Food Security in Rural Malawi: A Gender Perspective* (IZA Discussion Papers, 2008).

2 Briguglio, P. Lino, "Exposure to External Shocks and Economic Resilience of Countries: Evidence from Global Indicators" (2016) 43 *Journal of Economic Studies* 1060.

3 Amparo Palacio-Lopez, Luchristiansen and Talip Kilic, "How Much of the Labour in African Agriculture Is Provided by Women?" (2017) 67 *Food Policy* 58.

4 Cheryl R. Doss, "Women and Agricultural Productivity: Reframing the Issues" (2018) 36 *Development Policy Review* 40.

debate and evidence that the farmer's gender explains productivity is still not conclusive. Using the gender-disaggregated data collected under the *Living Standards Measurement Studies-Integrated Survey for Agriculture* project in Tanzania, Malawi and Uganda, this study contributes to this policy debate by comparing contextual and individual factors that explain the productivity differences between women and men in agricultural sector.

In most parts of Africa, the agricultural sector continues to be a main contributor to pro-poor growth and poverty reduction.[5] According to the *World Development Report* (WDR) 2013 which focused on jobs, the majority of low-income development countries are "agrarian" economies, defined as countries in which 60 per cent or more of the population live in rural areas. The inseparable relationship between women-led rural economy and agricultural production dimensions, such as access to land, decision-making power dynamics, and time allocation is key in addressing gender gaps.[6]

Women constitute the majority of smallholder farmers, and the constraints that rural women face have been comprehensively documented in recent publications, including the WDR 2012 on Gender Equality and Development (World Bank[7] and earlier one by Morrison.[8]

5 Previous studies, for instance, have shown that a 1 per cent annual increase in Kenya's per capita GDP driven by agriculture would lead to a 1.25 per cent reduction in the country's poverty headcount rate per year whereas a similar increase driven by non-agriculture would only contribute to a 0.57 per cent reduction in the poverty rate; See, Xinshen Diao, Peter Hazell & James Thurlow, "The Role of Agriculture in African Development" (2010) 38 *World Development* 1380; Xinshen Diao, James Thurlow, Samuel Benin & Shenggen Fan, *Strategies and Priorities for African Agriculture: Economy Wide Perspectives from Country Studies* (International Food Policy Research Institute (IFPRI)) (2012); Habiba Djebbari, *The Impact on Nutrition of the Intra-Household Distribution of Power* (IZA Discussion Papers, 2005).

6 Sabina Alkires, Ruth Meinzen-Dick, Amber Peterman, Agnes Quisumbing, Greg Seymour and Ana Vaz "The Women's Empowerment in Agriculture Index" (2013) 52 *World Development* 80. Also see, Markus Goldstein and Christopher Udry, "The Profits of Power: Land Rights and Agricultural Investment in Ghana" (2008) 116 *Journal of Political Economy* 1020; Also see World Bank, *Tapping the Potential of Farming in Kenya* (Kenya Gender Policy Note, June 2013).

7 World Bank, *Malawi Economic Monitor: Managing Fiscal Pressures* (World Bank Office Malawi. Mulanje House, Lilongwe, 2015).

8 Andrew Morrison, Dhushyanth Raju and Nishtha Sinha, "Gender Equality, Poverty and Economic Growth" (2007) *Policy Research Working Paper* 4349, World Bank, Washington, DC.

These reference studies have all convincingly concluded that gender inequalities hold back agricultural growth and negatively affect household welfare. Indeed, women are over-represented among poor farmers and do most of the farm work. Case studies from Ghana indicate that female farmers do not equitably access resources required to be more productive in agriculture.[9] Recent studies on communities' pre-exposition to livelihood-related vulnerabilities indicate that such communities require adaptive policies that would enable them to withstand the harmful effects of external shocks.

Although shocks strike without discrimination, the resilience of women is particularly tested as they are often in charge of balancing care work and productive engagement despite having limited access to resources and opportunities.[10] In times of shock, women's role in providing food and care for the family becomes more critical. On this note, Sadequr Rahman found that economic losses resulting from socio-economic disturbances (e.g. agricultural losses of female farmers, the destruction of women's home-based businesses, limited access to post-disaster economic aid), are disproportionately higher among women and girls than men and boys.[11]

Furthermore, conflict, displacement, and natural disaster account globally for 53 per cent of under-five deaths, three in five preventable maternal and 45 neonatal deaths.[12] Gender-based violence – being subjected to rape, trafficking and prostitution, forced pregnancies and marriages including early marriage are also critical risks accentuated in resilience-challenged situations.

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9 Hazel J.L Malapit and Agnes R. Quisumbing, "What Dimensions of Women's Empowerment in Agriculture Matter for Nutrition in Ghana" (2015) 52 *Food Policy* 58; Also see, Michael O'Sullivan, Arathi Rao, Raka Banerjee, Kajal Gulati & Margaux Vinez, *Levelling the Field: Improving Opportunities for Women Farmers in Africa*, (Washington, DC: World Bank and One Campaign, 2014); Samuel Benin, James Thurlow, Xinshen Diao, Allen Kebba & Nelson Ofwono, *Agricultural Growth and Investment Options for Poverty Reduction in Uganda* (2008), IFPRI Discussion Paper 00790; Samuel Benin, James Thurlow, Xinshen Diao, Christen McCool, and Franklin Simtowe, *Agricultural Growth and Investment Options for Poverty Reduction in Malawi* (IFPRI Discussion Paper 74 International Food Policy Research Institute, Washington, DC, 2008).

10 Vanessa Loh and Hal Kendig, "Productive Engagement across the Life Course; Paid Work and Beyond" (2013). 48 *Australian Journal of Social Issues* 120.

11 Sadequr Rahman, "Climate Change, Disaster and Gender Vulnerability: A Study on Two Divisions of Bangladesh"(2013) 2 *American Journal of Human Ecology* 78.

12 United Nations Population Fund, UNFPA, State of World Population, 2015.

Indeed, gender-based inequalities in access to, and control of, productive (including land) and financial resources continue to slow down agricultural productivity and undermine resilience efforts.[13] More than two decades of research has demonstrated that in many African countries, the productivity levels of farms managed by women is often significantly lower than those managed by men.[14] The gaps vary across and even within countries, but recent studies suggest that gender gaps are in the range of 10 to 30 per cent. The gender gap in agricultural productivity means that crop production is lower than its potential. Indeed, closing the gender gap in agricultural inputs alone has been estimated to have the potential of lifting 100–150 million people out of hunger, thus resulting in benefits that spread far beyond female-managed farms.[15] It will also produce significant economic benefits in terms of GDP growth.[16] Certainly, investing in female farmers will boost agricultural growth and could bring countries closer to achieving the objectives of the Comprehensive Africa Agricultural Development Programme (CAADP), which targets 6 per cent agricultural growth and allocates at least 10 per cent of the budget to agriculture.

13 UN Women, AU, IFAD, FAO, WFP, Technology Policy Brief – Upscaling Technologies for Rural Women. UN Women, Nairobi, 2015; *World Bank/Republic of Kenya, Kenya Gender Policy Note – Tapping the Potential of Farming in Kenya; Report No: ACS5140*, World Bank Sustainable Development Department Agriculture and Rural Development Unit (AFTA2), Country Department, 2013; Also see, Kate Schneider & Mar K. Gugerty, "Agricultural Productivity and Poverty Reduction: Linkages and Pathways" (2011) Abridged EPAR Brief No. 121; For further reading see, Colin Thirtle, Lin Lin & Jenifer Piesse, "The Impact of Research-Led Agricultural Productivity Growth on Poverty Reduction in Africa, Asia and Latin America" (2003) 31 *World Development* 1960.

14 Xavier Irz, Lin Lin, Colin Thirtle & Steve Wiggins, "Agricultural Productivity Growth and Poverty Alleviation" (2001) 19 *Development Policy Review* 460.

15 Food and Agricultural Organization, *The State of Food and Agriculture 2010–11. Women in Agriculture: Closing the Gender Gap for Development* (Rome: FAO, 2011).

16 Luc Christiaensen, Lionel Demery & Jesper Kuhl, "The (Evolving) Role of Agriculture in Poverty Reduction – An Empirical Perspective" (2011) 96 *Journal of Development Economics* 240; Luc Christiaensen, Lionel Demery & Jesper Kühl, "The Role of Agriculture in Poverty Reduction; An Empirical Perspective" (2006) World Bank *Policy Research Working Paper* 4013, 2006; See David Seidenfeld, Sudhanshu Handa, Gelson Tembo, S. Michelo, C. Harland Scott, and L. Prencipe, *The Impact of an Unconditional Cash Transfer on Food Security and Nutrition: The Zambia Child Grant Programme* (Brighton: Institute of Development Studies; 2014).

Gender gap in agricultural productivity has been associated with women's limited access to factors of production, including land, labour, fertilizer, irrigation, pesticide and improved seeds.[17] Even in cases when women access these factors of production relatively easily, they have been found to yield lower returns compared to men, perhaps due to their less technical knowledge and access to social networks or less time and access to labour.[18]

There are policy and scholarly discourses that explain the causes of persistent gender gaps in agricultural productivity. However, efforts to link gains made from closing gender gap to women's resilience and national economy has been hampered by lack of accurate estimation.[19]

In this article, we bring current analyses further, draw fully on existing gender-disaggregated data, and interrogate potential benefits from closing the gender gap in terms of GDP growth and poverty reduction.[20] The article measures these gaps focusing on three agriculture-based economies in Sub-Saharan Africa (SSA) – Malawi, Tanzania and Uganda – for which gender-disaggregated data is available, and propose policy responses to redress these gaps. We draw largely on findings from a recent report, "The Cost of the Gender Gap in Agricultural Productivity: In Malawi, Tanzania and Uganda."

The article is divided into six main sections. This introduction is followed, in Section 2, by methodological and conceptual considerations. Section 3 presents the basic results comparing men and women's access to land. Section 4 examines the implications of closing gender gaps on gross domestic product and poverty. Section 5

17 Esther Duflo, Michael Kremer and Jonathan Robinson, *Nudging Farmers to Use Fertilizer: Theory and Experimental Evidence from Kenya* (NBER Working Paper No. 15131, 2009); Esther Duflo and Christopher Udry, *Intrahousehold Resource Allocation in Côte d'Ivoire: Social Norms, Separate Accounts and Consumption Choices* (NBER Working Paper 10498, National Bureau of Economic Research, Cambridge, MA, 2004).

18 Asa Torkelsson, *Trading Out?: A study of Farming Women's and Men's Access to Resources in Rural Ethiopia*, (Stockholm University: Department of Sociology, Doctoral dissertation, Monograph, 2008).

19 Palacio-Lopez, Amparo and Lopez, Ramon, "The Gender Gap in Agricultural Productivity: The Role of Market Imperfection" (2015) 51 *Journal of Development Studies* 1180; See Daniel Ali, Derick Bowen, Klaus Deininger and Marguerita Duponchel, "Investing the Gender Gap in Agricultural Productivity? Evidence from Uganda"(2016) 87 *World Development* 160.

20 Cheryl Doss, "Women and Agricultural Productivity; Framing The Issues" (2017) 36 *Development Policy Review* 40.

explores policy implications of the above cause-effect relationship, while section 6 is the conclusion. It offers some insights on policy implications of addressing gender gaps in agricultural productivity with focus on the countries under investigation – Malawi, Tanzania and Uganda.

2. METHODOLOGICAL AND CONCEPTUAL CONSIDERATIONS

In this article, a simple method is developed to quantify the benefits from closing the gender gap in agriculture for the economy as a whole. The benefits are expressed as higher total agricultural production, higher total gross domestic product (GDP), and lower poverty levels. Decomposition methods have been used to identify the factors that explain the gender gap and around which gender-informed policies can then be designed.[21] Recent nationally-representative, gender-disaggregated data collected under the Living Standards Measurement Studies-Integrated Survey for Agriculture project is used to produce estimates for these three Sub-Saharan African countries under discussion.[22]

All data sets are nationally-representative and contain gender-disaggregated data at the plot level. The Malawi questionnaire allows only one person to be listed as a decision maker while the Tanzanian and the Ugandan data allow for multiple family members to be listed, allowing us to distinguish between plots managed individually by a woman, individually by a man, jointly by women in the households, jointly by men in the household, or jointly by household members of opposite sex. The incidence of joint decision making in both Tanzania and Uganda is high – more than half of all plots in Tanzania and more

21 Arturo Aguilar, Eliana Carranza, Markus Goldstein, Talip Kilic, and Gbemisola Oseni, "Decomposition of Gender Differentials in Agricultural Productivity in Ethiopia" (2015) 46 *Agricultural Economics* 320; Also see Nicole Fortin, Thomas Lemieux and Sergio Firpo, "Decomposition Methods in Economics" in David Card and Orley Ashenfelter (eds), *Handbook of Labor Economics*, (Volume 4, 1st edn,Amsterdam: Elsevier (North Holland), 2011), 1-102; Ben Jann, "The Blinder-Oaxaca Decomposition for Linear Regression Models" (2008) 8 *Stata Journal* 460.

22 Gerald E. Shively & Jacob Ricker-Gilbert, "Measuring the Impacts of Agricultural Input Subsidies in Sub-Saharan Africa: Evidence from Malawi's Farm Input Subsidy Program" (2013) Policy Brief, Purdue University, Global Policy Research Institute.

than two-thirds of plots in Uganda are under joint management.

Several primary and secondary data sources are used for the analysis of the gender gaps in agricultural productivity in Malawi, Tanzania and Uganda.[23] The decompositions of the gender gap in all three countries have used data available under the Living Standard Measurement Study-Integrated Survey on Agriculture (LSMS-ISA). For Malawi, we used the Third Integrated Household Survey (IHS3) collected between March 2010 and March 2011; for Tanzania, we used the second wave of the Tanzania National Panel Survey (TZNPS) collected between October 2010 and December 2011; and for Uganda we used the 2011/2012 wave of the Uganda National Panel Survey (UNPS).

The article uses the terms "agricultural productivity" and "crop productivity" interchangeably, although crop production is only one component of total agricultural production.[24] Agricultural productivity is represented by the gross value of output per hectare. For each crop grown, the study used the self-reported harvested quantity (in kilograms) and multiplied it by the median crop sale price per kilogram for the crop in the respective enumeration area (or higher geographic areas where village-level unit sale prices were not available). The values of all crops were then summed up and divided by the size of land[25] (in hectares), to arrive at the gross value of output per hectare.

Productivity was compared between female- and male-managed farmlands rather than between farms. The mean difference in the values of output per hectare between male and female-managed farmlands was used to constitute the unconditional (gross) gender agricultural productivity gap. Using the Oaxaca-Blinder (O-B) decomposition method,[26] we explain the part of the gap that is associated with

23 Talip Kilic, Amparo Palacios-Lopez and Markus Goldstein, "Caught in a Productivity Trap: A Distributional Perspective on Gender Differences in Malawian Agriculture" (2015) 70 *World Development* 420.

24 The other components are livestock, fisheries and forestry which are included under agricultural production in the national accounts statistics.

25 Ideally, GPS-measured plot size data should be utilized but the GPS-measured area data are usable only in the case of Malawi. GPS-measured plot area data were collected for about 80per cent of plots in Tanzania, which means that if we use GPS-data about 20per cent (1,312) of plots will be dropped from the analysis.

26 Allan S. Blinder, "Wage Discrimination: Reduced Form and Structural Estimates" (1973) 8 *Journal of Human Resources* 440;Ronald L. Oaxaca & Michael Ransom, "On Discrimination and the Decomposition of Wage Differentials" (1994) 61 *Journal of Econometrics* 15.

differences in the quantities of inputs and that which is associated with differences in the returns to inputs.[27]

One caveat is that, while the calculation of the unconditional gender gap at the centre of the O-B decomposition is not complicated, it does not take into account that on average, women control smaller farmlands than men. Because farmers may be more productive on smaller lands than they are on larger ones, there could be a possibility that female farmers may record similar gross value of output per hectare as male farmers, because they cultivate smaller lands.[28] As a complement, we therefore also discuss an alternative measure of the unconditional (raw) gender gap that is conditional on plot area (and geographic characteristics[29]), which we refer to as the *naive* gender gap.

3. GENDER GAPS AND WOMEN'S ACCESS TO LAND

Results show that women's access to agricultural production resources is constrained due to lack of a range of material and technological resources. Agricultural economists have found in previous studies that such constraints arose due to limited access to farm inputs and affordability of modern technologies, including improved seeds, irrigation technologies and finance, and this holds back agricultural productivity.[30] In Malawi, for example, female and male farmers use male family labour differently and grow different crops. In particular, women suffer a disadvantage in accessing agricultural machinery and production technologies. Although marginal factors, such as access to pesticide (0.97 per cent), inorganic fertilizer (5.32 per cent) and education (8.20 per cent) contribute to women's ineffective production, the key factors contributing to gender gaps include male domination (45.19 per cent) and lack of access to high value crops (28.43 per cent) (see Table 1).

27 Kenneth T. Baltzer & Henrik Hansen, "Agricultural Input Subsidies in sub-Saharan Africa: Ministry of Foreign Affairs of Denmark" (2011) Danida.

28 Calogero Carletto, Sara Savastano & Aberto Zezza, "Fact or Artefact: The Impact of Measurement Errors on the Farm Size - Productivity Relationship" (2011) Policy Research Working Paper 5908. World Bank. Washington, DC.

29 Geographic characteristics capture the range of agro-climatic conditions under which farmers operate. These are not policy variables.

30 Gbemisola Oseni, Paul Corral, Michael Goldstein, and Paul Winters, "Explaining Gender Differentials in Agricultural Production in Nigeria" (2015) 46 *Agricultural Economics* 290.

Even with the conservative assumptions used in this study, we find that there are large gains to be achieved should the policy makers address the gender gap effectively. Annual crop output could increase by 2.1 per cent in Tanzania, 2.8 per cent in Uganda, and 7.3 per cent in Malawi. Taking into account the contribution of crops to total agricultural output, the size of the agricultural sector in the overall economy, and spillover effects of higher agricultural output to other sectors of the economy, we estimate the potential gross gains to GDP to be US$100 million in Malawi (or 1.85 per cent of GDP), US$105 million in Tanzania (0.46 per cent of GDP), and US$67 million in Uganda (0.42 per cent of GDP).

In all three countries, however, there are significant gender gaps in agricultural productivity measured by the crop harvest value per hectare. The largest difference in mean productivity is reported for Malawi, where women's plots are, on average, 28 per cent less productive than men's.[31] In Tanzania and Uganda, the gaps between both genders' productivity are 16 per cent and 13 per cent.

Female managers are significantly older, less educated[32] and more likely to be widowed, divorced, or separated than male managers. While age could be expected to have a positive effect on productivity through experience, older managers may be relatively constrained with physically demanding agricultural work compared to younger managers.

Across the three countries, education levels among farmers are extremely low. Expectedly, female managers have been to school, but they have had about two years of less education than their male counterparts, having on average 3.3 years of schooling in Malawi, 3.7 years in Tanzania, and 4.6 years in Uganda. This trend may affect the farmers' tendency and ability to adopt new technologies. Apart from the low level of education, disadvantages in technical knowledge, access to labour and non-labour inputs and technologies could explain the lower productivity on women's plots.

The study shows that female farmers have a smaller family labour pool to draw from, which puts them at a disadvantage in a farming system that is heavily reliant on family labour, yet often performs work

31 The gap is estimated from regressing (log) harvest value per hectare on an indicator for female management (the estimates are weighted according to the survey design).

32 For jointly managed plots, we take the maximum of the age and education of the managers.

	Malawi		Tanzania		Uganda	
	Fraction of gap (%)	In terms of GDP (2010 US$)	Fraction of gap (%)	In terms of GDP (2010 US$)	Fraction of gap (%)	In terms of GDP (2010 US$)
Quantity of male family labour per HA	45.19	US$45,110,180	97.34	US$102,180,543	–	–
High valued crops	28.43	$28,378,296	3.00	$3,153,441	13.29	$8,872,253
Agricultural implements	17.76	$17,722,900	8.18	$8,591,710	9.02	$6,021,846
Pesticide use	0.97	$964,601	12.03	$12,630,384	4.45	$2,973,106
Inorganic fertilizer	5.32	$5,313,775	6.39	$6,707,789	3.04	$2,026,367
Education	8.20	$8,181,246	-1.74	$-1,828,052	12.86	$8,586,135

Source: UN Women, UNDP/UNEP/PEI, World Bank (2015): The costs of gender gap on agricultural productivity.[33]

on male plots. In Tanzania, 67 per cent of female plots are controlled by women who are widowed, divorced or separated compared to 9 per cent of all other plots under the control of widowed or divorced men. In Malawi, the difference is even starker with 70 per cent of female plots and only 3 per cent of male plots managed by the widowed or divorced of both genders. In Malawi and Tanzania, some male family labour is provided on almost all male plots compared to 44 per cent and 38 per cent on female plots, respectively. It is not surprising, therefore, that significantly less male family labour and more female family labour is applied on female plots in these countries. Perhaps to make up for the lower access to male family labour, female farmers use more days of female family labour, including their own and more days of child labour.

In Uganda, we only report total family labour as not all family members who worked on the plot were recorded in the labour module, but the survey did inquire about total family labour. There are no gender differences in using hired labour, and the incidence of hired labour is

33 Factors that are statistically significant at the 5 per cent level are in bold print. In each country for high valued crops is defined slightly differently; in Uganda, we use a dummy variable equal to one if a cash crop is grown on the plot; in Malawi, we use the fraction of plot under export crops (tobacco); Tanzania we use the fraction of plot under cash crops.

similar across countries – 23 per cent, 28 per cent and 27 per cent of all plots in Malawi, Tanzania and Uganda, respectively (see Table 2). Besides labour, few other inputs are applied on the plots in any of the countries.

Pesticide or herbicide is applied on less than 2 per cent of all plots in Malawi, on 7 per cent of plots in Uganda and 9 per cent of plots in Tanzania with significant differences that can be attributed to gender. In Tanzania, pesticides and herbicides are applied on only 6 per cent of female plots compared to 10 per cent of male plots, but the incidence of fertilizer (organic or inorganic) is not high and does not vary significantly between female and other plots. Organic fertilizer is applied on about 13 per cent of all plots vis-a-vis about 15 per cent of inorganic fertilizer on all plots, despite the launch of the National Agricultural Input Voucher Scheme in 2008.[34]

In Uganda, the incidences of both organic and inorganic fertilizer are lower than in Tanzania, and the gender differences in application are statistically – though not economically – significant. Also, in Uganda, inorganic fertilizer is applied on 1 per cent of female plots and 3 per cent of male plots. In Malawi, inorganic fertilizer is applied on about 62 per cent of female plots and about 64 per cent of male plots. The higher levels of application are likely traceable to the national fertilizer and seed subsidy programme (the Farm Input Subsidy Programme (FISP) that has been running since the 2005/2006 agricultural season). The gender gap in the use (and the quantities used) of fertilizer in Malawi is small but statistically significant.

Women are also less likely to grow cash crops on their plots.[35] In Malawi, a cash crop is listed as the main crop only on 14 per cent of female and 22 per cent of male plots compared to 25 per cent of female and 31 per cent of male plots in Uganda. The average Tanzanian farmer in this dataset does not appear to allocate much land to cash crops. There is a gender gap in the probability of growing an export crop

34 Tanzanian National Bureau of Statistics (NBS) , 2012 <http://www.nbs.go.tz/nbstz/index.php/english/tanzania-in-figures/229-tanzania-in-figures-2012> accessed 20 June 2018.

35 In Malawi, we include tobacco, groundnuts, sugar, coffee and cotton under cash crops but under export crop we only include tobacco. The cash crops in Tanzania are cotton, tobacco, pyrethrum, jute, seaweed, sisal, coffee, tea, rubber, sugar cane, cardamom, tamarind, cinnamon, nutmeg, clove, cashew nut and some other that are grown on few plots, if any at all. In Uganda the cash crops are fruits, vegetables, tobacco, cotton and sugar cane.

among farmers in Tanzania, but the difference is only marginally significant.

Table 2: Naive Estimate of Gender Gap in Agricultural Productivity in Malawi

Dependent variable: Log gross harvest value per hectare (MK)

Female decision maker	-0.284***	-0.244***	-0.284***	-0.258***	-0.271***	0.312**
	(0.025)	(0.025)	(0.025)	(0.024)	(0.025)	(0.025)
FE	No	Region	Agro-ecological zone	District	Region	Agro-ecological zone
Plot size	No	No	No	No	Yes	Yes
Number of observations	16,192	16,192	16,192	16,192	16,192	16,192
R-squared	0.013	0.029	0.014	0.074	0.081	0.058

Note: ***p<0.01, **p<0.05, *p<0.1. Estimates weighted in accordance with the survey design.

Source: UN Women, UNDP/UNEP/PEI, World Bank (2015): The costs of gender gap on agricultural productivity.

Gender differences in other technologies are also apparent. For example, women are less likely to manage an irrigated plot, but the difference is consistently economically small because of the overall low incidence of irrigation; hence, the differences may not show up in the decomposed results as factors that are significantly associated with the mean differences in productivity even though they may be relevant factors for policy targeting.

Previous studies have indicated that female plots may be of much lower quality than male plots.[36] In our data, we only focused on general

36 Shelly J. Lundberg, Robert A. Pollak & Terence J. Wales, "Do Husbands and Wives Pool Their Resources? Evidence from the United Kingdom Child Benefits" (1997) 32 *The Journal of Human Resources* 485; Also see, John Hoddinott & Lawrence Haddad, "Does female income share influence household expenditures? Evidence from Côte d'Ivoire" (1995) 57 *Oxford Bulletin of Economics and Statistics* 80.

indicators of plot quality such as whether the soil is sandy, clay or some other visible type, whether the soil quality is bad, fair or good, and whether the plot is flat or steep, with no pronounced significant differences in those physical characteristics that can be attributed to the woman or man being the plot manager.

4. LINKAGES BETWEEN CLOSING GENDER GAP, IMPROVED GDP, AND POVERTY REDUCTION

Estimating and subsequently closing the gender gap in agricultural productivity is a step towards reducing inequality with important developmental outcome benefits of its own, including additional benefits in terms of higher agricultural output, higher total GDP and lower poverty rates.

Agriculture makes up between a quarter and a third of total GDP in all the three studied countries and employs more than two thirds of the population, suggesting that significant benefits could be yielded from higher agricultural output. At least half of the agricultural labour force in sub-Saharan Africa (SSA) have been reported to be women. Women participate in agriculture both as labourers and as main producers, either managing plots solely or jointly with other family members. While the total contributions of female farmers through joint decision making cannot be assessed using our data and method, our analysis focuses on female producers and the benefits from redressing gender inequalities in accessing productivity inputs for these farmers.

More analysis is needed to understand the characteristics of joint decision making since it is widespread in both Tanzania and Uganda using qualitative approaches that may reveal whether female and male family members truly share an equal role in the decision-making process or whether joint decision making is, de facto, male decision making. In Tanzania, joint decision makers are more similar in characteristics to male than to sole female managers, which explains the absence of productivity gaps between jointly managed plots (mixed gender) and sole male managed plots.

A significant difference between the unconditional and the naive gender gap arises in contexts where women farm significantly smaller plots than men do, as is the case in Tanzania, where the plots of sole female farmers are about 0.5 hectares smaller than those of sole male and joint farmers. The gap increases almost twofold, from 16 per cent to 30 per cent, after accounting for plot size and regional characteristics

(see Table 1). In Uganda, the plots managed by sole female farmers are, on average, 0.23 hectares smaller than those managed by male and joint managers. Furthermore, the 13 per cent unconditional gap grows to 28 per cent after accounting for plot size and geographic characteristics (see Table 4). The difference in plot size between male and female managers is even smaller in Malawi – less than 0.05 hectares – and, therefore, the naive estimate of the gap is only marginally higher than the unconditional gap (31.2 per cent versus 28.4 per cent) (see Table 3).

Female farmers also control fewer plots – about 20 per cent of all plots in Tanzania, 26 per cent in Malawi and 28 per cent in Uganda. Considering the fraction of plots under the control of female managers and their average sizes, we estimate that women control about 13 per cent of arable land in Tanzania, 20 per cent in Uganda, and 24 per cent in Malawi. Although the estimated share of land under the control of female managers in Tanzania appears small, it only represents the share that women manage individually. A larger fraction of female farmers in both Tanzania and Uganda manage land jointly with their spouses or other family members. In this analysis, joint land management forms a separate category, which is combined with the sole male managed group.

As mentioned earlier, agricultural GDP represents a sizable share of total GDP in all three countries, employs the majority of the working-age population, and has extensive linkages with the rest of the economy. To estimate the total contribution of higher agricultural production to total GDP, we use economy-wide models developed specifically for the three countries, which illustrate the trade-offs and synergies from higher growth in different agricultural subsectors and the economy-wide linkages between the agricultural sector and the rest of the economy.[37] The benefits from redressing gender inequality in agricultural production will likely be highest in Malawi, where crop output will be 7.3 per cent higher if the (unconditional) gender gap is closed and 8.1 per cent higher if the naive gender gap is closed (i.e., if women achieve the same productivity as men on same-sized plots).

37 Athur Mabiso, Karl Pauw and Samuel Benin, "Agricultural Growth and Poverty Reduction in Kenya: Technical Analysis for the Agricultural Sectoral Development Strategy (ASDS) – Medium Term Investment Plan (MTIP)", (2012) IFPRI, RESAKSS Working Paper.

These numbers are interpreted against a scenario of persisting gender inequality in productivity. Coupled with the fact that crop production constitutes about 83 per cent of agricultural GDP in Malawi, the 7.3 per cent higher crop production translates into 6.06 per cent higher agricultural GDP compared to the case with no change in the gender gap.[38] Because the naive gender gap for Malawi is only marginally higher, the respective benefits from closing the naive gender gap are only slightly larger, and in terms of agricultural GDP, they translate to an increase of 6.71 per cent. For every one Malawian Kwacha (MK) increase in agricultural GDP, total GDP will increase by MK 1.11.[39] Therefore, if agricultural GDP increases by 6.06 per cent (US$ 89.9 million in 2010 prices), total GDP will increase by 1.85 per cent (or US$ 99.8 million).

In Tanzania, the gains in terms of higher crop output vary more widely depending on whether we focus on the unconditional or the naive gender gaps. If the unconditional gender gap of 16.2 is closed, then output will be about 2.09 per cent higher, and if the naive gender gap of 29.8 per cent is closed, then crop output will be 3.9 per cent higher compared to a baseline scenario where the current gender inequality persists. Because crop GDP constitutes about 70 per cent of agricultural GDP in Tanzania, the additional growth in crop sub-sector results in 1.46 per cent higher agricultural GDP,[40] if the unconditional gender gap is closed, and 2.72 per cent higher agricultural GDP if the naive gender gap is closed. The benefits from closing the naive gender gap are almost twice as large as the benefits from closing the unconditional gender gap.

Ignoring the economy-wide linkages between the agricultural sector and the rest of the economy, the 1.46 per cent growth of the agricultural GDP after closing the gender gap in productivity will result in 0.37 per

38 Samuel Benin, James Thurlow, Xinshen Diao and Christen McCool (n 10) estimates the share of crop GDP in agricultural GDP to be close to 86 per cent, 2008.

39 Samuel Benin, James Thurlow, Xinshen Diao and Christen McCool (n 10) developed a CGE model for Malawi where they forecast that if agricultural GDP grows at 6per cent rather than 2.8 per cent based on historic patterns, total GDP will increase from 3.2 per cent to 4.8 per cent per year, that is total GDP will be 1.6 percentage points higher in the presence of accelerated agricultural growth. The study also provides estimates of the multiplier effects for various agricultural sub-sectors.

40 Earlier studies on the multiplier effects between agricultural GDP and overall GDP reveal very high multiplier effects. See Irz, Lin, Thirtle, & Wiggins (n 15)).

cent increase in overall GDP.[41,42] For Tanzania, the multiplier effect from the broad-based agricultural growth scenario is estimated to be around 1.23[43] This means that 1.46 per cent higher agricultural GDP will result in about 0.46 per cent higher total GDP compared to the 0.37 per cent estimate with no multiplier effects.[44] The increase may not appear striking, but sole female producers control only a small fraction of total arable land (13 per cent). Women control about 24 per cent of arable land in Malawi and about 20 per cent in Uganda. Women control plots together with their spouses and if some jointly managed plots are de facto female managed, policies to close the gender gap in productivity will likely reach those female farmers as well. Therefore, the benefits from closing the gender gap are likely to be higher.

Closing the gender gap in Uganda would result in 2.8 per cent higher crop output, which brings about 1.64 per cent increase in agricultural GDP given that crops constitute about 59 per cent of the agricultural sector in the country. Closing the naive gender gap brings about significantly higher benefits in terms of agricultural output. If productivity on women's plots is the same as on men's plots, irrespective of plot size, then crop production would increase by 6.09 per cent, which will lead to 3.6 per cent increase in agricultural GDP.

41 There is a discrepancy in the official statistics regarding the contribution of the agricultural sector to total economy. Officially the WDI report that agriculture is about 28 per cent but when we use the reported agricultural GDP and divide it by the total GDP, the share is closer to 25 per cent (it varies slightly depending on whether we use constant or current prices but it is around 25 per cent). We use the 25 per cent estimate, which means that our estimates of the contribution of agriculture are lower than they would be if we used the 28 per cent reported share, but our choice leads to consistent estimates when the percentages are used to estimates the levels of the contributions.

42 It is not clear that the estimates reported in FAO (2011) take into account the economy-wide linkages between the agricultural sector and the non-agricultural sector. Also, we are not sure whether the estimates in the same study are from closing the unconditional gender gap or other estimate of the gender gap.

43 Rounded down from 1.238: In the valuation of the benefits from closing the gender gap, we tend to take statistics the statistics that lead to the lower bound of the estimate for the total benefit we prefer to err on the conservative side rather than overstate the full benefit in terms of monetary value.

44 Karl Pauw and James Thurlow, "Agricultural Growth, Poverty, and Nutrition in Tanzania" (2011) 36 Food Policy800; Shelley A. Phipps & Peter S. Burton, What's Mine is Yours? The Influence of Male and Female Incomes on Patterns of Household Expenditure" (1998) 65 *Economica* 605.

The potential benefits from closing the naive gender gap are tremendous. Taking the multiplier effects into account, we estimate that total GDP will be higher by 0.42 per cent or (US$ 66.8 million in 2010 prices) if the unconditional gender gap is closed, and 0.9 per cent (or US$ 145 million in 2010 prices) if the naive gender gap is closed. The results for Uganda are very similar to the results for Tanzania with small differences linked to the estimates of the gender gaps, the relative shares of agricultural GDP in total GDP and slight differences in multiplier effects.

In regard to the linkages between agricultural productivity and poverty reduction, numerous studies show that agriculture-led growth has strong effects on poverty reduction and that agriculture-led-growth is more effective generally at reducing poverty than non-agriculture led-growth.[45] There is also evidence that within the agricultural sector, growth led by food crops grown on most smallholder farms is more poverty-reducing than that led by export crops which are more likely grown by wealthier farmers and on large-scale farms. Because female farmers are among the poorest and most resource-constrained, improving productivity on women's plots will inevitably improve their welfare and help them and their families to come out of poverty.[46] In addition, we have argued above that the benefits from closing the gender gap will likely spill to other sectors and therefore lead to broad-based poverty reduction.

Among the three countries in this study, Malawi has by far the highest poverty rate with more than 72 per cent of the population living on less than US$1.25 a day (in 2005 PPP-adjusted dollars). In Tanzania, the comparable number is 43.5 per cent, and for Uganda, it is 38 per cent. The PGE associated with growth in the agricultural sector is largest for Uganda, where 1 per cent increase in GDP reduces poverty rate by 2.15 per cent compared to 1.19 per cent poverty reduction in Malawi and 0.89 per cent in Tanzania. For comparison, 1 per cent growth led by the non-agricultural sector will reduce poverty

45 Derek Bezemer & Dirk Headey, "Agriculture, Development, and Urban Bias" (2008) 36 *World Development,* 1345.

46 Martin Ravallion & Gaurav Datt, "How Important to India's Poor Is the Sectoral Composition of Economic Growth?" (1996) 10 *The World Bank Economic Review* 15; For further reading see, Martin Ravallion & Gaurav Datt, "Why Has Economic Growth Been More Pro-Poor in Some States of India Than Others?" (2002) 68 *Journal of Development Economics* 390.

by 1.04 per cent in Uganda, 0.61 per cent in Malawi and 0.33 per cent in Tanzania (see Table 3). Across the three countries, agriculture has the potential to lift more than twice as many people out of poverty than growth generated in the non-agricultural sector with some heterogeneity across non-agricultural subsectors.[47]

Table 3: Benefits in Terms of Lower Poverty From Closing the Gender in Agricultural Productivity

	Malawi	Tanzania	Uganda
Poverty rates			
Percentage of population living on < US$1.25 per day*	72.16%	43.48%	37.91%
Estimated number of people <US$1.25 per day (in 2010)	10.833,882	19,554,404	13,324,631
Poverty-growth elasticities*			
Poverty-growth elasticity (US$1.25): Agriculture	-1.19	-0.89	-2.15
Poverty-growth elasticity (US$1.25): Non-Agriculture	-0.61	-0.33	-1.04
Percentage change in poverty rates			
Poverty reduction (US$1.25):Agriculture-led	2.20%	0.41%	0.90%
Poverty reduction (US$1.25):Non-Agriculture-led	1.13%	0.15%	0.43%
people OUT of poverty (US$1.25):Agriculture-led	238,362	79,723	119,287
people OUT of poverty (US$1.25):Non-Agriculture-led	122,185	29,560	57,702

Source: UN Women, UNDP/UNEP/PEI, World Bank (2015): The costs of gender gap on agricultural productivity.

Given a PGE of -1.19 for Malawi, the 1.85 per cent growth generated from closing the gender gap in crop production implies that poverty will reduce by 2.2 per cent, bringing almost a quarter million people out of poverty in the same year, whereas a similar growth rate generated from the non-agricultural sector would lift only half as many people

47 Paul Dorosh and James Thurlow, "Beyond Agriculture versus Nonagriculture: Decomposing Sectoral Growth-Poverty Linkages in Five African Countries" (2014) IFPRI Discussion Paper 1391, International Food Policy Research Institute, Washington, DC.

out of poverty. The 0.42 per cent growth in Uganda generated from closing the gender gap in crop production will lead to 0.90 per cent reduction in poverty or 119,287 people lifted above the poverty line in the same year. In Tanzania, the 0.46 per cent growth would result in 0.41 per cent poverty reduction or about 80,000 people lifted above the poverty line in the same year.

The poverty reduction may be even higher if we take into account that policies to close the gender gap will directly benefit women.

Further analysis shows that economy-wide benefits on GDP of closing the gender gap in Malawi are higher (1.85 per cent) compared to Tanzania (0.46 per cent) and Uganda (0.42 per cent) (see Table 4).

Table 4: Economy-Wide Benefits from Closing the Gender Gap in Agricultural Productivity

	Malawi	Tanzania	Uganda
Change in total GDP	1.85%	0.46%	0.42%
Change in Agricultural GDP	6.06%	1.46%	1.64%
Change in crop harvest value	7.30%	2.09%	2.80%
Estimated gain in (current 2010 US$)*	$99,813,239.27	$104,970,747.16	$66,751,606.18

Source: UN Women, UNDP/UNEP/PEI, World Bank (2015): The costs of gender gap on agricultural productivity.

5. THE NEED FOR GENDER-TARGETED POLICY AND GOVERNANCE REFORMS

To address gender gaps and differences in agricultural productivity in Africa, there is a need for gender-targeted policy reforms at different levels of governance across the continent. First, to close the gender gap in agricultural productivity, we need to understand the disadvantages and challenges that women face as producers. As discussed in this article, women's access to resources are constrained, although, overall, in Africa, there is limited use of fertilizer and pesticide inputs, and access to modern technologies, including improved seeds, irrigation technologies, and finance.

We focus the discussion on the explained component of the gender gap, i.e., the part of the gap that is due to differences in the levels of production as these factors can be directly linked to policy options. In many contexts, the gender gap may be linked to other factors, including differences in the returns of the factors of production, but it is difficult to design policies around these factors without a deeper understanding of why women achieve lower returns.

Equally important is the need to explore alternative sources of labour. Results in this article show that the most important factor that contributes to gender gap in agricultural productivity is availability of male family labour. The average farmer in developing countries is heavily reliant on family labour at each level of the agricultural production cycle, given especially the inadequate access to farming machinery and implements. Fewer days of male family labour are applied on female plots, and the labour constraint is particularly pronounced in Tanzania where as much as 97 per cent of the gender gap is due to the lower application of male family labour.[48]

Designing policies that directly reduce inequality in access to male farm labour can take two avenues. One option is to tackle constraints related to women's access to household male labour. Another option is to think about policies that help female farmers to access other resources, such as hired workers and labour-saving technologies. First, it is possible to increase women's labour productivity by enabling them to adopt labour-saving technologies on-farm or by freeing up their time by adoption of labour-saving technologies at home. Second, policies could focus on enabling women's access to hired labour. Prevalent cultural norms may prevent women from hiring male labour, especially if women and men perform specific agricultural tasks separately.[49] Hence, policies involving both women and men, such as awareness and sensitization campaigns, may be needed to reform these antiquated structures.

Greater insight is value addition in agricultural production. Another important factor, which is associated with a larger gender gap, is the

48 Vanya Slavcherska, "Gender Differences in Agricultural Productivity: The Case of Tanzania"(2015) 46 *Agricultural Economics* 340 <https://onlinelibrary.wiley.com/doi/epdf/10.1111/agec.12168> Accessed 3 April 2018.

49 Marcel Fafchamps, "Cash Crop Production, Food Price Volatility, and Rural Market Integration in the Third World" (1992) 74 *American Journal of Agricultural Economics* 95.

type of crops grown on the plot. Female farmers are less likely to grow the higher-valued cash or export crops and tend to cultivate smaller plots. Owing to their documented responsibilities in ensuring household food security, after planting food crops for household consumption, they may have less additional land to allocate to the higher valued crops. In Malawi, for example, this difference in the fraction of land under export crops cultivation contributes to 28 per cent of the gender gap. In Tanzania, only about 5 per cent of male plots and 4 per cent of female plots are cultivated for cash crops.

Notwithstanding that a higher fraction of land under cash crop cultivation is associated with a higher value of output per hectare of land,[50] the small and statistically insignificant gender difference in the fractions of land devoted to cash crops explains the insignificant contribution of high value crops to the gender gap in Tanzania. In Uganda, we capture crop choice with an indicator for whether a cash crop is grown on the plot. A cash crop is, in addition, grown on about 25 per cent of women's plots and 31 per cent of men's plots. A cash crop on the plot is associated with a significantly higher value of output per hectare of land and the gender difference in the probability of growing a cash crop explains the 13 per cent of the gender gap in Uganda. Several complementary policies can play a significant role. First, improving women's control over marketed output so they can better take charge of the income they earn has the potential to shift the underlying conditions in which female farmers operate.[51] Second, strengthening women's groups and networks so that women can sell in larger quantities can help them reach markets and sell their produce at a lower cost. Too often, women may shy away from growing higher-value crops due to labour or cash shortages, especially if growing cash crops is culturally associated with greater male involvement.

Third is responding to women preferences and choices. Understanding what women want in terms of crop cultivation is also crucial, especially if they prefer growing crops that embody certain characteristics such as nutritional value (see, for example, evidence on

50 The coefficient on the fraction of land under cash crops in a pooled model for both men's and women's plots is 0.54 ($p<0.01$).

51 Ruth V. Hill and Marcella Vigneri, "Mainstreaming Gender Sensitivity in Cash Crop Market Supply Chains" In Agnes R. Quisumbing, Ruth Meinzen-Dick,Terri L. Raney, André Croppenstedt, Julia A. Behrman, Amber Peterman (eds) *Gender in Agriculture: Closing the Knowledge Gap* (Springer, Dordrecht, 2014).

women's preference for growing orange flesh sweet potato in Uganda in Gilligan et al.).[52] Another option is to market certain crops as women's crops, although the policy design for this intervention is somewhat complicated given the shifting cultural norms where women are taking up roles that traditionally fall within a man's domain. Women may also refrain from growing cash crops, as it has been documented that men hold income from cash crops. Policies that allow for quotas in which women can also be guaranteed to hold income from high-value crops could assist in this. Also, shifting the balance of unpaid work in time may assist in the rebalancing with men taking on a larger role in households.

Fourth is technology. Results in this article indicate that women in the three countries use very low levels of technology and women are particularly disadvantaged in accessing the available technology. In all three countries, women's access to agricultural implements and machinery is lower than men's, and this is reflected in the positive effect of agricultural technology on the gender gap in productivity. Differences in access to technology are especially pronounced in Malawi, and this difference explains the 18 per cent of the gender gap. In Tanzania and Uganda, the difference in access to technology explains about 8 and 9 per cent of the gender gap in the respective countries.

Fifth, cash vouchers. Cash vouchers or in-kind transfers may help women increase their use of machinery, as could collective solutions, access to financial services, training, and general awareness of affordable technology options. However, women are unlikely to buy and operate heavy units of machinery if they are deemed culturally or socially inappropriate.[53] Indeed, technology adoption is embedded in a complex web of challenges, which have a gender dimension.

Finally, the need to upscale further research on salient issues linked to power relations and cultural impediment to women's agricultural productivity. Further analyses give opportunity for further research. Further analyses exploring women's bargaining power within the household and yielding data that distinguishes between female

52 Daniel O. Gilligan, Neha Kumar, Scott McNiven, J.V. Meenakshi, Agnes Quisumbing, "Bargaining Power and Biofortification: The Role of Gender in Adoption of Orange Sweet Potato in Uganda" (2014) International Food Policy Research Institute (IFPRI): *Discussion Paper* 01353.

53 Judy C. Bryson, "Women and Agriculture in Sub-Saharan Africa: Implications for Development (an exploratory study)" (1981) 17 *The Journal of Development Studies* 35.

managers who receive remittances and those who do not is key to future research. Remittances are a key determinant of the poverty status of female-headed households and would likely be an important determinant of productivity on female-managed plots. This has been established elsewhere in GPN, which found that when shared in households, men's income provides a productive injection to rural income that allows farming to be more intensive, diverse, and productive. Yet, it is often not shared, and this accentuates the vulnerability of those women who are left to farm on their own, holds back spending in favour of family welfare and nutrition and slows down the agricultural sector as a whole. Other opportunities relate to costing what it would take to close the gaps under different scenario. Also, the methodology, being straightforward and herein presented, could easily be applied to other country contexts for which gender-disaggregated data is available; hence contributing to the cross-country evidence base regarding gender, agricultural productivity and other related developments such as environmental protection and sustainability.[54]

6. CONCLUSION

Gender gaps in agricultural productivity and gender differences in access to productive resources have caught researchers' interest for a long time. Despite the large number of studies showing that women do not obtain the same value of output per unit of land as men because they cannot access the same amount and type of productive resources, there has been little progress in improving female farmers' situation.

As demonstrated in this article, the benefits of closing the gender gap in productivity are substantive and are not restricted to female farmers only. Gender-targeted policy options at different levels of governance can provide opportunities for women in Africa to take part in cash crop schemes, achieve greater access to financial services and loans, and also earn higher incomes that can enable them support their children and family in general. Such reforms will ultimately spread to the rest of the economy and could bring about higher economic output and lower poverty rates across Africa.

54 David A. Ali, Klaus Deininger and Markus Goldstein, "Environmental and Gender Impacts of Land Tenure Regularization in Africa: Pilot Evidence from Rwanda" (2014) 110 *Journal of Development Economics* 265.