GAINS FROM GENDER EQUALITY IN IRISH POTATO PRODUCTION AMONG FARMING HOUSEHOLDS IN UASIN GISHU COUNTY

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ABSTRACT

Women play a significant role in improving livelihoods and supporting food security and nutrition as they are increasingly involved in agriculture. However, gender differences manifest with women displaying lower agricultural productivity than men. These differences affect agricultural output levels, food security, and livelihoods. This study investigates the potential production and welfare gains from gender equality among potato farming households in Uasin Gishu County, Kenya. This study adopted a quantitative survey design to collect data from 256 farmers selected using simple random sampling. The Oaxaca-Blinder decomposition model was employed to identify the gender difference in production, which was used to analyze the potential gains from gender equality. This study determined that substantial production and welfare gains would be achieved by closing an 11% ($P \leq 0.01$) production gap that favours male farmers. 33% ($P \leq 0.05$) of this production differential was attributed to gender differences in returns to production factors ($P \leq 0.05$) and 53% to the endowment factors. The potential production and welfare gains to be achieved through gender equality in production would be a 6% increase in the total potato output and a 9% increase in per capita consumption in the county, respectively. This study's general conclusion is female farmers can be as productive as male farmers if their resource endowment and use constraints would be addressed.

Keywords: Welfare, consumption, Oaxaca-Blinder, gender gap, farmers

INTRODUCTION

According to the U.N. Women Watch Organization (2019), women play a significant role in improving livelihoods, supporting food security and nutrition, and ensuring the survival of their communities and households as they are mainly involved in farming activities. However, a productivity gap exists between male and female farmers even in agricultural activities where women take a lead role (FAO, 2011). Gicheru (2013) also argues that farming activities are the primary source of income for women in most developing nations; however, female-headed households are the poorest. As a result, researchers have attempted to assess gender imbalances, but limited research has been done on how gender affects agricultural production and productivity (Osuafor and Anarah, 2015). Peterman *et al*. (2011), Holden and Bezabih (2008), and Udry (1996) have examined the gender gap in African countries such as Uganda, Ethiopia and Burkina Faso and found that women are more disadvantaged in economic activities than men. Additionally, previous research has demonstrated that, in many ways, women and men have different production capabilities, access to technology, financial services, extension, education, labour, and land needed to sustain agricultural activities (Kiptot *et al*., 2014). However, sex-aggregated research has primarily focused on adopting agricultural technology as the main component in addressing gender gaps in agriculture (Burke and Banda, 2018).

Irish potato is one of the most widely consumed foods in Kenya, serving as both a staple and a cash crop (GOK, 2016). Irish potato was selected for this study because of its economic significance in Kenya. It is the second most-consumed staple food after maize and is grown by approximately 800 000 growers (GOK, 2016). Every year, the Kenyan population grows by more than one million and will double by 2034 (National Council for Population and Development and United Nations Population Fund, 2013). FAO (2011) notes that with an increase in population, developing nations can boost their agricultural yields by 2.5- 4% if they reduce the productivity gap between gender categories. The Kenyan population

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recognizes the agricultural sector as one with considerable potential to contribute to the accomplishment of different development objectives associated with the reduction of poverty, nutrition enhancement, and food security (FAO, 2011). Regardless of these challenges and opportunities, the gender divide in Irish potato farming in Uasin Gishu County has not been well researched. The results provided by this study are useful to potato farmers, policymakers, and international development agencies working in the potato sector. They also offer more information from the production side of agriculture, particularly on the gap in productivity between men and women farmers in the Irish potato value chain. This study aimed to investiga the potential production and welfare gains from gender equality among Irish potato farming households in Uasin Gishu County, Kenya.

MATERIALS AND METHODS

Study setting

This study was conducted in Uasin Gishu County and involved potato farming households. Uasin Gishu County has a temperature range of 8.4°C- 27°C and covers an area of 3,345.2 $km^{2.}$ (African Development Bank Group, 2015). It is located in the Rift Valley on latitude 0.5167, longitude 35.2833, and is bordered by Bungoma to the West, Nandi to the South West, Baringo to the South East, Kericho to the South, Trans-Nzoia to the North and Elgeyo-Marakwet to the East (KIRA, 2015).

Sampling design

Simple random sampling was employed for this study. According to GOK (2017), 30 to 60 % of the County's population practices Irish potato farming. The formula was employed to calculate the sample size as highlighted:

$$n_0 = \frac{Z^2 pq}{e^2}$$

where: n_0 is the sample size, p is the population proportion that is estimated to have the required characteristic, e is the preferred precision level or error margin, Z is the z value and q is 1 – p. The sampling was done based on a 95% confidence level, 6% margin of error, and a sample of 256 Irish potato farmers arrived at as shown:

$$n_0 = \frac{1.96^2(0.6)(0.4)}{0.06^2} = 256 \text{ potato farmers}$$

Data collection

Participant screening was done, and potato farmers were randomly selected from each sub-county. Farmers who did not practice potato farming or refused to participate in the study were skipped. The Kobo-Collect software application was used to administer a closed-ended questionnaire to acquire data from 256 potato farmers. Standardization of the questionnaire was done through a pilot study that comprised three focus group discussions and the administration of questionnaires to 25 farmers not assessed in the main study.

Data analyses

Microsoft Excel and the South Texas Art Therapy (STATA version 16) statistical software were used for data analysis where summary statistics including means, the difference between means, and standard deviations were generated. Regression analysis of study variables was done, and the gender gap in productivity was examined using the Oaxaca-Blinder decomposition approach. The potential gains that can be achieved by reducing the gender production gap were then calculated based on agricultural output and consumption.

Empirical assessment

Oaxaca-Blinder decomposition model

The Oaxaca-Blinder decomposition model is based on counterfactual decomposition and quantifies the difference between two groups (Backiny-Yetna and McGee, 2015; Kilic *et al*., 2013; Aguilar *et al*., 2015; Rios-Avila, 2019). Previous studies have used this model to decompose wages (Hotchkiss and Rios-Avila, 2013; Kwenda and Ntuli, 2018) and agricultural yield (Mugisha *et al*., 2019) by gender. The investigation of gender gaps using the Oaxaca-Blinder model has shown noteworthy improvements from Oaxaca (1973) to recent studies (Rios-Avila, 2019). The model is founded on the basic assumption that covariates (resource endowments) and coefficients (differences in returns to the covariates) cause the differences in the means of groups. Considering a linear regression of the Oaxaca-Blinder model, which evaluates two gender categories, *g=f,m,* where *m* signifies male farmers and *f* represents female farmers, the model is presented as;

$$Y_g = \beta_{go} + \sum_{k=1}^{k} X_{gk}\beta_{gk} + e_g \qquad \text{(Equation 1)}$$

where: Y is the mean log yields, e is the error term, X is a vector of k observable independent variables, β is the coefficient, and g is the farmer's gender. A counterfactual estimation of the coefficients in Equation 1 is included in decomposing the production gap. This counterfactual assessment corresponds to a condition that lacks gender discrimination, as shown in Equation 2, where the dummy variable for gender is presented as G:

$$Y = \beta_O + \sum_{K=1}^{K} X_k \beta_k + \beta_g G + e$$

(Equation 2)

With Equations 1 and 2 [supposing E (e) =0], the mean difference between the productivity of female and male farmers or the gender gap is estimated as:

$$E(Y_m) - E(Y_f) = \beta_m + \sum_{k=1}^{k} E(X_{km})\beta_{km} - \beta_f - \sum_{k=1}^{k} E(X_{fk})\beta_{fk}$$

(Equation 3)

Equation 3 is re-arranged by subtracting and adding the intercept (β_0) and the yields of male and female farmers valued at $\beta_k(\sum_{k=1}^{k} X_{fk}\beta_k)$ and $\beta_k(\sum_{k=1}^{k} X_{km}\beta_k)$, generating the cumulative decomposition as shown in Equation 4:

$$E(Y_m) - E(Y_f) = \sum_{k=1}^{k}[E(X_{km}) - E(X_{fk})]\beta_k + (\beta_m - \beta_o) + \sum_{k=1}^{k}[X_{km}(\beta_{km} - \beta_k)] + (\beta_o - \beta_f) + \sum_{k=1}^{k}[X_{fk}(\beta_k - \beta_{fk})]$$

Endowment effect Structural effect (Equation 4)

Production and Consumption Gains

The potential gains achieved through gender equality are calculated in terms of agricultural output, food security, and broader aspects of social welfare and food security. Mukasa and Salami (2015) used this method and stated that closing a gender gap means that female farmers realize the same yields as male farmers, leading to substantial production gains as shown in Equations 5 to 11.

Let Y_f and Y_m be the yields of female and male Irish potato farmers in Uasin Gishu County, respectively. Let also Q_T represent the additional output of both female and male farmers in Uasin Gishu County. Then finally, g is used to describe the estimated gender production gap in the County, p, the size of land owned by men, T_A, the total cultivated land in the County, and i the percentage of the gap that should be filled. Therefore, the following equations were used:

$$Q_T \equiv Y_T * A_T, \quad \text{(Equation 5)}$$

$$Y_f = \frac{1}{[1+(1-i)g]} Y_m, \quad \text{(Equation 6)}$$

$$Q_T = p * Y_m + (1-p) * Y_f, \quad \text{(Equation 7)}$$

With Equations (6) and (7), the association (5) can be written as:

$$Q_T = \left[p + \frac{(1-p)}{1+(1-i)g}\right] * (A_T * Y_m)$$

, (Equation 8)

If the county has gender equality in both returns and endowments between male and female farmers and the gap between the two groups is negligible, then g=0 and $Y_f = Y_m$, so that:

$$Q_T^n \equiv Y_m * A_T, \quad \text{(Equation 9)}$$

where: Q_T^n symbolizes the new production level after the gender production gap has been closed. Therefore, the difference between Q_T^n and Q_T gives us the potential production gain for different targets of i :

$$Q_T^n - Q_T = \left[\frac{(1-P)(1-i)}{1+(1-i)g}\right] * (A_T * Y_m)$$

, (Equation 10)

Other potential gains from reducing the gender production gap include welfare improvements among female farmers. This study considered the consumption benefits. Depending on the characteristics of each household, the additional output from closing or reducing the production gap, as shown in Equation 10 ($Q_T^n - Q_T$), can be used for consumption. Therefore, let τ be the share of yield consumed.

Therefore, if $C_T^n - C_T = \frac{\tau}{(1-P)n} * \left(Q_T^n - Q_T\right)$

(Equation 11)

where: n is the sample size.

RESULTS AND DISCUSSION

Summary statistics

The summary statistics for female and male farmers are presented in Table I.

There findings indicate there were statistically significant differences in education level, marital status (P≤ 0.001), fertilizer use (P≤ 0.001), application of climate-smart technologies (P≤ 0.001), and use of certified seeds (P≤ 0.001) between male and female farmers. The difference in education favored male farmers whose education level surpassed that of female farmers by 23%. The results show that a lower number of female farmers were married, as shown by a 77% difference. Fertilizer use was 27% lower among female farmers than male farmers. Regarding the application of climate-smart technologies, a 61% difference was found in favor of male farmers. Concerning certified seeds, female farmers used higher quantities than male farmers as shown by a 24% difference. On average, the size of land cultivated by male farmers was 21% higher than that of female farmers (P≤0.01). Male farmers also had higher access to market and price information than female farmers, as shown by a difference of 18% (P≤0.01) .

The findings show that female farmers had longer farming experience than male farmers, as shown by a 20% difference (P≤0.01). Further, male farmers had a higher perception of climate change than female farmers, as shown by a 48% difference. The contacts with extension services were also 10% higher among male farmers than female farmers (P≤0.05). In terms of labour, female farmers used more labour than male farmers, as seen in a 13% difference (P≤0.05)

These findings align with Burke *et al.* (2018), who found gender gaps in education levels, with men having more education than women, thus increasing inequality in production. Kapur (2019) also found that men are more productive as they are more educated than women. Further, Sam (2019) argues that fewer female farmers are married compared to male farmers; being unmarried improves their access to and control of productive resources such as land. On the contrary, Bahta and Myeki (2022) found that most men who engage in agriculture are married and have more control over family resources than female farmers.

Kehinde *et al*. (2016) argue that men have higher fertilizer adoption rates than women. Sheremenko and Magnan (2015) found that male farmers utilize fertilizer due to their risk-averse nature. Moreover, male farmers are more resilient and adaptable than female farmers (Fuller and Lain, 2020). The high adaptability of male farmers makes them less sensitive to climate change and variability than female farmers (Alhassan *et al*., 2018). Otieno *et al*. (2021) found that the involvement of women in extensive networks makes them more capable of accessing diverse seed varieties than men. A study by Karanja *et al*. (2014) indicates that certified seeds support agricultural productivity. These findings infer that the productivity of female farmers can benefit from the use of certified seeds. Access and ownership of large parcels of land also increase a farmer's productivity (Bahta and Myeki, 2022). This increase in productivity is because land ownership permits control over production activities and expenditures (Badstue *et al*., 2020).

FAO (2017) notes that market information is required for long-term and short-term decision-making to support agricultural activities. Moreover, market information access supports production decision-making (David-Benz *et al.,* 2016). Research has also shown that female farmers have longer farming experience than male farmers (Nyikahadzoi *et al*., 2012). A study by Ainembabazi and Mugisha (2014) shows the importance of farming experience by arguing that it is crucial for sustainable agricultural activities and technology adoption.

A different study found that female farmers were less aware of climate change than male farmers, making them more vulnerable to the impacts of climate change

TABLE I- CHARACTERISTICS OF POTATO FARMERS IN UASIN GISHU COUNTY

Variables	Overall (N=256)		Female (N=67)		Male (N=189)		Difference
	Mean	SD	Mean	SD	Mean	SD	
Socio-economic factors							
Education (years)	9.773438	3.848	8.029851	3.713	10.39153	3.711	-2.362 ***
Age (years)	48.62109	14.054	51.1791	13.62	47.71429	14.129	3.465
Married (Married=1, Otherwise=0)	.765625	.189	.2238806	1.708	.957672	.2019	-.7338 ***
Farming experience (years)	16.14887	4.328	18.86567	4.897	15.18577	3.420	3.679 ***
Land ownership							
Cultivated land (acres)	3.36523	1.595	2.82388	1.737	3.557143	1.851	-.7333 **
Yields (kg/acre)	2609.36	863.87	2394.89	848.5	2685.39	869.3	290.5 *
Use of inputs							
Certified seeds (Yes=1, No=0)	1.23383	.041	.1492537	.0528	.1128571	.0566	.0364 ***
Fertilizer (Yes=1. No=0)	.953125	.212	.880597	.3267	.978836	.1443	-.0982 ***
Herbicides (Yes=1, No=0)	.3828125	.487	.4328358	.4992	.3650794	.4827	.0678
Traction (Yes=1, No=0)	.5703132	.496	.6567163	.4784	.539683	.4997	.1170
Labour (man-days)	59.29297	32.755	65.53731	32.10	57.07937	28.87	8.458 *
Market and price information							
Information access (Yes=1, No=0)	.277344	.149	.238806	.1296	.291005	.1354	-.0522 **
Access to credit and extension							
Request for credit (Yes=1, No=0)	.2070311	.406	.2238812	.4199	.2010582	.4019	.0228
Extension contacts (Number)	3.338216	1.613	3.08333	1.066	3.428571	1.152	-.3452 *
Climate change							
Perception (Yes=1, No=0	.375	.894	.223881	.4868	.428571	.4954	-.2047 **
Climate-smart technologies (Yes/No)	5.472657	1.181	2.522388	1.223	6.518519	1.1696	-3.997 ***

*, **, and *** denote statistical significance at 0.05, 0.01, and 0.001 respectively

(Alhassan *et al.,* 2018). Climate change perception permits the understanding of climate change and can support the adoption of climate-smart strategies. Ragasa *et al*. (2013) associate increased access to extension services with a farmer's land size and formal education. Research also found that male farmers have higher access to extension services than female farmers and are more likely to get higher yields than their female counterparts as a result (Raney *et al.*, 2011; Ragasa *et al.*(2013). Moreover, Donald *et al*. (2020) notes that male farmers use less labour than female farmers as they can access more resources and advanced machinery than female farmers.

Base determinants of Irish potato production

An ordinary least squares (OLS) estimation was used in this section to examine the relationship between the covariates and Irish potato productivity, as shown in Table II. The analysis is done for the total sample (pooled) and by gender (male and female samples), as presented in Table II.

The results for the total sample (all Irish potato farmers) are presented in Column II of Table II and show that the use of certified seeds (P≤ 0.01), fertilizer use (P≤ 0.001), application of climate-smart technologies P≤0.01), farming experience P≤ 0.05), extension contacts P≤ 0.05), gender P≤ 0.01), education level P≤ 0.05), and the size of cultivated land P≤ 0.05) affected Irish potato productivity in Uasin Gishu County.

TABLE II- THE ORDINARY LEAST SQUARES REGRESSION OUTPUTS OF FACTORS AFFECTING POTATO PRODUCTION IN UASIN GISHU COUNTY

Variable	Pooled model N=256	Female model N=67	Male model N=189
	0.1142**		
	(0.0348)		
Gender	0.0409*	0.0115	0.0185**
	(0.013)	(0.0126)	(0.005)
Cultivated land	-0.00083	-0.000185	-0.000403
	(0074)	(0.009)	(0.003)
Labour	0.00872*	0.0213*	0.0163**
	(0.0039)	(0.0101)	(0.005)
Education	0.0426*	0.0811	0.0327
	(0.0213)	(0.136)	0.155)
Extension contacts	0.00156*	0.00338*	0.00423
	(0.0007)	(0.0016)	(0.003)
Farming experience	0.0486**	0.0191*	0.0579**
	(0.0156)	(0.008)	(0.018)
Climate-smart technologies	-0.0252	-0.0704	- 0.0567
	(0.044)	(0.069)	(0.0515)
Age	0.0848***	0.0902*	0.0229 **
	(0.0141)	(0.039)	(0.0007)
Fertilizer	0.0460	0.0868	0.0557
	(0.061)	(0.153)	(0.059)
Herbicides	0.0332**	0.0506**	0.0289*
	(0.0107)	(0.0158)	(0.013)
Certified Seeds	0.0158	0.0344	0.0208
	(0.0180)	(0.172)	(0.0194)
Credit access	0.0109	0.0142	0.0102
	(0.0116)	(0.0163)	(0.0188)
Perception of climate change	0.0625**	-0.0497	0.0686**
	(0.0201)	(0.029)	(0.021)
Marital status	0.122**	0.256*	0.0733*
	(0.039)	(0.121)	0.032)
Market and price information	0.106	0.0200	0.131
	(0.145)	(0.12)	(0.148)
Mechanical traction	7.471***	8.040***	7.391***
	(0.1397)	(0.106)	(0. 127)
_Constant			

Note: Standard errors in parentheses; *P<0.05, **P<0.01, ***P<0.001

The coefficients in columns III and IV (Table II) indicate that access to market and price information, the use of certified seeds, application of climate-smart technologies, fertilizer use, and education affected potato production of both female and male farmers positively.

Earlier research showed that education positively impacts productivity (Durán and Wives, 2018; Said and El-Hamidi, 2008; Oduro-Ofori *et al*., 2014). Education also improves information access and supports agricultural innovations and improved technologies, thus boosting productivity (Sánchez-Toledano *et a.l*, 2018, Mo, 2011). In terms of certified seeds, Karanja *et al.* (2014) and GOK (2016) argue that access to clean seeds increases productivity. Abebe and Alemu (2017) note that certified seeds are economical and efficient agricultural inputs whose use boosts agricultural productivity.

The positive influence of climate-smart technologies aligns with previous studies (Mutabazi *et al*., 2015; Kasirye, 2013), which argue that climate-smart agriculture supports development goals and increases productivity by enhancing food security, increases resilience to climate change, and reduces poverty. Adoption of such technologies is influenced by farmers' attitudes, physical, and social-economic characteristics (Udimal *et al.*, 2017). The positive significance of access to market and

price information is evident in previous studies (FAO, 2017; David-Benz *et al*., 2016), which show that access to market information improves decision-making and supports agricultural productivity. In terms of fertilizer use, other studies also found that fertilizer increases productivity by offsetting low soil nutrient levels (Liu *et al*., 2021; Wang *et al*., 2020). The impact of fertilizer use on increasing yields is also shown in other studies (Yousaf *et al*., 2017; Sheremenko and Magnan, 2015).

The results in Table II also show the effect of gender on productivity (P≤0.01). This confirms that gender inequality affects Irish potato production. Other studies align with these findings by arguing that gender affects agricultural productivity (Bello *et al*., 2021; Joe-Nkamuke *et al*., 2019).

Potential production gains from bridging the production gap

This section investigates the potential gains to be attained if gender equality is realized. The mean gender differential and aggregate decomposition Oaxaca-Blinder results estimate the production difference between male and female farmers as shown in Table III. The estimated gap is then used to calculate the potential gains according to Equations 10 and 11 as shown in Tables IV and V.

TABLE III- YIELD DIFFERENCES BETWEEN MALE AND FEMALE POTATO FARMERS IN UASIN GISHU COUNTY

Mean gender differential		
Log yields of male farmers	7.8955*** (0.043)	
Log yields of female farmers	7.7811*** (0.0789)	
Difference	0.1144** (0.0381)	
Aggregate composition	Endowment effect	Structural effect
Total	0.03824* (0.0166)	0.06043*(0.0302)

Note: Standard errors in parentheses; *P<0.05, **P<0.01, ***P<0.001

The mean gender differential results in section I (Table III) display the extent of the gender difference between male and female potato farmers. These mean gender differential results indicate the presence of a statistically significant production gap of 11% in favour of male farmers, with the mean log potato yields of male and female farmers being 7.8955 and 7.7811, respectively (P≤0.01) (Table III). This production gap indicates that male farmers surpass the production levels of female farmers by 11% (Table I).

Section II divides the gender differentials into the endowment and structural effects in columns II and III, respectively (Table III). The endowment and structural effects represent the production gap caused by differences in endowment factors or explanatory variables and differences in returns to endowment factors or explanatory variables, respectively. The findings indicate that of the 0.1144 production gap, 0.06043 (53%) is attributed to differences in returns to endowment factors and 0.03824 (33%) to differences in endowment factors (P≤0.05) between male and female farmers. The remaining part of this production gap (14%) is associated with the interaction, which measures the simultaneous impact of the variations between the endowment and structural effects.

Similarly, previous studies have shown that male farmers surpass the agricultural productivity of female farmers (Auma *et al.*, 2010; Gebre *et al*., 2021; Bello *et al*., 2021, Gutierrez-Pionce, 2016). Bello *et al*. (2021) also found that the yields of male farmers significantly surpassed those of female farmers by 11%. Further, Auma *et al*. (2010) argued that female farmers had lower agricultural production volumes than male farmers. Gutierrez Pionce (2013) also found similar results, which indicated that the structural effect was associated with a larger part of the difference between genders than the endowment effect.

To improve food security, an increase in potato yields is inevitable. From Equation 10, the maximum production gain as shown in Table IV is calculated from the percentage of the current production levels.

TABLE IV- POTENTIAL POTATO PRODUCTION GAIN TO ACHIEVE FOOD SECURITY IN UASIN GISHU COUNTY

Total output	Percentage	Quantity (kg)	Quantity (50 kg bags)
Initial	100%	2609.36	52
Potential	106%	2765.92	55
Total Gain	6%	156.56	3

Weighting the effects by the number of female farmers indicates closing the production gap would cause a 6% increase in the total Irish potato output to achieve food security in Uasin-Gishu County (Table IV). This denotes that the mean total production will increase from 2609.36 kg or 52 (50 kg) bags per acre to 2765.92 kg or 55 bags per acre. This increase represents a negligible difference from the national average of 3100 kg per acre (GOK, 2019). A study by Ghanem (2011) supports this finding by showing that limited access to land by women widens the gender gap through limited control over resources and decisions and vice versa.

From Equation 11, the potential welfare gain is represented in Table V.

TABLE V- POTENTIAL WELFARE GAIN FROM POTATO CONSUMPTION IN UASIN GISHU COUNTY

Consumption (per capita)	Percentage	Quantity (kg)	Quantity (50 kg bags)
Initial	100%	33	0.66
Potential	109%	35.97	0.72
Total Gains	9%	2.97	0.06

The results indicate there will be a 9% (2.97 kg or 0.06 (50 kg) bags) increase in per capita consumption if potato farmers allocate at least 10% of their additional Irish potato output to consumption. These results represent an increase in consumption from 33 kg or 0.66 (50 kg) bags to 35.97 kg or 0.72 (50 kg) bags (Table V). Irish potato consumption is estimated to be 33 kg per capita in Kenya, annually (USAID, 2015). The potential benefits are higher when the gender production gap is closed completely. Rationally, the larger the prevailing gender production gap, the higher the potential productivity gain that Uasin Gishu County can achieve by closing the gap.

These results are based on the assumption that the farmers' observable characteristics (endowment effect) drive the gender gap (Mukasa and Salami, 2015). However, the results only approximate the gains anticipated from gradually eliminating or reducing female farmers' disadvantages in Irish potato production.

The method used to calculate welfare and production gains offers approximations and not exact estimates of the gains for various reasons, as highlighted by Mukasa and Salami (2015). First, female and male farmers may utilize different agricultural or production techniques, unobservable in research but potentially affect productivity. Second, the unpredictability of agricultural production and factors beyond farmers' control, such as climate change, may affect a substantial part of yield and production levels. Third, female and male farmers may operate under different agronomic conditions; thus, a nonzero gender productivity gap remains even if productive resources are allocated equally between female and male farmers. The approximated welfare and production gains are just some of the direct benefits that the county could get. Other indirect benefits, such as improvement in their social status and earnings, could be attained through gender parity in agriculture or by substantively decreasing the current magnitude of the gender gap (FAO, 2011).

CONCLUSION AND RECOMMENDATIONS

The study reveals that gender equality will generate tangible and significant gains in Irish potato production. Male farmers are 11% more productive than female farmers in Uasin Gishu County. 53% of this production gap is attributed to the endowment of production factors and 33% to differences in returns to the production factors. To achieve food security, gender equality in production should be enabled by bridging the 11% gap between the male and female farmers. Gender equality will increase the total Irish potato output by 6% and improve welfare in terms of per capita consumption by 9% in Uasi Gishu County. Female farmers are disadvantaged in access and ownership of many productive resources. These findings indicate that attaining these gains will improve productivity, food security, and reduce poverty. Further, the results indicate the no difference between the county's and the country's average yield. This denotes that Uasin-

Gishu County could be representative of other counties in Kenya in terms of productivity according to gender, land allocation, and input use. Therefore, countrywide production and consumption gains of the same magnitude would be expected if prevailing gaps were reduced in other counties. These findings have significant policy implications for potato production because female and male farmers will contribute to healthy development and food security in Uasin Gishu County if they have equal chances and better conditions for realizing their full agricultural production potential. In this regard, policies aimed at reducing the gender gap in potato farming should focus on increasing female farmers' access to productive resources. Other indirect improvements should be on the social status and agricultural earnings of female farmers.

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