

Understanding gender power relations in irrigation resource access and decision-making in small-scale irrigation schemes in Mbarali District, Tanzania

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Abstract

Purpose – Resource access and decision-making power remain critical gender concerns. This paper examines gender power relations in irrigation resource access and decision-making among smallholder rice farmers in Mbarali District, Tanzania.

Design/methodology/approach – The study utilized a cross-sectional research design with mixed-method approaches. Quantitative data from 397 smallholder rice farmers were collected through structured questionnaires and analyzed using descriptive and inferential statistics, including multiple linear regression models. Qualitative data from focus group discussions and key informant interviews were analyzed through thematic analysis.

Findings – The study reveals that access to irrigation resources was mediated through multiple sources of power derived from the economic status of farmers, land ownership, marriage and social capital, shaping access differently for male and female farmers. Males dominated decision-making over land, labor, income and farming equipment, with exclusive irrigation water access rights. Multiple linear regression analysis showed that being male increased the decision-making power (coef. = 0.890, $p < 0.05$). Factors like land size, scheme membership and joint farm management were positively associated with male decision-making power and marriage and joint rice selling enhanced female farmers ($p < 0.01$).

Practical implications – The findings provide valuable insights for development practitioners and policymakers, highlighting the persistent gender inequalities in irrigation resources and decision-making. These insights inform practical and policy interventions to promote gender equality in resource access and decision-making.

Originality/value – This paper contributes to the literature on how gender power relations shape irrigation resource access and decision-making, underscoring the need for gender-specific interventions to promote gender equality in resources.

Keywords Gender, Power relations, Irrigation, Resources, Access, Decision-making

Paper type Research paper

Introduction

Gender and power shape relationships and serve as the basis for resource access, control, and decision-making. Gender is a cause and an instrument that shapes power and contributes to



power differentials that may affect the ability of an individual to make decisions (Koester, 2015). Scholars in various disciplines define the term “power” however, their definitions vary depending on the context. For example, Godwin *et al.* (2000) define power based on control and dependencies, and their outcomes are in social relationships in which persons who control others are comparatively powerful, while those who depend on others are generally powerless. Power manifests in various forms: the ability and freedom to make decisions that achieve goals (“power to”), achieving shared interests through collective action (“power with”), a sense of freedom from restriction and self-respect (“power within”), and control over others or make other comply (“power-over”) (Koester, 2015; Galinsky *et al.*, 2003; Kabeer, 1999). Gender and power are closely linked and contribute to inequalities and social divisions. Gender relations are the foundation of power relations in decision-making processes, which form hierarchies between and among groups of men and women, resulting in unequal distributions of power that disadvantage one group over another (Tarar *et al.*, 2022; Jhaveri, 2021; Australia Pacific Training coalition, 2020; Lusiba *et al.*, 2017). On the other hand, gender power relations are influenced by power resources including economic power, positional power, positional power, personal power, and collective power. For example, Onyambu (2019) found that land ownership was a symbol of gender power relations in Kenya. Therefore, gendered power relations may affect one’s rights to access, use, and control resources, and decision-making power.

The existing literature in the Global South (Peralta, 2022; Haug *et al.*, 2021; Carnegie *et al.*, 2020; Obayelu *et al.*, 2020; Bjornlund *et al.*, 2019; Sell and Minot, 2018) highlighted the complexity of gender relations in decision-making on farming resource access and benefits. Men often dominate decisions in productive resources like land while women have minimal involvement in decision-making despite their active participation in food and cash crop production (Peralta, 2022; Obayelu *et al.*, 2020; Masamha *et al.*, 2018; Sell and Minot, 2018). Evidence from previous studies indicates that inequalities in decision-making are outcomes of the interplay of multiple factors deeply embedded in social, economic, and institutional structures. These include those by Gómez-Valle and Holvoet (2022), Osanya *et al.* (2020), Bjornlund *et al.* (2019), Nyabaro *et al.* (2019), Sell and Minot (2018) and Anderson *et al.* (2017) have identified several factors that influence or affect the ability of individuals to access and make decisions over resources. These factors are age, marital status, education, farming experience, gender roles, land holdings, employment, asset ownership, economic contribution, income, farm size, social networks, group membership, off-farm income, health, and family structures. For example, Nyabaro *et al.* (2019) found that off-farm income enhances women’s bargaining power and participation in decision-making regarding income in Kenya. Conversely, an increase in land holdings reduces the ability of women to participate in decisions while increasing the decision-making of men (Osanya *et al.*, 2020; Nyabaro *et al.*, 2019).

Studies in sub-Saharan African countries (Ethiopia, Kenya, Malawi, Mozambique, Rwanda, South Africa, Tanzania, and Zimbabwe) by Bjornlund *et al.* (2019) and Haug *et al.* (2021) reveal distinct patterns of decision-making in agricultural productive resources. For instance, males dominate decisions in Ethiopia and Tanzania. Women farmers dominate decisions in Malawi, Rwanda, South Africa, and Zimbabwe. However, in Mozambique and Zimbabwe, females dominate decision-making while their husbands work in other countries. Female-only decision-making is more common in Zimbabwe among widowed households (Bjornlund *et al.*, 2019). Decision-making in Kenya lacks clear gender domination. Only 20% of balanced decision-making is reported in Tanzania and Zimbabwe. A notable number of studies including studies by Mwalyagile *et al.* (2023), Haug *et al.* (2021), Imburgia *et al.* (2021), Ankrah *et al.* (2020), Imburgia *et al.* (2021), Sinyolo *et al.* (2018), and Mushi (2018) highlighted ongoing gender inequalities in agricultural productive resource access including irrigation resources such as land, water, agricultural machinery. Women continue to face significant barriers in accessing irrigation resources and participation in decision-making.

Similar trends have been observed in Tanzania where gender inequalities are still high, ranked 146th out of 191 globally in 2021 as per the UNDP report 2023 despite the efforts of the government to promote gender equality through various interventions including policies and guidelines (Richards, 2019; URT, 2009, 2019). Men continue to dominate productive resources and decision-making while women encounter barriers to accessing resources such as land, water, technology, finance, extension services, information, assets, and credit, and lack decision-making power (Mwalyagile *et al.*, 2024; Were *et al.*, 2021; Kansime *et al.*, 2020; Achandi *et al.*, 2018; Jeckoniah, 2018; Anderson *et al.*, 2017; Sikira and Kashaigili, 2017). While several studies have examined gender relations and resource access (Mwalyagile *et al.*, 2023; Mushi, 2018; Sikira and Kashaigili, 2017), as well as decision-making in resource access (Bjornlund *et al.*, 2019). However, there is a paucity of literature on how gender and power relations specifically shape resource access and decision-making in small-scale irrigation schemes in Mbarali District. Although gender and power are recognized as contributing to inequalities in resource access and decision-making, detailed studies on this specific context are scarce. Therefore, this study explores gender power relations in resource access and decision-making in small-scale irrigation schemes, focusing on differences between male and female smallholder rice farmers. Specifically, the study answered the following questions (1) What power sources shape irrigation resource access and how do these sources differ by gender? (2) What are the gender-specific patterns in access rights and decision-making power on irrigation resources among farmers? and (3) What factors are associated with decision-making power on irrigation resource access for male and female farmers?

This paper contributes to the literature on gender and power relations in resource access and decision-making. Similarly, the study presents empirical evidence on power sources that shape irrigation resource access, and gender-specific patterns in access rights and decision-making power, factors associated with decision-making by gender. This information is worthy for researchers, practitioners, and policymakers. The rest of this paper presents a theoretical framework, study methodology, findings and discussion, and conclusions and recommendations.

Literature review

Gender and power relations have been extensively studied across the world in various contexts on politics, health, organization structures, work relationships, households, and families such as Garrison-desany *et al.* (2021), Guseva and Ibragimova (2021), Hillesland and Doss (2024), Oppong and Bannor (2022). While there is a wealth of literature in these contexts, studies specifically addressing gender power relations in irrigation resource access and decision-making in Tanzania are scarce. The existing literature, however, rarely explored irrigation-specific contexts and gender analysis. For example, Haug *et al.* (2021) and Bjornlund *et al.* (2019) examined decision-making power in small-scale agriculture and on-farm income. However, they did not specifically address gendered power dynamics. Mntambo (2017) analyzed gender relations in urban agriculture but did not extend this analysis to small-scale irrigation settings. Similarly to Gafura (2017) who examined gendered power relations and land grabbing. While these studies provide valuable insights, they do not sufficiently explore gender power dynamics in irrigation resource access and decision-making. This highlights the need to address this gap by investigating gender power relations in irrigation resource access and decision-making among smallholder farmers in small-scale irrigation schemes in Mbarali District, Tanzania.

Theoretical framework

This study builds upon Ribot and Peluso's "Theory of Access," which posits that access to resources is the result of "powers" (Ribot and Peluso, 2003). According to Peluso and Ribot (2020), powers constitute the materials, cultural, and political-economic stands within the "bundles" and "web" of power that configure resource access. This means that individuals depend on bundles and a web of powers to access resources. On the other hand, powers held by individuals dictate their access to or facilitate access for others. The theory provides mechanisms of access through which people can gain access to resources. These are (1) rights-based and illicit mechanisms that are used directly to gain access to resources through law, custom, and convention, and (2) structural and relational mechanisms including technology, capital, markets, labor, knowledge, authority, identities (age, gender, status, common education), and social relations (friendship, trust, dependence) considered "power relations" that emerge from social relations (Peluso and Ribot, 2020). These mechanisms are known as "bundles of powers" and may work sequentially. The framework of Ribot and Peluso provides a foundational lens to this study to understand how farmers gain access to resources and how bundles of powers shape irrigation resource access for male and female farmers.

Methodology

Description of study area

The study was conducted in Mbarali District, Mbeya Region, Tanzania, focusing on irrigation resources for rice production, smallholder farmers, and small-scale irrigation schemes. In this district, rice is the primary source of food, revenue, and household income, largely grown under small-scale irrigation systems by smallholder farmers, and gender plays a critical role in rice production (Kulyakwave *et al.*, 2022; Ngailo *et al.*, 2016; URT, 2017). The district constitutes nearly a third of all small-scale irrigation schemes available in the country, and it is leading in the Mbeya Region (Makoi and Matekere, 2018). Making it a good case to analyze gender power relations in irrigation resource access among smallholder rice farmers.

Research design

The study utilized a cross-sectional research design with a mixed methods approach that allows the simultaneous collection of quantitative and qualitative data within a single timeframe. Mixed methods minimize the limitations of single method approach, provide a deeper understanding of the research problem, and yield a more generalizing outcome (Creswell, 2015; Şahin and Ozturk, 2019).

Sampling procedure and sample size

A simple random sampling technique was used to select the respondents for quantitative data collection involving a sample size of 397 smallholder rice farmers. This sample size was estimated from a population of 42,592 using the Yamane formula with a 95% confidence interval and a precision of 0.05 (Yamane, 1967). The stratified proportional sampling formula was used to calculate proportionate samples of 121, 123, and 153 from population size strata of 12,981, 13,196, and 16,415 in three randomly selected small-scale irrigation schemes namely Majengo, Mbuyuni, and Mwendamtitu, respectively. The formula was also used to compute proportionate samples of 258 male and 139 female farmers.

$$\text{Stratified Proportionate Sample} = \frac{\text{Sample Size}}{\text{Population Size}} * \text{Strata size}$$

Purposive sampling techniques with the help of scheme leaders and extension officers were employed to select participants in focus group discussions (FGDs) for qualitative data collection. The participants were selected based on their extensive knowledge of the study. Six

(6) FGDs were conducted with three (3) comprised of both male and female (mixed FGDs) and three (3) FGDs comprised female-only, two groups from each scheme. A total of 45 participants participated in FGDs each group consisted of 6–8 participants. Key informant interviews (KIIs) included the District Community Development Officer, District Irrigation Officer, scheme leaders, scheme extension officers, and farmers.

Data collection methods and tools

The study utilized structured questionnaires to collect quantitative data from selected farmers through in-person interviews. Three sets of questions on power sources, access rights, and decision-making power were included in the questionnaire. Demographic data were also collected because these factors may influence or affect the ability of individuals to access resources (Quisumbing and Doss, 2021). Qualitative data were collected from FGDs and KIIs which were guided by FGD and KI interview guides. Three main themes: power sources, access rights, and decision-making power were used to guide discussions and interviews. Audio tape recorders, field notebooks, and diaries were used to record information for FGDs and KIIs.

Data analysis

The study analyzed quantitative data through descriptive and inferential statistics using STATA 15 statistical software. Multiple linear regression models were used to estimate factors associated with the decision-making power of the farmers. To enhance the understanding of gender-specific pattern on factors associated with the decision-making power. Two regression analyses were performed (1) gender-segregated (for male and female samples) analysis to explore the unique effects of independent variables on dependent variable for each gender and (2) full sample with gender dummy variable (1 = male, 0 = female) incorporated the interaction effects between gender and other independent variables to understand how gender moderates the relationships between independent and dependent variables. The model was chosen following its suitability in continuous dependent variables and its ability to accommodate both continuous and categorical predictors (Marill, 2004). The dependent variable of this study was continuous, “gender power relations (GPR)” constructed from fifteen dimensions assessing power sources, access rights, and decision-making power. A factor analysis technique was used to reduce these 15 dimensions into one scale called the gender power relations index (GPRI). Model diagnostic test results in Table 1 confirm the assumptions of multiple linear regression and the validity of statistical inferences.

The Kolmogorov-Smirnov (KS) test was used to test the normality of the dependent variable. The results in Table 1 showed that KS had a p -value of 0.0532, greater than the conventional alpha level of 0.05. Hence, the dependent variable follows a normal distribution (Hillier, 1991). Goldfeld-Quandt (GQ) test was used to test homoskedasticity. A p -value of 0.977 indicated the presence of homoskedasticity in the data. The Variance Inflation Factor (VIF) was used to check multicollinearity. All VIF values were below 5, indicating the absence of multicollinearity among the predictor variables (Pires and Rodrigues, 2007). Breusch-Godfrey test was used to check the autocorrelation in residuals. The p -values of 0.114 and 0.7772 for males and females indicate no significant autocorrelation. The RESET test was used to check the functional form misspecification. The results showed a p -value of 0.6146, indicating no evidence of misspecification (Alguraibawi et al., 2015). Diagnostic results also showed DW = 1.8416 and a p -value of 0.05132 on the Durbin-Watson test. This indicates a slight positive autocorrelation but was not statistically significant. The normal quantile-quantile (Q-Q) plot was used to visually assess the normality of residuals, and the results show that most residuals were situated within the fitted line with low dispersion of quantiles. This indicates normality. The results confirm the reliability of the multiple linear regression model. Hence, the model was specified as follows:

Table 1. Regression model diagnostic results

Diagnostic test	Hypothesis	Decision rule
Kolmogorov-Smirnov	Normality of dependent <i>Ho: The dependent variable is normally distributed</i>	<i>Normality is achieved</i> <i>p-value: 0.0532</i>
Goldfeld-Quandt test	Homoskedasticity present <i>Ho: Homoskedasticity is present</i>	<i>Homoskedasticity</i> <i>p-value: 0.977</i>
Variance Inflation Factor	No severe multicollinearity <i>Ho: (VIF < 5)</i>	<i>No severe multicollinearity</i> Marital status 1.529 Age 1.338 Education level 1.234 landownership 1.753 Land size cultivated 1.163 Member of scheme 1.620 Farm management 1.797 Involvement in rice selling 1.326 Second occupation 1.130
Breusch-Godfrey test	Residuals are not autocorrelated <i>Ho: Residuals are not autocorrelated</i>	<i>No autocorrelation of residual</i> <i>p-value: 0.114 male</i> <i>p-value: 0.7772 female</i>
RESET test	No functional form misspecification <i>Ho: No functional form misspecification</i>	<i>No misspecification</i> <i>p-value: 0.6146</i>
Durbin-Watson test	No significant autocorrelation <i>Ho: No significant autocorrelation</i>	<i>No significant autocorrelation</i> DW = 1.8416 <i>p-value: 0.05132</i>

Source(s): Authors' own work

$$GPRI_i = \beta_0 + \beta_1 X_{1i} + \dots + \beta_k X_{ki} + \varepsilon_i$$

$$\varepsilon_i \underset{iid}{\sim} N(0, \delta^2)$$

Where.

- (1) $GPRI_i$: The dependent variable, computed as an index of a single composite scale from fifteen dimensions assessing power sources, access rights, and decision-making power using factor analysis techniques. The factor loadings from the analysis were used to assign weights to each of the 15 dimensions. The final GPRI score for each individual calculated as the weighted sum of their responses access these dimensions.
- (2) β_0 : Represents the intercept term, indicating the value of $GPRI$ when all independent variables are equal to zero.
- (3) $\beta_1, \dots, \beta_k$: These are estimated coefficients for each independent variable $X_{1i}, X_{2i}, \dots, X_{ki}$. The coefficients capture the relationship between each independent variable and dependent variable $GPRI_i$, holding other factors constant. The coefficients are used to explain the directions independent variables on the decision-making power of the farmers.
- (4) $X_{1i}, X_{2i}, \dots, X_{ki}$: These were selected independent variables: age, education, marital status, land ownership, land size cultivated, membership in scheme association, farm management, involvement in rice selling, and second occupation. These variables

were selected based on theoretical foundations and empirical studies that provide their relevant influence on the decision-making power of the farmers (Peluso and Ribot, 2020; Nyabaro *et al.*, 2019). The variables have been identified in the literature as significant determinants of decision-making power in resource access. Description, measurement, expected signs in predicting the decision-making power of farmers on resource access, and reference are presented in Table 2.

- (5) ϵ_i : This term represents residuals or error terms, which are assumed to be identically and independently distributed with a mean of zero and variance δ^2 .

The unit of analysis for this study was an individual rice farmer who grew rice in small-scale irrigation schemes during the 2020–2021 crop-growing season.

Qualitative data were analyzed using thematic analysis with the aid of ATLAS.ti computer software. Qualitative data analysis steps were followed (De Casterlé *et al.*, 2012). The analysis started with data transcription and familiarization and was followed by the actual coding process. Key themes were identified through coding and then coded using deductive and inductive coding techniques. Codes were generated and revised based on themes and then organized into broader themes such as the power sources for irrigation resource access, access rights, and decision-making power. These themes were compared across different FGDs and KIIs to identify both commonalities and variations in responses. Finally, the data were interpreted to draw out key findings. The findings were presented in narrative texts.

Table 2. Independent variables estimated in the multiple regression model

	Variable	Type of variable	Variable description and measurement	Expected sign	References
X ₁	Marital status	Dummy	1 If farmer married; 0 otherwise	±	Imburgia <i>et al.</i> (2021), Rahel (2021)
X ₂	Age of the farmer	Continuous	Number of years from birth	+	Gómez-Valle and Holvoet (2022), Osanya <i>et al.</i> (2020), Sell and Minot (2018)
X ₃	Education	Dummy	1 If the farmer went to school; 0 otherwise	+	Gómez-Valle and Holvoet (2022), Sell and Minot (2018)
X ₄	Land ownership	Dummy	1 If farmer owned land in the scheme; 0 otherwise	+	Osanya <i>et al.</i> (2020)
X ₅	land size cultivated	Continuous	Total land size grow rice in the scheme (acres)	+	Osanya <i>et al.</i> (2020), Singh and Srivastava (2023)
X ₆	Membership in scheme association	Dummy	1 If farmer had membership in irrigation scheme; 0 otherwise	+	Osanya <i>et al.</i> (2020)
X ₇	Farm management	Dummy	1 = Tf farmer manage farm jointly with spouse; 0 otherwise	±	Hillesland <i>et al.</i> (2020)
X ₈	Involvement in rice selling	Categorical	0 = myself 1 = husband/wife 2 = jointly	+ ± +	Amusa <i>et al.</i> (2022) Sell and Minot (2018)
X ₉	Second occupation	Categorical	0 = farming only 1 = off-farm activities 2 = livestock keeping	+ +	Nyabaro <i>et al.</i> (2019), Obisesan and Akinola (2021) Singh and Srivastava (2023)

Source(s): Authors' own work

Results and discussion

The sources of power in irrigation resource access for male and female farmers

Table 3 reveals that economic status is the primary power source for both male and female farmers in irrigation resource access. More than 86% of males and 71.9% of females identify it as their power source. This means that farmers with better economic stands such as financial resources can afford expenses for accessing resources like water user fees and farm rent. The role of economics in resource access was also reported by Imburgia *et al.* (2021) in Ethiopia and Argentina. FGDs from *Majengo*, *Mbuyuni*, and *Mwendamtitu* also insisted on economics in accessing resources. The consensus from FGDs is summarized as follows:

In our community, farming in irrigation schemes is very expensive; financial resources are very crucial in irrigated rice farming; farmers with stable financial resources can access irrigation resources because they can pay water fees, labour, rent or buy land, and farm machinery. (FGDs, May 2022).

Social capital and marriage were reported by 55.5 and 50.4% of female farmers as their power sources, compared to 32.6 and 35.7% of males, respectively. This indicates that female farmers who participate in social networks and relationships and those married have more power to influence their access to resources. This may be attributed to the patrilineal system of resource ownership. For example, men are the lineage of land ownership and control in sub-Saharan Africa, and women access land through marriage. These findings concur with Larsson and Jormfeldt (2017), who asserted that social capital is an essential aspect of power for managing lives. Rahel (2021) found that marriage increases women's access to land in Ethiopia. In FGDs, the importance of marriage and social capital in resource access was also acknowledged. The following is a consensus concerning marriage from female FGD:

Marriage is a partnership essential in rice farming. It is important in resource pooling and mutual support in farming activities. Our men assist in irrigating farms and accessing water during night turns, as it is risky for women to participate. Some women here access land through their husbands (Female FGD, Mbuyuni scheme, May 2022).

On the other hand, it was observed that male participants in mixed FGDs disagreed with marriage in enhancing their access to resources and regarded it as a symbol of dependency. This may stem from the prevailing patriarchal system, which grants men primary resource rights (Hasunga *et al.*, 2022). Below are insights drawn from mixed FGDs in the Mbuyuni scheme:

"You can see why most men here don't place a high value on marriage in terms of gaining access to resources." Men in our community have been taught to be independent and admitting that marriage has power in resource access might be perceived as a sign of dependency, even though some men here farm on their wives' plots (mixed FGD, Mbuyuni Scheme, May 2022).

Key Informant Interviews (KIIs) with male farmers in both *Majengo*, *Mbuyuni*, and *Mwendamtitu* Schemes propounded that depending on marriage in resource access limits the

Table 3. The distribution of sources of power for irrigation resource access by gender

Sources of power	Male (N = 258)		Female (N = 139)	
	No (%)	Yes (%)	No (%)	Yes (%)
Economic status	13.6	86.4	28.1	71.9
Education	83.7	16.3	65.5	34.5
Social capital	67.4	32.6	44.6	55.4
Marriage	64.3	35.7	49.6	50.4
Land ownership	39.9	60.1	61.2	38.8

Source(s): Authors' own work

ability of females to access irrigation resources because of power disparities between men and women.

The study reveals that land ownership was a power source for accessing irrigation resources for 63.1% of male farmers while not for 61.2% of female farmers. This suggests that land ownership provides male farmers greater influence in irrigation resource access. This is attributed to cultural norms and historical practices that traditionally link land ownership to male authority and decision-making power (Magambo and Nyamwesa, 2022). On the other hand, education was the source of power for 34.5% of female farmers and 16.3% of males. Although education is a predominant power source, it still has potential for female farmers. This highlighted the need of training and capacity building to enhance irrigation resources for female farmers.

Gender pattern in irrigation resource access rights

The study found that males dominate access rights to land and irrigation water. Results in Table 4 show that 51.8% of males had sole access rights to owned land and 61.7% had sole access rights on rented land compared to less than half of female farmers on both owned land and rented land. This indicates that land access rights insecurity is higher among women in small-scale irrigation schemes. This was also supported by FGDs and KIIs. Traditional and customary norms in Tanzania often associate land with men (Magambo and Nyamwesa, 2022). This possibly limits women’s agency in resource-related access rights. Hasunga *et al.* (2022) also observed similarly in the Mbozi district, Tanzania. Customary law in most African countries is a key structural barrier to equal land tenure rights for women (Djurfeldt and Sircar, 2018). The following are expressions from FGDs and KIIs:

In our community, our husbands and elderly male relatives traditionally control land access rights. Even when we get access to farm on husband or family land, our spouses and male relatives often retain rights on particular land, have decision power over its use, and are the ones who decide who can access it. (Female FGD, Mwendamtitu scheme, May 2022).

It is common practice for men to hold primary land access rights in this community. Even when women make important contributions to rice farming, men have the final decision on land use and access. (KI, District Community Officer, May 2022).

The study further reveals that 48.2% of male and 38% of female farmers shared access rights with their spouses on owned land. This indicates a notable level of collaboration among married farmers, particularly among male farmers. This finding suggests progress toward shared land resources within male farmers’ households. Conversely, shared access rights on

Table 4. The distribution of access rights over resources between male and female farmers (*n* = 397)

Resource access rights	Male (<i>n</i> = 258)			Female (139)		
	Myself (%)	Wife (%)	Both (%)	Myself (%)	Husband (%)	Both (%)
land owned	51.8	0.0	48.2	45.3	16.8	38.0
Land rented	61.7	0.0	38.3	46.9	7.1	45.9
	Men (%)	Women (%)	Both (%)	Women (%)	Men (%)	Both (%)
Irrigation water	58.5	2.0	40.3	2.0	69.6	29.0
Source(s): Authors’ own work						

rented land were more common among female farmers (45.9%) than their male counterparts (38.3%), challenging the traditional norms of land ownership in the study area. On the other hand, the findings highlight the role of rental markets in expanding women's land access rights. FGDs across *Majengo*, *Mbuyuni*, and *Mwendamtitu* schemes also emphasized the importance of sharing access rights for women as follows.

Although men in our community predominantly hold sole access rights to land, shared access rights provide an opportunity for women without land ownership in schemes to access land and engage in rice farming. (FGDs, May 2022)

The study also found that 58.5% of male farmers hold exclusive access rights to irrigation water compared to only 2% of female farmers. This disparity underscores the persistent gender inequalities in irrigation water distribution within small-scale irrigation schemes, limiting women access to water resources and posing challenges to achieving gender equity in resource access. Similar findings have been reported in previous studies by [Mushi \(2018\)](#), [Sikira and Kashaigili \(2017\)](#), which indicates male dominance in irrigation water in Tanzania.

Gender pattern in decision-making power over irrigation resource access

To ascertain the decision-making power on irrigation resource access, farmers were classified as decision makers or non-decision makers and then categorized as “self,” “husband/wife,” or “both.” Results of [Table 5](#) show that 71.1% of male farmers hold sole land decision-making power, compared to 45.3% of female farmers. It is evident from this finding that decisions on land are male dominance. In Tanzania, land ownership is mostly regarded as a male entitlement ([Haug et al., 2021](#)). This finding is consistent with the study by [Obisesan and Akinola \(2021\)](#) in Nigeria. Additionally, 70.3% of male farmers hold sole decision-making power over labor access, compared to only 47.4% of female farmers. This finding aligns with [Asante et al. \(2023\)](#), who also observed male dominance in controlling labor in rice production in Ghana. These disparities highlight ongoing gender inequalities in the resource decision-making process.

The study further reveals that 54% of male compared to 36.5% of female farmers had sole decision-making power over income, suggesting more limitations for women on financial autonomy and economic independence. FGDs from the *Mwendamtitu* scheme and KIs from the *Majengo* scheme supported these findings. Similarly, [Chengula et al. \(2023\)](#) reported on male control income from agriculture in Wanging'ombe District, Tanzania. The female FGD in the *Mwendamtitu* scheme concurred that:

Selling rice and handling money, particularly from jointly farmed land, is primarily done by their husbands. They access rice income first and hold greater decision-making power on how it is spent. (FGD, *Mwendamtitu* Scheme, May 2022).

Additionally, the consensus statement from mixed FGD indicates that:

Table 5. Distribution of decision-making power in irrigation resource access by gender ($n = 397$)

Decision-making power	Male Myself (%)	Wife (%)	Both (%)	Female Myself (%)	Husband (%)	Both (%)
land in the scheme	71.1	0.4	28.5	45.3	26.3	28.5
Labour	70.3	0.8	28.9	47.4	20.4	33.1
Income	54.3	1.6	44.1	36.5	34.3	29.2
Farming equipment	64.1	1.6	34.4	37.2	34.3	28.5

Source(s): Authors' own work

We agreed that in our community, men had more decision-making power over accessing income earned from rice production. (Mixed FGD, Mwendamtitu scheme, May 2022).

Female KI in the *Majengo* scheme shared that:

When we sell rice, my husband controls the money. He makes decisions on its use, whether to use it personally or reinvest in the farm. I have little access and decision on its spent. (Female KI, Majengo Scheme, May 2022)

Male KII from the *Majengo* scheme also shared that:

It is obvious here in our community that financial management is primarily the role of men. It is just how we do things here; even in my family, I am the one who used to make decisions on income earned from rice. This is because I know how much needs to be spent and how much should be saved for future investments. (Male KI, Majengo Scheme, May 2022).

The results from [Table 5](#) further reveal that 64.1% of male farmers possess exclusive decision-making power over access to farming equipment compared to 37% of female farmers. Findings from mixed FGDs from Mbuyuni schemes corroborated this and connate that this is a long-standing traditional practice. The findings highlight the persistence of gender inequalities in decision-making power on farming equipment. As described in the FGDs, it was revealed that deeply rooted gender norms are passed down through generations. Similarly, [Pelekamoyo and Umar \(2019\)](#) observed the male dominance in decision-making around farming implements in Zambia. The following is the consensus statement from mixed FGDs:

We (men) are in charge of maintaining the farming equipment and ensuring we have the necessary tools for production. We have been doing this way for years. It is something we learned from our fathers. (Mixed FGD, Mbuyuni Scheme, May 2022).

On the other hand, the study found the shared decision-making power among married farmers on land labor, income, and farming equipment. This is a good signal for the shift towards inclusive decision-making in productive resources. However, husbands of female farmers still retain exclusive decision-making power, particularly on income and farming equipment. Results in [Table 5](#) showed that a third of husbands in female farmers maintain sole decision-making power over income and farming equipment access. This pattern reflects the persistence of gender inequalities in decision-making processes. Previous studies by [Singh and Srivastava \(2023\)](#), [Peralta \(2022\)](#), [Hillesland et al. \(2020\)](#), [Obayelu et al. \(2020\)](#), [Sell and Minot \(2018\)](#) reported similar trends of male dominance in decision-making processes.

Factors associated with decision-making power over irrigation resources access of farmers

The multiple linear regression models estimated factors associated with the decision-making power of farmers. Analyses were performed separately by gender (for male and female samples) (gender-segregated analysis) to uncover gender-specific predictors that might not be visible in the full sample and the full sample with a gender dummy variable to explore broader gender dynamics and to capture the overall interaction effects between gender with other variables. Gender-segregated results are presented in [Table 6](#), while full sample results are available in [Appendix I \(Table VII in Supplementary materials\)](#). The results in the full sample indicate that being male increased decision-making power by a coefficient of 0.890 ($p < 0.05$). This imply that male farmers have more decision-making power regarding irrigation resource access than female farmers. The results in [Table 6](#) show that the coefficient of age was insignificant for both genders ($p > 0.05$). However, the interaction between age and gender was positive and significant. This indicates that the decision-making power of males increases with age by the coefficient of 1.496 ($p < 0.001$) while declining for females. The finding infers that older male farmers hold more decision-making power, while older female farmers lose it. Marital status was positively associated with the decision-making power of females

Table 6. Factors associated with decision-making over access to resources across gender

Variables (predictors)	Female Coef. (C.I.)	<i>p</i> -value	Male Coef. (C.I.)	<i>p</i> -value
(Intercept)	1.68*** (0.93–2.43)	<0.001	1.50*** (0.79–2.21)	<0.001
Marital status	0.56** (0.23–0.90)	0.001	–0.37 (–0.85–0.11)	0.126
Age of the farmers (in years)	–0.01 (–0.02–0.00)	0.083	0.00 (–0.01–0.01)	0.741
Education	–0.17 (–0.56–0.22)	0.393	–0.15 (–0.50–0.19)	0.387
Land ownership	0.09 (–0.29–0.46)	0.653	–0.40* (–0.73 to –0.08)	0.014
Land size cultivated	–0.01 (–0.06–0.04)	0.644	0.07** (0.03–0.12)	0.001
Membership in the scheme association	0.12 (–0.19–0.44)	0.438	0.31** (0.08–0.54)	0.009
Joint farm management	–0.13* (–0.49–0.23)	0.047	0.49*** (0.23–0.75)	<0.001
Joint rice-selling involvement	0.39*** (0.25–0.52)	<0.001	0.30*** (0.22–0.38)	<0.001
Second occupation	–0.02 (–0.11–0.08)	0.757	–0.13** (–0.21 to –0.05)	0.002
Observations	139		258	
<i>R</i> ² / <i>R</i> ² adjusted	0.526/0.493		0.349/0.326	

Note(s): **p* < 0.05, ***p* < 0.01, ****p* < 0.001
C.I = Conf. Interval
The numbers in parentheses are Conf. Interval
Source(s): Authors' own work

(Coef. = 0.05, *p* < 0.01) but did not affect male farmers, showing that marriage enhances the decision-making power of females. This finding concurs with [Rahel \(2021\)](#) but contradicts [Imburgia et al. \(2021\)](#), who reported that married women in Ethiopia face more decision-making barriers than female household heads.

The results in [Table 6](#) reveal that land ownership was negatively associated with the decision-making power of male farmers (Coef. = –0.40, *p* < 0.05), suggesting that owning land in small-scale irrigation schemes does not necessarily enhance their influence over resource decisions. This may reflect the individualized nature of land ownership in small-scale irrigation schemes in the Mbarali District, where land is owned independently rather than collectively by families. Additionally, farmers in these schemes are recognized and registered as individual beneficiaries rather than families ([Mwalyagile et al., 2023](#)). For female farmers, land ownership showed no significant associations with decision-making power (Coef. = 0.09, *p* = 0.653), indicating that land ownership does not increase their decision-making power in irrigation resource access. The interaction between land ownership and gender was insignificant (*p* > 0.05), suggesting that land ownership does not impact male and female farmers' decision-making power differently. These findings imply that land ownership without active engagement in management may not automatically lead to decision-making power for irrigation resource access ([Peluso and Ribot, 2020](#)).

The results show that increasing land size cultivated significantly enhances the decision-making power of male farmers (Coef. = 0.07, *p* < 0.01) and not for female farmers in irrigation resource access. This is possibly due to large-scale rice farming in irrigation schemes requiring mechanized equipment, which men predominantly access and control ([Mwalyagile et al., 2023](#)). Similarly, [Osanya et al. \(2020\)](#) found that larger land sizes increase the likelihood of decision-making being skewed towards the husband while reducing the probability of decision-making being skewed towards the wife Kenya. However, the interaction between land size and gender was insignificant (*p* > 0.05).

Additionally, the membership in the irrigation scheme association was positive and significant only for male farmers (Coef. = 0.31, *p* < 0.01). The interaction effect for gender and membership also showed positive and significant (coef. = 0.326 (*p* < 0.01)). This suggests male membership in scheme associations enhances their decision-making power but lacks a similar

effect for female farmers. The findings contrast with the findings by [Osanya et al. \(2020\)](#), who found that group membership positively influences the decision-making of women. This contradiction may be attributed to contextual factors and cultural norms.

Joint farm management had a positively significant impact on the decision-making power of male farmers (Coef. = 0.49, $p < 0.001$) but negatively on females (Coef. = - 0.013, $p < 0.05$). The interaction between gender and joint farm management was positive and significant, indicating that the decision-making power of male farmers increases by the coefficient of 0.242 ($p < 0.05$) while it declines for females. These findings align with [Amusa et al. \(2022\)](#), who found that men tend to dominate pre-harvest decisions. Joint involvement in selling rice had a significant and positive association with decision-making power for both male and female farmers (Coef. for males = 0.30, $p < 0.001$; Coef. for females = 0.39, $p < 0.001$) with a positive and significant interaction effect of gender (Coef. = 0.412, $p < 0.001$). This infers that shared selling crop activities, particularly those involving markets, enhance decision-making power for both male and female farmers. On the other hand, selling involvement could be a key lever for boosting female farmers influence on irrigation resource access. Furthermore, having a second occupation negatively affects the decision-making power of male farmers (Coef. = -0.13, $p < 0.01$). The engagement of male farmers in off-farm activities may potentially divert male attention from farm management, hence lowering their power in decisions on irrigation resource access. However, this factor showed no significant impact on female farmers, and the gender interaction effect was not statistically significant ($p > 0.05$).

Conclusions and recommendations

The study highlights that access to irrigation resources is shaped by multiple interplays of sources of power that stem from the economic status of the farmers, land ownership, marriage, social capital, and education. These power sources have a distinct influence on male and female farmers, reflecting gendered patterns in resource access. While economic status remains a prominent power source, female farmers' power is also mediated through social capital and marriage, and male farmers through land ownership, reflecting the prevailing cultural norms on land ownership that are predominantly male-dominant. While marriage enhances female farmers' access to irrigation resources, it reinforces dependency on male partners, as males retain decision-making power over key irrigation resources. The study underscores the importance of education in enhancing resource access for female farmers. The persistence of gender inequalities is evident in access rights to land and irrigation water and decision-making power over land, labor, income, and farming equipment, where male dominance prevails. However, the existence of shared access rights and joint decision-making among married farmers signals an increase in progress toward gender-inclusive resource management. Membership in irrigation scheme associations, age, gender, larger rice farms, joint farm management, and participation in joint rice selling increase male farmers' decision-making power, suggesting that institutional and economic structures currently favor males. Marital status and joint rice-selling involvement have a significant positive association with the decision-making power of female farmers, indicating the important social relations and market activating in mediating their power in resource access decisions.

To promote gender-inclusive access to irrigation resources, comprehensive interventions are essential to ensure equal opportunities in economics, land ownership, and education for both male and female farmers. Development practitioners, government agencies, Mbarali Local Authority, and Ruaha Basin Development Authority should promote gender-sensitive programs that strengthen social capital and education for female farmers. Capacity-building initiatives promoting joint farm management and resource sharing among married couples will foster collaborative decision-making. Ministries of Agriculture, Land, and Gender Affairs should coordinate efforts to empower women in resource access. Policymakers should

implement gender-sensitive policies that integrate social capital and marriage to enhance female farmers' access to irrigation resources and decision-making authority.

Practical and policy implications

This study offers practical and policy implications. It emphasizes the role of economic status, land ownership, social capital, marriage, and education in shaping power dynamics in irrigation resource access. Practical interventions should focus on strengthening the economic standing of smallholder farmers and promoting female land ownership to foster gender equality in resource access. Policy interventions should be gender-sensitive, addressing gender disparities in resource access and decision-making power. These interventions will not only promote equitable resource access in small-scale irrigation schemes but will also strengthen gender relations in rural communities.

References

- Achandi, E.L., Mujawamariya, G., Agboh-Noameshie, A.R., Gebremariam, S., Rahalivavololona, N. and Rodenburg, J. (2018), "Women's access to agricultural technologies in rice production and processing hubs: a comparative analysis of Ethiopia, Madagascar and Tanzania", *Journal of Rural Studies*, Vol. 60, pp. 188-198, doi: [10.1016/j.jrurstud.2018.03.011](https://doi.org/10.1016/j.jrurstud.2018.03.011).
- Alguraibawi, M., Midi, H. and Imon, A.H.M.R. (2015), "A new robust diagnostic plot for classifying good and bad high leverage points in a multiple linear regression model", *Mathematical Problems in Engineering*, Vol. 2015, pp. 1-12, doi: [10.1155/2015/279472](https://doi.org/10.1155/2015/279472).
- Amusa, T.A., Anugwo, S.C. and Egwue, O.L. (2022), "Comparative analysis of the contributions of men and women to farming decisions among rice producing households in Ebonyi state, Nigeria", *Journal of Agricultural Extension*, Vol. 26 No. 3, pp. 86-97, doi: [10.4314/jae.v26i3.8](https://doi.org/10.4314/jae.v26i3.8).
- Anderson, C.L., Reynolds, T.W. and Gugerty, M.K. (2017), "Husband and wife perspectives on farm household decision-making authority and evidence on intra-household accord in rural Tanzania", *World Development*, Vol. 90, pp. 169-183, doi: [10.1016/j.worlddev.2016.09.005](https://doi.org/10.1016/j.worlddev.2016.09.005).
- Ankrah, D.A., Freeman, C.Y. and Afful, A. (2020), "Gendered access to productive resources – evidence from small holder farmers in Awutu Senya West District of Ghana", *Scientific African*, Vol. 10, e00604, doi: [10.1016/j.sciaf.2020.e00604](https://doi.org/10.1016/j.sciaf.2020.e00604).
- Asante, B.O., Puskur, R., Garner, E., Mangheni, M.N., Adabah, R., Asante, M.D., Frimpong, B.N. and Prah, S. (2023), "Access and control of resources and participation in rice-breeding activities among men and women farmers in southern Ghana", *Sustainability*, Vol. 15 No. 9, p. 7069, doi: [10.3390/su15097069](https://doi.org/10.3390/su15097069).
- Australia Pacific Training Coalition (2020), "Gender equality and social inclusion strategic framework, (2020-2022)", Australia Pacific Training Coalition.
- Bjornlund, H., Zuo, A., Wheeler, S.A., Parry, K., Pittock, J., Mdemu, M. and Moyo, M. (2019), "The dynamics of the relationship between household decision-making and farm household income in small-scale irrigation schemes in southern Africa", *Agricultural Water Management*, Vol. 213, pp. 135-145, doi: [10.1016/j.agwat.2018.10.002](https://doi.org/10.1016/j.agwat.2018.10.002).
- Carnegie, M., Cornish, P.S., Htwe, K.K. and Htwe, N.N. (2020), "Gender, decision-making and farm practice change: an action learning intervention in Myanmar", *Journal of Rural Studies*, Vol. 78, pp. 503-515, doi: [10.1016/j.jrurstud.2020.01.002](https://doi.org/10.1016/j.jrurstud.2020.01.002).
- Chengula, M., Mkelenga, A.J. and Mpeta, I.F. (2023), "Determinants of control over usage of women's cash earnings in the households of rural areas: a case of Wanging'ombe District Council in Tanzania", *East African Journal of Arts and Social Sciences*, Vol. 6 No. 1, pp. 142-155, doi: [10.37284/eajass.6.1.1170](https://doi.org/10.37284/eajass.6.1.1170).
- Creswell, J.W. (2015), *Educational Research: Planning, Conducting, and Evaluating Quantitative and Qualitative Research*, 5th ed., SAGE Publication, CA.

- De Casterlé, B.D., Gastmans, C., Bryon, E. and Denier, Y. (2012), "QUAGOL: a guide for qualitative data analysis", *International Journal of Nursing Studies*, Vol. 49 No. 3, pp. 360-371, doi: [10.1016/j.ijnurstu.2011.09.012](https://doi.org/10.1016/j.ijnurstu.2011.09.012).
- Djurfeldt, A.A. and Sircar, S. (2018), "Gendered land rights and access to land in countries experiencing declining farm size", *AgriFoSe2030 Report 6*.
- Gafura, A.G. (2017), *Land Grabbing, Agrarian Change and Gendered Power Relations: the Case of Rural Maasai Women of Lepurko Village, Northern Tanzania*, International Institute of Social Studies, The Hague.
- Galinsky, A.D., Gruenfeld, D.H. and Magee, J.C. (2003), "From power to action", *Journal of Personality and Social Psychology*, Vol. 85 No. 3, pp. 453-466, doi: [10.1037/0022-3514.85.3.453](https://doi.org/10.1037/0022-3514.85.3.453).
- Garrison-desany, H.M., Wilson, E., Munos, M., Sawadogo-lewis, T., Maïga, A., Ako, O., Mkuwa, S., Hobbs, A.J. and Morgan, R. (2021), "The role of gender power relations on women's health outcomes: evidence from a maternal health coverage survey in Simiyu Region, Tanzania", *BMC Public Health*, Vol. 21, pp. 1-15, doi: [10.1186/s12889-021-10972-w](https://doi.org/10.1186/s12889-021-10972-w).
- Godwin, S.A., Gubin, A., Fiske, S.T. and Yzerbyt, V.Y. (2000), "Power can bias impression processes: stereotyping subordinates by default and by design", *Group Processes and Intergroup Relations*, Vol. 3 No. 3, pp. 227-256, doi: [10.1177/1368430200003003001](https://doi.org/10.1177/1368430200003003001).
- Gómez-Valle, R. and Holvoet, N. (2022), "Incomes, employment and gender roles: understanding women's intrahousehold decision-making participation in Nicaragua", *Fulbright Review of Economics and Policy*, Vol. 2 No. 1, pp. 61-91, doi: [10.1108/frep-11-2021-0073](https://doi.org/10.1108/frep-11-2021-0073).
- Guseva, A. and Ibragimova, D. (2021), "Autonomy as empowerment, or how gendered power manifests itself in contemporary Russian families", in Bluhm, K., Pickhan, G., Stypińska, J. and Wiercholska, A. (Eds), *Gender and Power in Eastern Europe. Societies and Political Orders in Transition: Changing Concepts of Femininity and Masculinity in Power Relations*, Springer, Cham, pp. 173-189, doi: [10.1007/978-3-030-53130-0_12](https://doi.org/10.1007/978-3-030-53130-0_12).
- Hasunga, F., Mohamed, F. and Awinia, C. (2022), "The extent of women's access to customary land titles in Mbozi District, in Songwe Region, Tanzania", *Business Excellence and Management*, Vol. 12 No. 4, pp. 94-110, doi: [10.24818/beman/2022.12.4-07](https://doi.org/10.24818/beman/2022.12.4-07).
- Haug, R., Mwaseba, D.L., Njarui, D., Moeletsi, M., Magalasi, M., Mutimura, M., Hundessa, F. and Aamodt, J.T. (2021), "Feminization of African agriculture and the meaning of decision-making for empowerment and sustainability", *Sustainability*, Vol. 13 No. 16, pp. 1-16, doi: [10.3390/su13168993](https://doi.org/10.3390/su13168993).
- Hillesland, M. and Doss, C.R. (2024), "Addressing intrahousehold dynamics, power and decision-making in household water portfolios", *Water Alternatives*, Vol. 17 No. 3, pp. 669-687.
- Hillesland, M., Slavchevska, V., Henderson, H., Okello, P. and Oumo, F.N. (2020), "Beyond the sex of the holder: understanding agricultural production decisions within household farms in Uganda", *AgriGender Journal of Gender, Agriculture and Food Security AgriGender*, Vol. 5 No. 1, pp. 14-27, doi: [10.19268/JGAFS.512020.2](https://doi.org/10.19268/JGAFS.512020.2).
- Hillier, G.H. (1991), "On multiple diagnostic procedures for the linear model", *Journal of Econometrics*, Vol. 47 No. 1, pp. 47-66, doi: [10.1016/0304-4076\(91\)90077-q](https://doi.org/10.1016/0304-4076(91)90077-q).
- Imburgia, L., Osbahr, H., Cardey, S. and Momsen, J. (2021), "Irrigation in agriculture: a driver of social differentiation and an empowering livelihood option for rural women", *WH2O: Journal of Gender and Water*, Vol. 8, pp. 27-39.
- Jeckoniah, J. (2018), "Gendered analysis of the governance in the rice and sisal value chains in the Lake Zone, Tanzania", *Tengeru Community Development Journal*, Vol. 5 No. 2, pp. 1-14.
- Jhaveri, N. (2021), "Gender, tenure security, and landscape governance", No. PIM Flagship Brief November 2021.
- Kabeer, N. (1999), "Resources, agency, achievements: reflections on the measurement of women's empowerment", *Development and Change*, Vol. 30 No. 3, pp. 435-464, doi: [10.1111/1467-7660.00125](https://doi.org/10.1111/1467-7660.00125).

- Kansiime, M.K., Macharia, M., Baars, E., Rutatora, D.F., Silvestri, S. and Njunge, R. (2020), "Evaluating gender differentials in farmers' access to agricultural advice in Tanzania: an intra-household survey", CABI Working Paper.
- Koester, D. (2015), "DLP concept brief 04: gender and power", pp. 1-7.
- Kulyakwave, P.D., Xu, S. and Wen, Y. (2022), "Substantial factors influencing the performance of rice farmers in Mbeya Region, Tanzania", *Journal of Agricultural Extension and Rural Development*, Vol. 14 No. 4, pp. 183-189, doi: [10.5897/jaerd2021.1293](https://doi.org/10.5897/jaerd2021.1293).
- Larsson, I. and Jormfeldt, H. (2017), "Perspectives on power relations in human health and well-being", *International Journal of Qualitative Studies on Health and Well-Being*, Vol. 12 No. 1, pp. 1-3, doi: [10.1080/17482631.2017.1358581](https://doi.org/10.1080/17482631.2017.1358581).
- Lusiba, G.S., Kibwika, P. and Kyazze, F.B. (2017), "decision-making on rice postharvest handling practices: a case of Eastern Uganda intra-household gender division of labour and decision-making on rice postharvest handling practices: a case of Eastern Uganda", *Cogent Social Sciences*, Vol. 4 No. 1, doi: [10.1080/23311886.2017.1296323](https://doi.org/10.1080/23311886.2017.1296323).
- Magambo, E.F. and Nyamwesa, A.M. (2022), "Gender gap in asset ownership: Tanzania state of play", *African Journal of Applied Research*, Vol. 8 No. 1, pp. 351-361, doi: [10.26437/ajar.03.2022.23](https://doi.org/10.26437/ajar.03.2022.23).
- Makoi, H.J. and Matekere, E. (2018), "Current policy priorities and regulatory approaches for irrigation and associated challenges of 'farmer-led' irrigation development in Tanzania", *Forestry Research and Engineering: International Journal*, Vol. 2 No. 3, pp. 152-161, doi: [10.15406/frej.2018.02.00041](https://doi.org/10.15406/frej.2018.02.00041).
- Marill, K.A. (2004), "Advanced statistics: linear regression, part II: multiple linear regression", *Academic Emergency Medicine*, Vol. 11 No. 1, pp. 94-102, doi: [10.1111/j.1553-2712.2004.tb01379.x](https://doi.org/10.1111/j.1553-2712.2004.tb01379.x).
- Masamha, B., Thebe, V. and Uzokwe, V.N.E. (2018), "Unlocking the household 'black box': a gendered analysis of smallholder farmers' participation in the Cassava (*Manihot esculenta* crantz) value chain in Tanzania", *Journal of International Development*, Vol. 30 No. 1, pp. 20-41, doi: [10.1002/jid.3317](https://doi.org/10.1002/jid.3317).
- Mntambo, B.D. (2017), "Intra-household gender relations and urban agriculture: the case of vegetable cultivation in Morogoro Municipality, Tanzania".
- Mushi, C.A. (2018), "Gender issues in irrigated agriculture in Tanzania: a case study of the lower Moshi scheme", Research Paper for Master's Thesis, International Institute of Social Studies, The Hague.
- Mwalyagile, N., Jeckoniah, J.N. and Salanga, R.J. (2023), "Gender and mechanization in small-scale irrigation schemes: analysis of agricultural machinery access by smallholder rice farmers in Mbarali District, Tanzania", *Tanzania Journal of Agricultural Sciences*, Vol. 22 No. 2, pp. 215-229.
- Mwalyagile, N., Jeckoniah, J.N. and Salanga, R.J. (2024), "Gender differences in rice production participation among smallholder farmers in small-scale irrigation schemes in Mbarali District, Tanzania", *Journal of Agriculture and Food Research*, Vol. 18, 101390, doi: [10.1016/j.jafr.2024.101390](https://doi.org/10.1016/j.jafr.2024.101390).
- Ngailo, J.A., Mwakasendo, J.A., Kisandu, D.B., Mlowe, F.C. and Tippe, D.E. (2016), "Rice farming in the southern highlands of Tanzania: management practices, socio-economic roles and production constraints", *European Journal of Research in Social Sciences*, Vol. 4 No. 4, pp. 28-39.
- Nyabaro, V., Mburu, J. and Hutchinson, M. (2019), "Factors enabling the participation of women in income sharing among banana (*Musa* spp.) producing households in South Imenti, Meru Country, Kenya", *Gender, Technology and Development*, Vol. 23 No. 3, pp. 277-292, doi: [10.1080/09718524.2019.1669104](https://doi.org/10.1080/09718524.2019.1669104).
- Obayelu, A.E., Ogbe, A.O. and Edewor, S.E. (2020), "Gender gaps and female labour participation in agriculture in Nigeria", *African Journal of Economic and Management Studies*, Vol. 11 No. 2, pp. 285-300, doi: [10.1108/AJEMS-03-2019-0128](https://doi.org/10.1108/AJEMS-03-2019-0128).
- Obisesan, A.A. and Akinola, M.O. (2021), "Women's involvement in intra-household decision making on agricultural production: what factors matter? Envolvimento das mulheres nas decisões dentro do domicílio na produção agrícola: quais fatores importam?", *Periodicity: Semestral*, Vol. 10 No. 2, p. 2021, doi: [10.5281/zenodo.5562354](https://doi.org/10.5281/zenodo.5562354).

- Onyambu, M.O. (2019), "Land ownership as symbol of gender power relations in Gusii, Kenya: a historical perspective", *International Journal of Gender Studies*, Vol. 4 No. 1, pp. 48-58.
- Oppong, D. and Bannor, R.K. (2022), "Gender and power work relationships: a systematic review on the evidence from Africa and Asia", *Cogent Social Sciences*, Vol. 8 No. 1, 2031686, doi: [10.1080/23311886.2022.2031686](https://doi.org/10.1080/23311886.2022.2031686).
- Osanya, J., Adam, R.I., Otieno, D.J., Nyikal, R. and Jaleta, M. (2020), "An analysis of the respective contributions of husband and wife in farming households in Kenya to decisions regarding the use of income: a multinomial logit approach", *Women's Studies International Forum*, Vol. 83, 102419, doi: [10.1016/j.wsif.2020.102419](https://doi.org/10.1016/j.wsif.2020.102419).
- Pelekamoyo, J. and Umar, B.B. (2019), "Access to and control over agricultural labor and income in smallholder farming households: a gendered look from Chipata, Eastern Zambia", *AgriGender Journal of Gender, Agriculture and Food Security AgriGender*, Vol. 4 No. 2, pp. 42-57, doi: [10.19268/JGAFS.422019.4](https://doi.org/10.19268/JGAFS.422019.4).
- Peluso, N.L. and Ribot, J. (2020), "Postscript: a theory of access revisited", *Society and Natural Resources*, Vol. 33 No. 2, pp. 300-306, doi: [10.1080/08941920.2019.1709929](https://doi.org/10.1080/08941920.2019.1709929).
- Peralta, A. (2022), "The role of men and women in agriculture and agricultural decisions in Vanuatu", *Asia and the Pacific Policy Studies*, Vol. 9 No. 1, pp. 59-80, doi: [10.1002/app5.344](https://doi.org/10.1002/app5.344).
- Pires, A.M. and Rodrigues, I.M. (2007), "Multiple linear regression with some correlated errors: classical and robust methods", *Statistics in Medicine*, Vol. 26 No. 15, pp. 2901-2918, doi: [10.1002/sim.2774](https://doi.org/10.1002/sim.2774).
- Quisumbing, A.R. and Doss, C.R. (2021), *Gender in Agriculture and Food Systems, Handbook of Agricultural Economics*, 1st ed., Elsevier B.V., Amsterdam, Vol. 5, doi: [10.1016/bs.hesagr.2021.10.009](https://doi.org/10.1016/bs.hesagr.2021.10.009).
- Rahel, K. (2021), "Access to land for women's empowerment: the case of Basona Werana Woreda, North Showa, Amhara National Regional state, Ethiopia".
- Ribot, J.C. and Peluso, N.L. (2003), "A theory of access", *Rural Sociology*, Vol. 68 No. 2, pp. 153-181, doi: [10.1111/j.1549-0831.2003.tb00133.x](https://doi.org/10.1111/j.1549-0831.2003.tb00133.x).
- Richards, N. (2019), "Water users associations in Tanzania: local governance for whom?", *Water*, Vol. 11 No. 10, p. 2178, doi: [10.3390/w11102178](https://doi.org/10.3390/w11102178).
- Şahin, M.D. and Ozturk, G. (2019), "Mixed method research: theoretical foundations, designs and its use in educational research", *International Journal of Contemporary Educational Research*, Vol. 6 No. 2, pp. 301-310, doi: [10.33200/ijcer.574002](https://doi.org/10.33200/ijcer.574002).
- Sell, M. and Minot, N. (2018), "What factors explain women's empowerment ? Decision-making among small-scale farmers in Uganda", *Women's Studies International Forum*, Vol. 71, pp. 46-55, doi: [10.1016/j.wsif.2018.09.005](https://doi.org/10.1016/j.wsif.2018.09.005).
- Sikira, A.N. and Kashaigili, J.J. (2017), "Gendered access and control over land and water resources in the southern agricultural Growth Corridor of Tanzania", *Journal of Natural Resources and Development*, Vol. 2016 No. 6, pp. 108-117, doi: [10.5027/jnrd.v6i0.12](https://doi.org/10.5027/jnrd.v6i0.12).
- Singh, A.P. and Srivastava, A.K. (2023), "Studying the impact of women's participation, social status, and decision-making on agriculture in Madhya Pradesh's Rewa District", *The Pharma Innovation Journal*, Vol. 12 No. 2, pp. 3223-3228.
- Sinyolo, S.A., Sinyolo, S., Mudhara, M. and Ndinda, C. (2018), "Gender differences in water access and household welfare among smallholder irrigators in Msinga local municipality, South Africa", *Journal of International Women's Studies*, Vol. 19 No. 5, pp. 129-146.
- Tarar, M., Ahamed, R.I. and Saleem, S. (2022), "Women's financial status, autonomy and household bargaining in the Punjab: a feminist analysis", *Pakistan Social Sciences Review*, Vol. 6 No. II, pp. 183-196, doi: [ii\)17](https://doi.org/10.1177/1119266222111111).
- URT (2009), *National Irrigation Policy, Draft*, Ministry of Water and Irrigation, Dar Es Salaam, Tanzania.
- URT (2017), "Mbarali district council socio-economic profile 2015".
- URT (2019), "National rice development strategy phase II (NRDS II) 2019-2030".

Were, M., Odongo, M. and Israel, C. (2021), "Gender disparities in financial inclusion in Tanzania",
World Institute for Development Economic Research (UNU-WIDER, No. Wp-2021-97).
Yamane, H. (1967), "Universal matrices for quantum groups associated, to simple lie super algebras",
pp. 108-112.

Supplementary material

The supplementary material for this article can be found online.

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