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Impact of Gender-Based Agricultural Decision-Making on Household Food Security: Evidence From Makalu Rural Municipality, Sankhuwasabha, Nepal

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Abstract

Food insecurity remains a persistent challenge in the mountain regions of developing countries, shaped by intra-household gender dynamics and structural resource constraints. Grounded in Feminist Political Economy (FPE) and Intra-Household Bargaining Theory (IHBT), this study examines how women's participation in agricultural decision-making influences household food security in Makalu Rural Municipality, Sankhuwasabha district, Nepal. Using census data from 3,075 farming households drawn from the National Sample Census of Agriculture (2021/22), the study analyzes the relationship between women's decision-making roles and both the likelihood and duration of household food insecurity through binary logistic and ordinal regression models. Contrary to conventional expectations, increased female participation in decision-making is associated with higher odds of food insecurity (OR = 1.534, $p < 0.001$) and longer periods of food shortages (OR = 1.428, $p < 0.001$). However, structural factors significantly shape these outcomes: land ownership (OR = 0.822, $p < 0.001$) and access to agricultural training (OR = 0.732, $p = 0.002$) are linked to reduced food insecurity risks. The findings suggest that decision-making power alone does not ensure improved food security without adequate resource access. Women's participation may reflect coping strategies under economic stress rather than genuine empowerment. Policy interventions should therefore prioritize equitable land rights and gender-inclusive agricultural extension services to strengthen household food security.

Keywords: gender, decision-making, food security, resource access, Makalu Rural Municipality

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Introduction

Food insecurity is one of the greatest global development challenges today. International communities have been taking efforts to address the problem of hunger through the Sustainable Development Goals (SDGs), most notably Goal 2, yet sufficient progress has not been achieved. The Food and Agriculture Organization [FAO] et

al. (2025) reported that in 2024, approximately 2.3 billion people (28% of the global population) experienced moderate or severe food insecurity, while 673 million people (8.2%) faced hunger. In addition, the global number of stunted children—an important nutritional indicator—has remained around 150 million since 2021 (United Nations Statistics Division [UNSD], 2025). These figures indicate that the failure of food systems to ensure adequate nutrition, food quantity, and safety largely stems from social and economic disparities rather than solely from insufficient production.

Traditionally, food security was mainly understood as an issue of food production and availability. Today, food security discourses increasingly emphasize social, institutional, and structural factors. Among these, gender inequality stands out as a major concern. The SDGs explicitly link Goal 2 (Zero Hunger) with Goal 5 (Gender Equality), highlighting their interdependence. Due to limited access to land and agricultural inputs, women face numerous food security barriers rooted in gender inequality (FAO et al., 2024). Similarly, the International Fund for Agricultural Development (IFAD, 2022) argues that only a gender-transformative approach can reform unjust social practices and agricultural policies to ensure sustainable food security.

Women are not only major contributors to household food and nutrition security, but also women's empowerment is strongly associated with improved dietary quality and reduced food insecurity (Ayamga et al., 2023). Nevertheless, this relationship is not automatic and is shaped by structural inequalities. Addressing these barriers can enhance their access to resources, decision-making roles, and agency, thereby contributing to both gender equality and food security (Bryan et al., 2024). At the household level, women's access to agricultural inputs and productive assets can increase agricultural productivity and improve food security outcomes. However, such outcomes are not inevitable, as deeper structural inequalities continue to condition them.

Studies have shown that women's empowerment has a linear and positive correlation with household food security (Beriso et al., 2023; Sraboni et al., 2014). However, this relationship is neither straightforward nor consistent. The proposition that women's participation in agricultural decision-making increases food security has been widely questioned, as it often overlooks the structural constraints shaping both the meaning and effectiveness of decision-making (Doss, 2015; Agarwal, 2018). In many cases, women's participation reflects necessity rather than empowerment—for example, when male family members migrate, labour shortages occur, or households experience economic stress.

The relationship between gender and food security varies across contexts. In Bangladesh, women's participation in household agricultural decision-making improved food security outcomes (Haque et al., 2024). In Ethiopia, women's empowerment has been linked to higher caloric consumption (Beriso et al., 2023). However, another study from southern Ethiopia found that women's involvement in decision-making and access to credit in farming were associated with higher levels of food insecurity (Jemaneh & Shibeshi, 2023). Similarly, in Kenya, female-headed households—particularly those with malnourished children—show higher vulnerability to food insecurity (Mikalitsa, 2015). These contrasting findings suggest that women's decision-making participation may not lead to sustained improvements in food security unless accompanied by broader structural changes.

Women's involvement in agriculture is often shaped by adverse incorporation under structurally unfavorable conditions (Jackson, 2007). When men migrate for employment, women assume greater responsibility for both household and agricultural activities. However, increased responsibility does not necessarily translate into access to resources or autonomous decision-making power (Cornwall, 2016). In such contexts, women may manage agricultural activities without owning land, accessing credit, or controlling income. Decision-making participation alone, therefore, does not automatically improve household food security, and women may continue to face disadvantages due to limited land entitlements and restricted access to credit (Choithani, 2019).

Women's access to productive resources remains a critical determinant of food security. Women continue to experience inequalities in access to agricultural inputs such as fertilizer, credit, extension services, and improved seeds (Peterman et al., 2014). Land ownership among women is also constrained by prevailing legal and social norms (Doss et al., 2015). Such inequalities contribute to productivity gaps; for example, in Malawi, female-managed farms recorded yield gaps of up to 25% compared to male-managed farms, largely due to unequal access to resources (Kilic et al., 2014). The International Food Policy Research Institute [IFPRI] (2020) further argues that women's ownership of productive assets strengthens household food security. In Nepal, as in many other parts of the world, land and livestock ownership are important factors of household food security. For a broader global perspective on how assets influence food security, further discussion is required.

In Nepal, agriculture remains the dominant sector, sustaining rural livelihoods. However, the country faces serious gender inequalities and other barriers affecting food security, most of which are structural in nature. One of the most striking aspects of gender inequality is the gap between women's labour contribution and their control over key agricultural assets. Women contribute a substantial share of agricultural labour (around 62% of the workforce), yet they control only a small proportion of land (24%) (National Statistics Office, 2022). Women's decision-making authority and access to productive resources such as land, credit, and extension services remain limited, largely due to patriarchal social norms, despite constitutional and policy commitments to gender equality (Asian Development Bank [ADB], 2023). This situation has created a paradox in which women remain the backbone of food systems while simultaneously facing heightened vulnerability to food insecurity and malnutrition (IFAD, 2022).

Geographical disparities within Nepal further shape food insecurity patterns. Remote mountain regions such as Karnali and the Far Western Province experience particularly high levels of food insecurity due to geographic isolation, climate change impacts, and inadequate infrastructure (Bhandari, 2018; Chemjong & KC, 2020). Social protection programs have contributed to reducing food insecurity vulnerability, especially among households with many children, yet deep-rooted structural inequalities persist (Paudel, 2024). Nepal has adopted gender-responsive policies, including the Agriculture Development Strategy (Ministry of Agriculture Development, 2015) and the Fifteenth Plan, emphasizing gender mainstreaming and social inclusion (National Planning Commission [NPC], 2020). Nevertheless, a significant gap remains between policy commitments and implementation,

largely due to enduring socio-cultural norms that continue to limit women's effective participation (Halim et al., 2023). In agricultural contexts, therefore, gender equality is shaped as much by social norms as by policy frameworks.

The relationship between gender and food security has shifted from a narrow focus on women's welfare to a recognition of their involvement and the structural limitations they face. Feminist Political Economy (FPE) argues that persistent inequalities are produced through interconnected economic, social, and political power relations, including gendered structures of social reproduction, labour inequality, household dynamics, and care work at both global and household levels (Cantillon et al., 2023). This perspective places women at the center of struggles over resources, knowledge, environmental justice, and sustainable development (Rocheleau, 1996). Capitalist and patriarchal systems contribute to gender disparities in access to productive resources, institutions, and markets (Jackson, 2007; Cornwall, 2016). Thus, these gendered relations not only determine the users and controllers of productive and natural resources (Agarwal, 2018) but, more importantly, they point to the need to understand the features of gender relations so that food insecurity can be effectively tackled. From this perspective, women's participation in household farming decisions alone does not transform outcomes; limited access to resources continues to constrain empowerment (WFP, 2020). Similarly, increases in women's income or education cannot fully explain empowerment because it remains embedded within broader structural and cultural power relations. Addressing these deeper inequalities is therefore essential for achieving household food security (Broussard, 2019).

In addition to FPE, Intra-Household Bargaining Theory (IHBT) views household food security as the outcome of negotiation among members with potentially differing interests rather than a unified household objective (Sen, 1987; Agarwal, 1997). The theory suggests that women's education, income generation, and property ownership strengthen their bargaining power, particularly in decisions regarding resource allocation and household food security (Doss, 2013). Within this framework, power is closely linked to a person's ability to support themselves if they decide to leave; finding a job, getting help from relatives, or turning to friends for assistance. Empowering women with access to social support if necessary. Expanding women's access to resources can therefore reshape household dynamics, often leading to decisions that promote improved nutrition and healthier diets. Without such support, decision-making authority may merely reflect unequal bargaining positions shaped by limited alternatives. Grounded in these two theoretical perspectives (FPE and IHBT), this study adopts a deductive approach to investigate why increased female decision-making participation may coexist with food insecurity when structural support is limited, and how such constraints weaken women's bargaining power within households. Accordingly, the study hypothesizes that households in which women assume primary agricultural decision-making roles without adequate structural support are more likely to experience food insecurity.

Despite being central actors in global food systems, women's access to productive resources, extension services, and decision-making authority remains constrained by structural and institutional barriers. Addressing these barriers by ensuring women's equal access to land, agricultural inputs, and extension

services could increase farm yields by 20–30% and raise total agricultural production by 2.5–4% across developing countries (FAO, 2011). However, increasing food production alone is insufficient to fully explain food security outcomes, as agricultural systems operate within multidimensional, multilayered, and context-specific gender dynamics embedded in socio-cultural structures. Moreover, growth potential is often undermined by persistent structural constraints across the Global South. Therefore, gendered structural dynamics must be carefully understood; otherwise, production-centered explanations of food security will remain incomplete. New institutional arrangements and innovative financing mechanisms that expand women's access to productive resources are necessary to overcome these barriers and ensure food security (FAO et al., 2024).

Existing studies highlight that the relationship between gendered agricultural decision-making and household food security is highly complex and strongly influenced by structural factors such as access to assets and institutional support. Much of the literature focuses on the broader relationship between women's empowerment and household food security rather than on intra-household decision-making processes themselves. Empirical understanding of the gender dynamics and food security in remote mountain regions also remains limited. This study seeks to fill this gap by examining how gender-based agricultural decision-making affects household food security in Makalu Rural Municipality of Sankhuwasabha district of Nepal.

Methodology

This study employs a quantitative research methodology using a correlational research design based on secondary data from the National Sample Census of Agriculture (2021/22) in Nepal. The dataset consists of cross-sectional data from 3,075 farming households in Makalu Rural Municipality, Sankhuwasabha. The target population includes all agricultural households in the municipality. Because the data were collected through a nationwide census conducted by the Government of Nepal, no additional primary sampling was required.

Both descriptive and inferential statistical analyses were conducted to examine the relationship between gendered decision-making and household food security. Household food security served as the dependent variable and was measured in two ways: (1) a binary indicator of food sufficiency (sufficient vs. insufficient) and (2) an ordinal variable measuring the duration of food shortage, categorized into four levels (1–3 months, 4–6 months, 7–9 months, and 10–12 months) to construct a food insecurity scale. Two regression models were estimated: (a) a binary logistic regression model to assess food security status and (b) an ordinal logistic regression model to examine the duration of food insecurity. These models are appropriate for categorical dependent variables and are widely used in empirical studies on gender and food security.

The main explanatory variable was gendered decision-making, measured through participation ratios and categorized into male-dominated, female-dominated, and balanced decision-making patterns. Control variables included landholding size, agricultural training, and sources of income. All statistical analyses were performed using SPSS software (version 26). Model predictive power and goodness-of-fit were evaluated using Nagelkerke R^2 values, the Hosmer–Lemeshow goodness-of-fit test, and the

parallel lines test for the ordinal logistic model. The unit of analysis was the farming household.

Results and Discussion

Descriptive Statistics

A total of 3,075 farming households from Makalu Rural Municipality were included in the study. As presented in Table 1, the results reveal significant gender differences in household headship: 74.2% of households were male-headed, and 25.8% were female-headed, representing a gender gap of 48.4 percentage points. Across these households, 11,666 individuals (5,814 males and 5,852 females) were engaged in agricultural activities. Food insecurity was reported by 51.4% of households, indicating a high prevalence of food insecurity in the study area. Decision-making patterns showed moderate gender inequality. The male decision-making share (53.3%) exceeded the female share (46.7%). Participation rates were 100% for both men and women, suggesting that joint decision-making practices at the household level were common; however, men continued to hold the majority of decision-making authority. Only 0.3% of households benefited from government agricultural subsidies or agricultural insurance programs, indicating that social protection coverage in the study area is extremely limited.

Table 1

Sample Characteristics and Distribution (N=3,075)

	Characteristic	n	%
Family headship	Male-headed families	2,282	74.2
	Female-headed families	793	25.8
Food security status	Food secure	1,495	48.6
	Food insecure	1,580	51.4
Decision-making ratio*	Male	—	53.3
	Female	—	46.7
Social protection indicators	Households receiving government agricultural subsidies	8	0.3
	Households receiving government agricultural insurance	8	0.3

Note. The decision-making ratio represents the proportion of agricultural decisions (crop choice, input purchase, and land use) made by each gender across all households. National Sample Census of Agriculture (2021/22), Government of Nepal.

Food Insecurity Duration

Each household experienced at least 1–3 months of food shortage annually (Table 2), indicating that food insecurity is a seasonal phenomenon in the study area. In Nepal, food insecurity remains a serious and largely seasonal issue, particularly affecting subsistence farmers who rely on rain-fed agriculture and have limited access to markets and land ownership (Karki et al., 2021). However, the severity of food insecurity varies considerably. Only 4.1% of households experienced extreme food insecurity, defined as a food shortage lasting 10–12 months. This finding suggests that prolonged food shortages are primarily associated with structural and seasonal vulnerabilities within rural livelihood systems rather than representing a uniform condition of chronic deprivation.

Table 2

Duration of Food Shortage Among Food-Insecure Households (n = 1,580)

Duration of Food Shortage (Months/Year)	Number of Households	Percentage of Food-Insecure Households (%)
1–3 months	1,580	100.0
4–6 months	912	57.7
7–9 months	596	37.7
10–12 months	64	4.1

Note. National Sample Census of Agriculture (2021/22), Government of Nepal

The results show that food insecurity is a serious problem in the study area, affecting both male- and female-headed households. More specifically, food-insecure households accounted for 51.0% of male-headed households and 52.5% of female-headed households. Although female-headed households show a slightly higher rate (1.5%) of food insecurity, this difference is not sufficient to demonstrate a strong relationship between household headship and food security outcomes. Overall, the findings suggest that household headship alone cannot be considered a strong determinant of food security outcomes.

Table 3

Food Insecurity by Sex of Household Head

Household Headship	Food Secure (n)	Food Insecure (n)	Total (n)	Food Insecurity Rate (%)
Male headed	1,118	1,164	2,282	51.0
Female headed	377	416	793	52.5
Total	1,495	1,580	3,075	100.0

Note. National Sample Census of Agriculture (2021/22), Government of Nepal.

Main Income Source and Food Security

The study identifies a significant difference in food security outcomes based on the primary source of household income. Households that depend on agriculture as their main income source have a food insecurity rate of 58.5%, whereas households with non-agricultural primary income sources show only 5.4% food insecurity. This substantial gap indicates that agriculturally dependent households are more vulnerable to food insecurity in the study area. This situation may be linked to the inherent uncertainties of agricultural livelihoods in rural contexts, including climate variability, limited market access, and low productivity. In contrast, households relying primarily on agriculture often have weaker fallback options, which reduces their resilience to shocks and increases their likelihood of experiencing food insecurity. Previous studies (Ellis, 2000; Barrett et al., 2001) consistently show that livelihood diversification is associated with improved food security outcomes.

Table 4

Food Insecurity by Main Income Source

Main Income Source	Food Secure (n)	Food Insecure (n)	Total (n)	Food Insecurity Rate (%)
Agriculture	1,106	1,558	2,664	58.5
Non agriculture	389	22	411	5.4
Total	1,495	1,580	3,075	51.4

Note. National Sample Census of Agriculture (2021/22), Government of Nepal.

Decision-Making Patterns and Food Security

The cross tabulation (Table 5) revealed that the association between decision-making patterns and food security status was statistically significant (x2=15.73, p<0.001). Food insecurity was very high in female-led decision-making households (62.1%), followed by balanced decision-making households (61.6%) and male-led households (58.0%). Nevertheless, decision-making patterns contributed very little variation in food security outcomes as indicated by a modest effect size (Cramer's V=0.071). Therefore, decision-making patterns within the household, by themselves, are probably less important compared to structural factors. Hence, a more in-depth analytical method encompassing multivariate analysis is necessary to properly explain the factors driving food security.

Table 5

Cross-Tabulation of Decision-Making Patterns and Food Security Status

Decision-Making Pattern	Food Secure n(%)	Food Insecure n(%)	Total n	Food Insecurity Rate (%)
Male-dominated	628 (42.0)	868 (58.0)	1,496	58.0
Female-dominated	568 (37.9)	932 (62.1)	1,500	62.1
Balanced	299 (38.4)	480 (61.6)	779	61.6
Overall	1,495 (48.6)	1,580 (51.4)	3,075	51.4

Note. X^2 =15.73, p<0.001, Cramer's V=0.071

Multivariate Analysis: Binary Logistic Regression

Binary logistic regression analysis (Table 6) shows that the female decision-making ratio was a significant predictor of food insecurity (OR = 1.534, 95% CI [1.288, 1.828], p < 0.001). This suggests that the odds of food insecurity are higher, rather than implying causation. In fact, after adjusting for other variables, it demonstrated that farming households with greater female decision-making participation were 53.4% more likely to be food insecure. Besides, land area showed a very strong negative association with food insecurity (OR = 0.822, 95 CI [0.752, 0.898], p < 0.001), meaning that each additional hectare was associated with 17.8% lower odds of food insecurity. Agriculture training was also a factor for significantly lowering the chances of food insecurity (OR=0.732, 95 CI [0.600, 0.893], p < 0.002), whereas being highly dependent on agriculture explained substantially higher odds of food insecurity (OR=1.332, 95%

CI [1.143, 1.553], p < 0.001). Overall, taking all the variables into account, decision-making dynamics within households and structural livelihood factors seem to be determining factors of food insecurity in households. However, the extent of the influence varies.

Table 6

Binary Logistic Regression Predicting Food Insecurity

Predictor	B	SE	Odds Ratio	p	95% CI for OR
Constant	0.215	0.104	1.240	0.039	[1.011, 1.521]
Female Decision Ratio	0.428	0.089	1.534	< 0.001	[1.288, 1.828]
Land Area (hectares)	-0.196	0.045	0.822	< 0.001	[0.752, 0.898]
Agricultural Training	-0.312	0.102	0.732	0.002	[0.600, 0.893]
Agriculture Main Income	0.287	0.078	1.332	< 0.001	[1.143, 1.553]

Note. Nagelkerke R^2=0.186, Hosmer-Lemeshow p=0.491, Classification Accuracy=67.3%

Ordinal Regression for Duration of Food Insecurity

Ordinal regression analysis (Table 7) shows that the female decision-making ratio is a significant predictor of longer food insecurity duration (OR = 1.428, 95% CI [1.188, 1.716], p < 0.001). In other words, when other factors are held constant, greater involvement of women in decision-making is associated with a higher probability of belonging to longer food insecurity duration categories. However, land area (OR = 0.799, 95% CI [0.723, 0.883], p < 0.001) and agricultural training (OR = 0.742, 95% CI [0.592, 0.930], p = 0.010) demonstrate protective effects against prolonged food insecurity. This means that larger farm sizes and access to agricultural training are linked to a lower likelihood of experiencing longer durations of food insecurity in the study area. In addition, cash crop production significantly reduces the duration of food insecurity (OR = 0.829, 95% CI [0.705, 0.976], p = 0.024). Overall, these findings indicate that intra-household decision-making dynamics and structural livelihood assets play important but contrasting roles in shaping the persistence of food insecurity over time.

Table 7

Ordinal Regression of Food Insecurity Duration Determinants

Predictor	Coefficient	SE	Odds Ratio	p	95% CI for OR
Female decision ratio	0.356	0.094	1.428	<0.001	[1.188, 1.716]
Land area (hectares)	-0.224	0.051	0.799	<0.001	[0.723, 0.883]
Agricultural training	-0.298	0.115	0.742	0.010	[0.592, 0.930]
Cash crop production	-0.187	0.083	0.829	0.024	[0.705, 0.976]

Note. Nagelkerke R^2=0.143, Parallel Lines Test p=0.322

This study adopted a deductive approach grounded in FPE and IHBT. The findings show that greater women's participation in decision-making is associated with both a higher occurrence and a longer duration of food insecurity (OR = 1.534, $p < 0.001$ for occurrence; OR = 1.428, $p < 0.001$ for duration). These results contradict the common assumption that women's empowerment through household decision-making automatically leads to improved food security outcomes. According to IHBT, this paradox can be explained as weak fallback positions. Women's participation in decision-making often occurs without adequate access to productive resources such as land, income, and institutional support, which limits their capacity to influence household outcomes effectively.

From the perspective of adverse incorporation (Jackson, 2007; Cornwall, 2016), this paradox becomes clearer when women's assumption of decision-making roles is interpreted as a coping response to household challenges, rather than as evidence of genuine empowerment. In situations of male out-migration, labour shortages, or economic insecurity, women's leadership roles often emerge as survival strategies, rather than indicators of enhanced agency. The findings, therefore, challenge dominant empowerment narratives that assume increasing women's decision-making authority will automatically improve household food security (Agarwal, 2018; Quisumbing, 2003). They further suggest that under structural constraints—particularly during male out-migration or household economic crises—women assume agricultural decision-making responsibilities out of necessity rather than strengthened decision-making capacity (Kadiyala et al., 2014). This reflects asymmetrical bargaining conditions in which increased responsibilities are not matched by greater bargaining power, as limited fallback options continue to constrain women's agency.

The findings provide strong empirical support for IHBT (Sen, 1987; Agarwal, 1997). Land area remains a significant protective factor in both regression models (binary: OR = 0.822; ordinal: OR = 0.799), highlighting asset ownership as a central determinant of bargaining power and food security. Land ownership creates stronger safety nets, as predicted by IHBT, by enhancing individuals' influence over household decisions. It strengthens fallback positions, enabling women to exercise greater agency and more effectively shape intra-household resource allocation. The results confirm that bargaining power does not depend solely on individual characteristics, but is fundamentally shaped by access to land, income, and institutions. Agricultural systems themselves are structured by socio-cultural and institutional barriers that limit women's rights and opportunities due to restricted resource access (Jackson, 2007). These barriers include limited access to credit markets, extension services, and adequate landholdings, all of which constrain women's capacity to exercise effective decision-making power (Doss, 2015).

At the same time, the positive association between female decision-making and food insecurity points to a condition of participation without power, in which women assume decision-making responsibilities despite lacking sufficient resources to improve household welfare. In this sense, the findings contribute to Feminist Political Economy debates by demonstrating that gender inequality involves not only exclusion but also constrained and conditional inclusion within resource-limited environments.

Agricultural training significantly reduces food insecurity (OR = 0.732, $p < 0.002$),

suggesting that skill development should be a central focus of food security interventions. However, decision-making without enhanced capabilities may result in what Cornwall (2016) described as "empty empowerment." Addressing inequalities in resource access is therefore essential for achieving sustainable food security. From an IHBT perspective, training enhances capabilities, improves economic participation, and strengthens women's bargaining positions within households. Furthermore, the vulnerability associated with agricultural dependence (OR = 1.332, $p < 0.001$) highlights the risks inherent in farm-based livelihoods in the study area. This finding strongly supports IHBT's emphasis on fallback options: households relying solely on agriculture possess fewer alternative income sources, weakening their bargaining position and increasing vulnerability to food insecurity.

As illustrated in Table 4, food insecurity differs by more than tenfold between households whose primary livelihood is agriculture (58.5%) and those relying on non-agricultural income sources (5.4%). This pattern indicates that many households depend heavily on agriculture without sufficient alternative income streams to buffer shocks such as production failure or seasonal variation. Agricultural development alone, therefore, cannot guarantee food security; livelihood diversification strategies are necessary to reduce vulnerability and strengthen household resilience (Ellis, 2000).

The framework proposed by FPE suggests that women-led households are systematically disadvantaged in terms of food security, primarily because of structural marginalization. However, univariate analysis (Table 3) shows only a 1.5 percentage point difference in food insecurity between male-headed and female-headed households (52.5% vs. 51.0%). This finding partially contradicts straightforward interpretations of the FPE framework that anticipate a large gender gap. Nevertheless, due to limitations of the secondary data used in this study—particularly the lack of detailed information on intra-household inequalities—it is difficult to conclude that this result invalidates FPE. Bargaining power among women in male-headed households may still be highly constrained. Thus, FPE remains relevant but should be complemented by a critical examination of intra-household dynamics rather than relying solely on household headship categories. This illustrates why IHBT remains important: being the household head alone does not determine bargaining power. Rather, control over resources and fallback positions within households constitutes the real basis of power.

This study provides a foundation for rethinking the relationship between gender and food security. Linear empowerment assumptions should be replaced with more integrated and context-sensitive frameworks. An approach combining FPE's focus on structural constraints, IHBT's emphasis on fallback positions, and the concept of adverse incorporation is necessary. Structural constraints include land tenure insecurity, limited credit access, and inadequate extension services, while fallback positions involve income diversification, remittances, and social protection mechanisms. Adverse incorporation reflects situations in which women's participation represents a survival strategy rather than genuine empowerment. Women's decision-making under structural constraints therefore mediates the gender–food security relationship. Land tenure reforms that strengthen women's access to and control over productive resources are essential for improving

food security outcomes. Similarly, agricultural extension services must be gender-responsive, addressing women's specific barriers as well as their broader needs and preferences. Livelihood diversification can expand income opportunities, while timely assistance programs can reduce food insecurity by responding to seasonal vulnerability. As shown in Table 1, only 0.3% of households benefit from government subsidies and agricultural insurance, indicating extremely low social protection coverage. This represents a critical policy gap that weakens households' capacity to withstand agricultural and economic shocks and increases food vulnerability. Consequently, integrating insights from both FPE and IHBT offers a more comprehensive explanation of the gender–food security paradox.

Conclusion

This study examined the impact of gender-based agricultural decision-making on household food security in Makalu Rural Municipality using a census-based sample of 3,075 households and guided by the FPE and IHBT frameworks. The findings indicate that increased women's involvement in decision-making is associated with significantly higher risks of food insecurity and longer durations of food shortages. In contrast, larger landholdings and access to agricultural training reduce food insecurity, suggesting that structural resources mediate this relationship. Moreover, reliance on agriculture as the primary income source increases food insecurity risk by 32.2%, while households with non-agricultural income sources are more than ten times as food secure. Female-headed households exhibit only slightly higher food insecurity compared to male-headed households.

Theoretically, the results strongly support IHBT, particularly the importance of fallback positions, while challenging simplified interpretations of FPE that expect substantial gender gaps based solely on household headship. The study also contributes theoretically by highlighting the role of adverse incorporation, demonstrating that women's decision-making may increase not only because of empowerment but also because of structural constraints.

Overall, the relationship between gendered decision-making and food security is not linear but mediated by unequal access to resources and persistent structural barriers. The observed association between higher female decision-making ratios and greater food insecurity prevalence and duration reveals a gender paradox that calls for theoretical refinement and policy attention rather than rejection of existing frameworks. Women's participation in agricultural decision-making under conditions of restricted access to land and resources challenges dominant empowerment narratives. Achieving food security, therefore, requires integrating women's access to productive resources with capability development while considering broader socio-cultural contexts.

The study reveals a complex set of factors shaping food security in Makalu. Agricultural training demonstrates a strong protective effect, whereas dependence solely on agricultural income increases vulnerability. Effective interventions should therefore combine livelihood diversification and human capital development alongside improvements in food production. Such measures must explicitly address structural inequalities affecting both men and women farmers in different ways.

At the policy level, the findings emphasize the need to prioritize land tenure reforms, strengthen gender-responsive agricultural extension services, promote livelihood diversification, and introduce targeted seasonal support mechanisms for vulnerable farming households. Expanding social protection coverage—particularly agricultural insurance and subsidies—is also essential, given the extremely limited coverage observed in the study area.

Finally, the study highlights limitations in existing literature and underscores the importance of analyzing resource mediation and intra-household dynamics through context-sensitive and structurally grounded frameworks. Future research should explore causal pathways using longitudinal designs and collect intra-household-level data to better capture gendered decision-making processes. In conclusion, simply increasing women's participation in agricultural decision-making is insufficient to resolve food insecurity if access to productive resources remains constrained. Sustainable household food security in rural mountain communities such as Makalu, Nepal, requires both women's empowerment and broader structural transformation.

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