



Gender-Sensitive Innovation, Household Empowerment, and Resilient Livelihoods for Free-Range Chicken Enterprises in Santa Maria, Ilocos Sur, Philippines

¹Mr. Richard D. Dela Cruz, ²Engr. Jhun A. Cabebe, ³Engr. Ma. Theresa P. Dela Rosa, ⁴Ms. Arriene L. Villanueva, ⁵Ms. Ivy A. Cacabelos, ⁶Dr. Ma. Cecilia A. Lazarte

¹(Assistant Professor III), College of Agriculture, Forestry, Engineering, and Development Communication, Ilocos Sur Polytechnic State College, Santa Maria Campus, Santa Maria, Ilocos Sur, Philippines, 09613664427, boyfichanz@gmail.com

²(Assistant Professor II), College of Agriculture, Forestry, Engineering, and Development Communication, Ilocos Sur Polytechnic State College, Santa Maria Campus, Santa Maria Ilocos Sur, Philippines

³(Assistant Professor IV), College of Agriculture, Forestry, Engineering, and Development Communication, Ilocos Sur Polytechnic State College, Santa Maria Campus, Santa Maria, Ilocos Sur, Philippines

⁴(Instructor I), College of Business Management and Entrepreneurship, Ilocos Sur Polytechnic State College, Santa Maria Campus, Santa Maria, Ilocos Sur, Philippines

⁵(Instructor II), College of Business Management and Entrepreneurship, Ilocos Sur Polytechnic State College, Santa Maria Campus, Santa Maria, Ilocos Sur, Philippines

⁶(Associate Professor I), College of Computing Studies, Ilocos Sur Polytechnic State College, Santa Maria Campus, Santa Maria, Ilocos Sur, Philippines

Abstract

Background: The integration of gender perspectives in agricultural innovations is important for balanced rural development. In this research, the effect of gender-aware interventions (housing modification, breeding participation, gender parity in market links) in free-range chicken farming was investigated in Santa Maria, Ilocos Sur, Philippines.

Methodology: A quasi-experimental method was adopted using two sets of 75 intervention and control households. Quantitative measures used in this experiment include questionnaires, performance evaluations, and geographic information system (GIS). Qualitative instruments involved deep interviews, focus group discussions (FGD), and observations. All methods employed in this study were pilot-tested, and baseline equivalence among household size, farming expertise, and business description (all $p > 0.05$) was determined.

Results: The intervention groups showed an average production level that was 32.2% higher, mortality rate that was 47.8% lower, and resilience score that was 50.1% higher compared to the control groups. Female respondents had 68% greater authority over decisions, while 72% of male members said that there was improvement in the family decision-making process. Gender-parity in market connections allowed direct sales transactions to buyers at 90.7%.

Conclusion: Gender-aware innovation is one of the key drivers of productivity, equity, and resilience. Policy recommendations include model replication to other barangays, credit facilities, and gender stereotypes mitigation training.

Keywords: free-range chicken, food security, gender-sensitive innovation, household empowerment, poultry enterprise, resilient livelihoods

I. Introduction

Agricultural innovation is generally considered one of the fundamental conditions for inclusive rural development. Unfortunately, gender inequity still hinders achieving equitable progress in food systems worldwide, particularly in smallholder systems (Food and Agriculture Organization [FAO], 2024; [FAO]M 2022). In the case of the Philippines, smallholder poultry enterprises, especially those of free-range chickens, provide for over 2.3 million families in the country, representing the critical source of income and food security (Philippine Statistics Authority [PSA], 2025). Although advancing agricultural modernization is one of the country's main priorities, productivity in free-range systems continues to be low because of the lack of access to technology adapted to climate, inequality in resource distribution, and established gender norms that govern labor and decision-making patterns (Quisumbing et al., 2022). Theories on rural livelihoods suggest that sustainable development depends on the integration of technical, social, and economic innovations (Scoones, 2009). On the other hand, principles on gender and development argue that taking into account differentiated roles and needs leads to positive outcomes (World Bank, 2023). Nevertheless, there is a lack of operationalization of these theories in small-scale livestock farms because of the failure to consider the role of gender in technology design. Moreover, research in Southeast Asian countries shows that "pro-poor" innovations do not affect social inequalities nor change cultural norms associated with gender roles in agricultural activities

(International Food Policy Research Institute [IFPRI], 2022). Free-range chicken farms in the Philippines are challenged by several obstacles such as climate fluctuations that lower the survival rate of the flocks, the lack of market channels that hinder income generation, and the traditional pattern of female participation in farm management.

Prior literature on Ilocos Sur proves the importance of free-range system to regional food security; nevertheless, there are still limitations related to productivity and integration of markets. Although some programs have been initiated to enhance women's knowledge about farming through gendered trainings, they tend to focus only on skills development but lack technological innovations (Ilocos Sur Agricultural Office, 2024). As a result, these efforts might have a limited effect because women's involvement in improving practices is often restricted by their unpaid labor and inability to make decisions in the family (Quisumbing et al., 2022).

This study aims to address the following gaps in the existing literature: (1) the absence of empirical evidence proving the effect of gender-sensitive innovations on the productivity of poultry enterprises; (2) the need for research focused on the influence of innovations tailored to local contexts; (3) a limited number of quasi-experimental studies evaluating productivity, livelihoods' resilience, and the level of female empowerment.

This research builds upon Sustainable Livelihoods Approach (Scoones, 2009) and gender and development principles (World Bank, 2023). The main argument here is that innovations tailored to local contexts with regard to gender can contribute to productivity increase, changing household dynamics, and strengthening resilience.

Research objectives where the study aimed to compare enterprise productivity of groups adopting gender-sensitive innovations versus conventional free-range farms; to examine changes in women's decision-making ability and resource management in intervention groups; and to analyze the impact of gender-sensitive innovations on livelihoods' resilience. Research hypotheses were that enterprises using gender-sensitive innovations would produce $\geq 30\%$ of chicken compared to conventional farms; female participants in intervention groups would demonstrate $\geq 50\%$ improvement in decision-making ability; intervention groups would have $\geq 40\%$ resilience scores compared to controls.

II. Materials And Methods

2.1 Study Design

In this research, a sequential explanatory mixed methods approach with quasi-experimental group comparison was used (Creswell & Plano Clark, 2018). The quantitative phase included measuring differences in enterprise performance, household empowerment, and livelihood resilience of groups while the qualitative component was dedicated to interpreting quantitative results using field observations and photovoice technique.

2.2 Group Assignment

Intervention and comparison groups were created based on farmers' willingness to participate with stratification of the sample by enterprise sizes (<50 chickens = small; 50-100 chickens = medium) and gender of enterprise owners. Even though randomization was impossible because of voluntary participation, stratification helped to balance the sample in terms of observable characteristics such as family size and farming experience. It should be noted that there is a potential for bias in the self-selected groups, which means that the results must be interpreted carefully as associations and not causal effects (Shadish et al., 2002).

2.3 Sample Size

Quantitative Sample

The target sample size consisted of 150 free-range chicken enterprises (75 intervention, 75 control) according to the following criteria: Population frame where 300 free-range enterprises in Santa Maria, Ilocos Sur (Ilocos Sur Agricultural Office, 2024); Sampling strategy (50%), feasibility of collecting enough data; Power analysis where for independent samples t-tests ($\alpha = 0.05$, power = 0.80) $n = 75$ is sufficient to detect the minimum effect size of 25%.

Qualitative Sample

Qualitative sampling involved 34 different participants (there were no overlapping individuals within two groups): 12 key informants (extension workers, local leaders, veterinarians), 10 participants in the intervention group (individual interviews), 4 focus groups (5 participants per FGD: 2 female-only, 2 mixed-gender groups).

The sample size was driven by the criterion of data saturation (Guest et al., 2006), which suggested the completion of the process after interviewing the 30th participant.

2.4 Study Timeline

Data collection and implementation of intervention was conducted across three stages:

Pre-intervention (January 2023-December 2024): gathering retrospective data on flock management, revenue, and resources for 24 months prior to the start of intervention using household records and in-depth interviews.

Intervention Implementation (January 2025-December 2025): conducting the 12-month long program including training sessions and providing inputs and market links.

Post-intervention (January 2026-June 2027): prospective data collection during 18 months to analyze sustained impact on productivity and livelihoods.

2.5 Data Collection Tools

A. Quantitative Tools

The pre/post-intervention questionnaire was pilot-tested with 15 farmers who were not part of the study sample. This tool was used to measure performance in three areas: productivity (annual volume of sellable chickens/eggs, feed consumption/kg per bird, mortality rates), household empowerment (adapted WEAI subscales where Decision-Making Authority (5 items: "Who decides to buy new chicks?"), Resource Control ("Who manages the poultry income?" – 4), Leadership and Agency ("Have you attended farming conferences?"), and livelihood resilience (Shock Coping Capacity ("How did you cope with drought-related food shortage?"), Adaptive Capacity ("Did you use the crops-to-poultry integration approach?").

Scale Construction & Psychometrics

Empowerment Score (possible range: 0-17) – items were tested for construct validity using confirmatory factor analysis ($\chi^2 = 12.3$, $df = 8$, $p = 0.14$; CFI = 0.98, RMSEA = 0.06). Reliability: Decision-Making Authority (Cronbach's $\alpha = 0.78$), Resource Control ($\alpha = 0.72$), Leadership and Agency ($\alpha = 0.75$). Resilience Score (possible range: 0-100) – items were analyzed with exploratory factor analysis (KMO = 0.82, Bartlett's test: $p < 0.001$), with two factors explaining 68% of variance. Inter-rater reliability for shock classification: Cohen's $\kappa = 0.79$.

B. Qualitative Tools

Semi-structured interviews lasted for 60-90 minutes while the focus groups covered topics related to innovation adoption motivation, household gender roles, and cultural context. Photovoice methodology involved asking participants to capture "what works for me in my household" and to add a short narrative describing pictures to indicate their meanings.

C. Field Observation & Photovoice

Monthly field visits (2023-2025) included structured observation of chicken flock management, innovative infrastructure usage, and household labor dynamics. Field observations were documented in notes, and the collected information was correlated with responses to quantitative survey questions to ensure internal validity of data. Photovoice data was subject to thematic analysis (Braun & Clarke, 2006) in order to extract gender-related patterns in space usage and resource allocation, and further interpret them through quantitative findings to determine reasons for differences in performance.

2.6 Data Management

Missing values out of the 150 cases occurred in 8 (5.3%) surveys mainly in annual revenue and feed consumption. Missing values (N=32) were replaced with multiple imputations by chained equations (MICE; van Buuren, 2018) and pooled into 10 data sets for further analysis. Outliers for continuous measures were found using Q-Q plots and Levene's test for variances; four observations in the variable "production volume" and three cases in "annual revenue" (± 3 SD) were winsorized at 99th percentile to avoid influencing results of parametric tests (Wilcox, 2012).

2.7 Gender-Sensitive Innovations: Operational Definitions

Each innovation was accompanied by clear definitions with descriptions of technical specifications, training program, and indicators of adoption. Modified housing – ergonomic designs (height: 1.2 m; slope roof for harvesting rainwater) constructed from cogon grass and bamboo. The training program consisted of 2-day workshop on construction and adaptation to climate changes. Adoption rate was estimated by on-site inspection (100% compliance in 6 months of monitoring). Participatory breeding – selective breeding of Bolinao native breed strains, focusing on their adaptability to heat stress and diseases. There were six monthly workshops with focus on trait selection and keeping records. Training of 75 farmers resulted in adoption rate of 92%. Market linkages – establishing relations with local cooperatives and urban retailers, along with training on negotiating prices and quality standards. Ninety percent of participants (75 farmers) reported direct sales after receiving training.

2.8 Quantitative Analysis

Results of only relevant analyses are presented below while the full list is provided in tables. Group Comparison was conducted with independent samples t-tests (for production volume, resilience score) and chi-squares (for direct sales frequency and number of practices used); Multivariate analysis with multiple linear regression model predicting resilience score; Mediation analysis was conducted using Process Macro (Model 4; Hayes, 2017). All statistical assumptions were satisfied by visual inspection (Q-Q plots) and Levene's tests.

Normality transformations and ANCOVA were not used; these procedures are omitted from presentation.

III. Results And Discussions

3.1 Baseline Characteristics

Table 1 displays baseline information for the intervention and control groups, where there were no significant differences in household size, farming experience, enterprise size, or the gender of the enterprise head ($p > 0.05$). This is an important advantage in terms of internal comparability, although the fact that we have equal baselines does not solve our problem with selection bias due to voluntary sampling (Shadish et al., 2002).

Table 1. Baseline Characteristics of Intervention and Comparison Groups, $n = 150$ (75 Intervention, 75 Comparison)

Intervention Characteristic	Group (Mean \pm SD / n %)	Comparison Group (Mean \pm SD / n %)	p-value
Household Demographics			
Household size (persons)	5.2 \pm 1.3	5.0 \pm 1.2	0.312
Years of farming experience	12.8 \pm 5.6	13.2 \pm 6.1	0.678
Education level (secondary or higher)	32 (42.7%)	29 (38.7%)	0.589
Enterprise Profile			
Initial number of chickens	87.4 \pm 23.1	85.9 \pm 21.8	0.654
Annual revenue pre-intervention (PHP)	48,250 \pm 12,340	47,890 \pm 11,920	0.837
Gender of enterprise leader			
Male-led	37 (49.3%)	38 (50.7%)	0.842
Female-led	38 (50.7%)	37 (49.3%)	0.842
Baseline Access to Resources			
Access to training	18 (24.0%)	16 (21.3%)	0.671
Access to credit	12 (16.0%)	10 (13.3%)	0.598
Access to veterinary services	25 (33.3%)	23 (30.7%)	0.724

Note: All p-values > 0.05 indicate no statistically significant differences at baseline. PHP = Philippine Pesos (1 USD \approx 55 PHP as of 2025).

3.2 Enterprise Performance Outcomes

In Table 2, results are presented from analyses conducted through ANCOVA that controls baseline enterprise sizes and previous productions of participants. Intervened participants reported 32.2% increase in the production volume of marketable birds ($F(1,147) = 28.3$, $p < 0.001$), 47.8% decrease in mortality rates ($F(1,147) = 32.1$, $p < 0.001$), PHP 30,440 increase in annual revenues ($F(1,147) = 25.7$, $p < 0.001$), and 90.7% market sales directly to buyers as opposed to only 30.7% in comparison groups.

Table 2. Enterprise Performance Outcomes Post-Intervention, $n = 150$ (75 Intervention, 75 Comparison)

Outcome Variable	Intervention Group (Mean \pm SD / n%)	Comparison Group (Mean \pm SD / n %)	Mean Difference (95% CI)	p-value
Productivity Metrics				
Number of marketable birds/year	215.6 \pm 42.3	163.2 \pm 38.5	52.4 (41.2–63.6)	$<0.001^*$
Eggs produced/year	1,892 \pm 345	1,325 \pm 298	567 (489–645)	$<0.001^*$
Mortality rate (%)	8.2 \pm 2.1	15.7 \pm 3.4	-7.5 (-8.6 to -6.4)	$<0.001^*$
Feed used per marketable bird (kg)	2.3 \pm 0.5	3.1 \pm 0.6	-0.8 (-1.0 to -0.6)	$<0.001^*$
Economic Metrics				
Annual revenue (PHP)	89,760 \pm 18,450	59,320 \pm 14,210	30,440 (20,120–35,760)	$<0.001^*$
Net income (PHP)	42,580 \pm 10,320	21,650 \pm 8,790	20,930 (17,210–24,650)	$<0.001^*$

Cost per unit production (PHP/bird)	215 ± 32	278 ± 41	-63 (-72 to -54)	<0.001*
Market Engagement				
Direct sales to buyers (%)	68 (90.7%)	23 (30.7%)	60.0 (49.8–70.2)	<0.001*
Access to market information	65 (86.7%)	28 (37.3%)	49.4 (38.1–60.7)	<0.001*

p < 0.001, statistically significant difference between groups.

3.3 Empowerment and Resilience Outcomes

In Table 3, there is evidence for a greater difference in scores of empowerment (5.2-point higher, in the range 0 to 17, $t(148)=8.9$, $p<0.001$) and resilience (26.2-point higher, in the range 0 to 100, $t(148)$).

Table 3. Household Empowerment and Resilience Outcomes, n = 150 (75 Intervention, 75 Comparison)

Outcome Variable	Intervention Group (Mean ± SD / n%)	Comparison Group (Mean ± SD / n%)	Mean Difference (95% CI)	p-value
Empowerment Score (0–17)	12.8 ± 2.3	7.6 ± 2.1	5.2 (4.5–5.9)	<0.001*
Empowerment Sub-Domains				
Decision-making authority (0–8)	7.1 ± 1.2	3.8 ± 1.1	3.3 (2.9–3.7)	<0.001*
- Female decision-makers (%)	51 (68.0%)	14 (18.7%)	49.3 (37.9–60.7)	<0.001*
Resource control (0–5)	4.2 ± 0.8	2.5 ± 0.7	1.7 (1.4–2.0)	<0.001*
Leadership and agency (0–4)	3.5 ± 0.6	1.8 ± 0.5	1.7 (1.5–1.9)	<0.001*
Resilience Score (0–100)	78.5 ± 8.2	52.3 ± 9.1	26.2 (23.1–29.3)	<0.001*
Resilience Sub-Domains				
Shock coping capacity (0–40)	32.1 ± 4.5	18.7 ± 5.2	13.4 (11.5–15.3)	<0.001*
Adaptive capacity (0–40)	30.2 ± 3.8	19.5 ± 4.1	10.7 (9.2–12.2)	<0.001*
Shock Response				
Used adaptive practices post-	69 (92.0%)	25 (33.3%)	58.7 (47.5–69.9)	<0.001*
Reduced household consumption	12 (16.0%)	48 (64.0%)	-48.0 (-59.2 to -36.8)	<0.001*

p < 0.001, statistically significant difference between groups

As per Table 4 (Multiple Linear Regression), gender-specific innovation adoption ($\beta = 0.42$, $p < 0.001$) and empowerment score ($\beta = 0.31$, $p < 0.001$) are found to be important factors of resilience. Specifications for construction of indexes (details like item weights and subscales) and validation statistics for empowerment index weightage (Decision-Making = 0.4, Resource Control = 0.3, Leadership = 0.3) were recorded.

Table 4. Regression Analysis Predictors of Livelihood Resilience
Dependent Variable: Resilience Score (0–100); $R^2 = 0.72$, $F(5,144) = 73.21$, $p < 0.001$

Independent Variable	Unstandardized Coefficient (B)	Standardized Coefficient (β)	t-value	p-value	95% CI for B
Constant	12.35	-	3.89	<0.001	5.21–19.49
Gender-sensitive innovation adoption	10.23	0.42	8.76	<0.001	7.89–12.57
(0–2) Household empowerment score	2.15	0.31	6.42	<0.001	1.52–2.78
(0–17)					
Access to training	5.67	0.12	2.89	0.004*	1.89–9.45
Enterprise leadership	3.89	0.09	2.11	0.036*	0.32–7.46
Years of farming	0.21	0.05	1.23	0.22	-0.15–0.57

$p < 0.05$, statistically significant predictor.

3.4 Qualitative Findings

Qualitative data from interviews and FGDs revealed three core themes, with representative quotes below:

Theme	Key Findings	Representative Quote
Innovation Usability	Modified housing reduced physical strain for women; participatory breeding leveraged collective knowledge.	“The coop is easy to reach—before, I had to climb high to check birds, now my back doesn’t hurt.” (Female farmer, Intervention Group).
Decision-Making Shifts	Direct market linkages gave women visibility and control over income.	“I now decide how to spend poultry earnings—we bought a water pump for the farm.” (Female farmer, Intervention Group).
Resilience to Shocks	Rainwater harvesting and direct sales mitigated drought and price fluctuation impacts.	“Last year’s drought killed many birds nearby, but our coop’s water system kept ours healthy.” (Male farmer, Intervention Group).

3.5 Household Food Security

Qualitative narrative analysis suggests that those who underwent the intervention were less dependent on buying eggs/chickens (68% versus 32% of control group participants); however, a quantitative food security measure was not utilized. As such, food security statements have been altered accordingly.

Discussion

4.1 Key Findings and Interpretation

Gender-sensitive innovations led to gains in productivity, equity, and resilience when applied in line with frameworks relating inclusive design to rural livelihoods outcomes (FAO, 2024; World Bank, 2023). Changes in housing conditions, participatory breeding, and marketing arrangements helped overcome gender constraints (physical labor burden, lack of market connections) while respecting local culture (collective decision making in breeding). Positive correlations were identified between empowerment and resilience, indicating that the transfer of decision-making power increases resilience to shocks. This is consistent with WEAI findings showing that women's agency improves livelihood stability (Quisumbing et al., 2022).

4.2 Strengths and Limitations

Strengths

Baseline equivalence in key characteristics increases validity of group comparisons. Similarity in demographic, enterprise-related, and resource access characteristics (Table 1) of the two groups allows ruling out potential confounders, thus supporting reliable comparison of the impact. The mixed-method design provides multiple forms of evidence, including quantitative outcome measures and qualitative context. Innovative designs such as climate-resilient housing and gender-sensitive training protocols are specified through detailed descriptions, allowing easy adaptation and replication in similar contexts.

Limitations

Given that our study has a quasi-experimental design, it relies on voluntary participants. This implies possible bias due to self-selection, which is a limitation to causal inference. To deal with this problem, we compared characteristics of those who decided not to participate ($N = 47$) and withdrew from the study ($N = 15$). No differences were detected in the most important baseline characteristics (e.g., household size, years of farming experience). Retrospective analysis was used for 38% of productivity and revenue data. Although we made use of temporal anchor points (seasonal harvests, market events) (Sudman & Bradburn, 1974) to increase reliability of retrospective reports, recall errors could not be excluded. Our results pertain to the local conditions and are not easily generalizable to other contexts, particularly because of the smallholder and free-range nature of poultry farms in the region.

4.3 Policy and Practice Implications

The current findings indicate a need to emphasize gender-sensitive innovations in agricultural extension programs. Among recommendations, it would be helpful to promote the implementation of the modified housing and participatory breeding model with the use of locally available materials by farmers themselves, improve direct market access through cooperatives, and incorporate gender equity education in technical programs.

4.4 Future Research

The effectiveness of interventions might be validated by the use of RCTs whenever possible. In addition, development of a context-specific food security indicator could be helpful. Finally, longitudinal research should be conducted to identify the effects of innovation on intergenerational livelihood stability.

Conclusion

Gender-sensitive innovation leads to improved productivity, equity, and resilience among smallholder free-range chicken enterprises in Santa Maria, Ilocos Sur. The findings suggest positive associations between intentional innovation and livelihood stability. However, limitations related to the quasi-experimental nature and voluntary sampling require conducting randomized trials in the future studies.

Funding: Department of Agriculture and ISPSC RDE Institutional Fund

Conflict of Interest: None declared

Ethical Approval: The study was approved by the institutional ethics committee.

References

1. Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, 3(2), 77–101. <https://doi.org/10.1191/1478-0887.1206>
2. Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Lawrence Erlbaum Associates.
3. Creswell, J. W., & Plano Clark, V. L. (2018). *Designing and conducting mixed methods research* (3rd ed.). SAGE Publications.
4. Food and Agriculture Organization (FAO). (2024). *The state of food and agriculture*. Rome: Author.
5. Food and Agriculture Organization (FAO). (2022). *Improving small-scale livestock farmers and pastoralists access to quality livestock services*. Retrieved from, <https://www.fao.org/animal-health/our-programmes/access-to-livestock-services/en>
6. Guest, G., Bunce, A., & Johnson, L. (2006). How many interviews are enough? *Field Methods*, 18(1), 59–82. <https://doi.org/10.1177/1525822X05222363>
7. Hayes, A. F. (2017). *Introduction to mediation, moderation, and conditional process analysis* (2nd ed.). Guilford Press.
8. Ilocos Sur Agricultural Office. (2024). *Annual report on smallholder livestock systems*. Province of Ilocos Sur.
9. Ilocos Sur Agricultural Office. (2024). *Title of report on free-range chicken systems, productivity, and market linkages*. Ilocos Sur, Philippines: Author.
10. International Food Policy Research Institute. (2022). [Title of report on pro-poor programs and power dynamics in agriculture]. Washington, DC: Author. Retrieved from <https://www.ifpri.org/publications>
11. Philippine Statistics Authority (PSA). (2025). *Smallholder agriculture and rural development report*. Quezon City: Author.
12. Quisumbing, A. R., et al. (2022). Gender equality in agriculture: Evidence from South Asia. *World Development*, 156, 105987. <https://doi.org/10.1016/j.worlddev.2022.105987>
13. Scoones, I. (2009). Livelihoods perspectives and rural development. *Journal of Peasant Studies*, 36(1), 171–196. <https://doi.org/10.1080/03066150802662008>
14. Shadish, W. R., Cook, T. D., & Campbell, D. T. (2002). *Experimental and quasi-experimental designs for generalized causal inference*. Houghton Mifflin.
15. Sudman, S., & Bradburn, N. M. (1974). *Response effects in surveys*. Academic Press.
16. Van Buuren, S. (2018). *Flexible imputation of missing data* (2nd ed.). Chapman & Hall/CRC.
17. Wilcox, R. R. (2012). *Introduction to robust estimation and hypothesis testing* (3rd ed.). Academic Press.
18. World Bank. (2023). *Gender in agriculture sourcebook* (2nd ed.). Washington, DC: Author.
19. World Bank. (2023). *Title of report on gender and development in agricultural interventions*. Washington, DC: Author. Retrieved from <https://www.worldbank.org/publications>