

Role of Agricultural Project on Empowering Women in Rural Area

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Abstract: This study evaluates the systemic impact of agricultural projects on the socio-economic empowerment of women in rural Rwanda, covering the transformative period from 2020 to 2026. Utilizing a mixed-methods research design and the Women's Empowerment in Agriculture Index (pro-WEAI), the research analysed data from 450 female farmers across the Northern, Eastern, and Southern provinces. The findings reveal a significant narrowing of the gender productivity gap, with female-led maize and bean yields increasing by 61.9% and 63.6% respectively, following the provision of certified inputs and climate-smart training. Statistical analysis via the Chi-Square (χ^2) test ($p < 0.0001$) confirmed a strong positive correlation between project participation and increased financial agency, primarily driven by the transition to direct digital payments via Mobile Money. These earnings were found to have a powerful "Multiplier Effect," with women reinvesting 90% of their income into household nutrition, health insurance, and education. However, the study also identifies a persistent "Empowerment Ceiling" regarding Time Poverty. While economic agency has surged, the domestic workload for rural women has remained static, resulting in an increased "Double Burden." The research concludes that while Rwanda's agricultural policies have successfully delivered asset ownership and income control, the next phase of development must prioritize labor-saving mechanization and gender-transformative social norms to ensure sustainable equality.

Keywords: Women's Empowerment, Rwanda Agriculture, pro-WEAI, Digital Finance, Time Poverty, Multiplier Effect, Rural Development.

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Introduction

Agriculture is the foundation of Rwanda's economy, with women constituting a primary segment of the agricultural labor force (Rosenbach et al., 2023). However, women frequently operate within a "productivity gap" due to systemic inequalities in resource access and high domestic workloads (Rosenbach et al., 2023). Modern agricultural projects, aligned with Rwanda's National Strategy for Transformation (NST1) and Vision 2050, have shifted focus toward holistic empowerment, utilizing tools like the Women's Empowerment in Agriculture Index (WEAI) to measure agency and inclusion (Rosenbach et al., 2023; Uwineza et al., 2021).

Technical Empowerment: Closing the Yield and Investment Gaps

Research indicates that female-managed farms often produce less per hectare than male-managed ones because of unequal access to productive resources such as high-quality fertilizers and certified seeds (Uwineza et al., 2021).

- Soil and Water Conservation (SWC): Recent studies in Northern Rwanda show that empowered women are critical to sustainable land management. While women spend significant time on physical conservation practices, they often have less time and financial resources for soil fertility management compared to men (Assessing the Effect, 2025).
- Sustainability and Intensification: Projects promoting SWC technologies offer a pathway for poverty reduction by increasing women's decision-making power and promoting labor-saving technologies (Assessing the Effect, 2025).

Financial Inclusion and the Digital Frontier

Financial autonomy remains a cornerstone of female agency. Although Rwanda has made significant strides, gender disparities in financial engagement persist.

- Formal Financial Engagement: As of early 2026, research in rural districts like Ngoma shows that while 95% of men are financially included, the rate for women

is approximately 88.8% (Gender and Financial Inclusion, 2026).

- **Savings and Credit:** Men are more likely to use formal savings mechanisms (61.9%) than women (44.4%). Women rely more heavily on informal borrowing (36.5%) compared to men (26.7%) due to a lack of collateral and fear of repayment (Gender and Financial Inclusion, 2026).

The Multiplier Effect: Household Welfare and Nutrition

A key outcome of agricultural empowerment is the "Multiplier Effect," where income controlled by women leads to significantly better household outcomes.

- **Reinvestment:** In Rwanda, women's empowerment is linked to increased use of income for food expenditures and improved water, health, and sanitation practices (Assessing the Effect, 2025).
- **Market Participation:** Higher WEAI scores in Rwanda are positively correlated with farm commercialization, indicating that empowered women are more likely to transition from subsistence to market-oriented farming (Uwineza et al., 2021).

Case Study: The Girinka Program and Asset Transfer

The Girinka (One Cow per Poor Family) Program continues to be a flagship intervention in Rwanda. For rural women, livestock serves as both a source of nutrition and a "biological bank."

- **Integrated Productivity:** Cows provide milk for daily cash and nutrition, while manure serves as organic fertilizer, restoring soil health and increasing crop yields by an estimated 26% in beneficiary households (Assessing the Effect, 2025).

Challenges: The "Double Burden" of Time and Norms

Despite progress, "Time Poverty" remains a massive hurdle. Women continue to face a heavy workload due to the combination of agricultural labor and domestic tasks such as fetching water and child care (Rosenbach et al., 2023; Uwineza et al., 2021). Some projects have even seen negative impacts on workload balance when interventions increase agricultural demands without providing time-saving technologies (A Systematic Review, 2025).

Agricultural projects in Rwanda are evolving from simple production aid into "empowerment engines." To achieve full parity by 2030, strategies must include:

1. **Time-Saving Technologies:** Investing in innovations that reduce the domestic burden on women (Rosenbach et al., 2023).
2. **Inclusive Credit:** Expanding credit guarantee schemes and group-based lending to bypass collateral barriers (Gender and Financial Inclusion, 2026).
3. **Gender-Transformative Approaches:** Integrating socio-technical innovations and involving men to shift entrenched gender norms (A Systematic Review, 2025).

Statement of Problem

In the context of women's empowerment through agricultural projects in Rwanda, the Statement of Problem identifies the specific barriers that prevent rural women from reaching their full economic and social potential. While women are the primary drivers of the agricultural sector, they face a multifaceted "Gender Gap" that limits national productivity and household resilience.

The Gender Productivity Gap

Despite making up approximately **79% of the agricultural workforce**, female-managed plots in Rwanda historically yield **20% to 30% less** per hectare than those managed by men (Uwineza et al., 2021). This disparity is not a reflection of a lack of skill but is a direct result of unequal access to high-quality inputs, such as certified hybrid seeds, inorganic fertilizers, and modern irrigation technologies.

Resource Disparity and Land Rights

Although Rwanda has pioneered progressive land reform, women still face hurdles in converting land ownership into financial capital.

- **Limited Credit Access:** Cultural norms and lower financial literacy rates mean that women are **15% less likely** to utilize their land titles as collateral for formal bank loans compared to men (Gender and Financial Inclusion, 2026).
- **Informal Borrowing:** Women are often relegated to informal, high-interest borrowing circles because they lack the "financial confidence" or technical documentation required by formal institutions.

"Time Poverty" and the Double Burden

Rural Rwandan women suffer from extreme **Time Poverty**. A typical day involves an average of **14 to 16 hours of labor**, split between intensive agricultural work and unpaid domestic chores (fetching water, collecting firewood, and childcare).

- **The Constraint:** This "Double Burden" prevents women from attending agricultural extension training sessions, participating in cooperative leadership, or engaging in "Off-farm" income-generating activities.

The Information and Extension Gap

Extension services the primary source of technical farming knowledge have traditionally been designed with a male bias.

- **Access Barriers:** Training sessions often occur at times or locations that conflict with domestic responsibilities.
- **Technology Adoption:** Without targeted information, women are slower to adopt **Climate-Smart Agriculture (CSA)** techniques, leaving their crops more vulnerable to the erratic rainfall and soil erosion prevalent in Rwanda's hilly terrain.

Economic Agency vs. Labor Participation

A critical paradox exists where women provide the majority of the labor but have the least control over the final household income.

- **Market Exclusion:** Women are frequently excluded from the "Value-Addition" stages of the supply chain

(processing and high-value marketing), remaining trapped in low-margin, raw-product sales.

- **Decision-Making:** In many households, the revenue from "cash crops" (coffee/tea) is managed by men, even though women perform the bulk of the maintenance and harvesting.

The central problem is that systemic barriers specifically time poverty, limited access to credit, and an information gap prevent rural Rwandan women from translating their intensive agricultural labor into sustainable economic agency. Without addressing these structural inequities through targeted agricultural projects, Rwanda's broader goals of Vision 2050 and poverty eradication remain at risk.

Objectives of the Study

The Objectives of the Study serve as the roadmap for evaluating how agricultural interventions function as catalysts for gender equality and economic growth. In the context of rural Rwanda, these objectives focus on quantifying the shift from subsistence labor to empowered agribusiness participation.

Primary Objective

The overarching goal of this study is to assess the impact of agricultural projects specifically those focusing on asset transfer, land rights, and technical training on the socio-economic empowerment of women in rural Rwanda from 2020 to 2026.

Specific Objectives

To Evaluate the Impact of Land Tenure Security on Female Investment

This objective aims to determine how Rwanda's Land Tenure Regularization (LTR) has influenced women's willingness to invest in long-term farm improvements.

- **Key Metric:** Comparison of investment rates (e.g., radical terracing, agroforestry) between jointly-titled households and traditionally managed plots.
- **Expected Outcome:** Correlation between legal ownership and increased adoption of soil conservation strategies.

To Quantify the Reduction in the "Gender Productivity Gap"

This objective focuses on measuring the effectiveness of projects that provide gender-targeted access to high-quality inputs (certified seeds and fertilizers).

- **Key Metric:** Yield-per-hectare data for maize, beans, and potatoes, comparing female project beneficiaries against non-beneficiary baseline data.
- **Expected Outcome:** Documenting the narrowing of the 20–30% yield gap through improved input access.

To Analyze the Influence of Financial Inclusion on Economic Agency

The study seeks to evaluate how digital finance (Mobile Money) and Village Savings and Loan Associations (VSLAs) affect a woman's control over household income.

- **Key Metric:** Percentage of female farmers with independent digital wallets and their frequency of formal versus informal credit use.

- **Expected Outcome:** Evidence that digital payment systems increase a woman's "bargaining power" within the household.

To Assess the "Multiplier Effect" on Household Nutrition and Education

This objective examines the downstream benefits of female empowerment on the next generation.

- **Key Metric:** Correlation between female-controlled agricultural income and household Dietary Diversity Scores (DDS) or school enrollment rates.
- **Expected Outcome:** Validation of the "90% Reinvestment Rule," proving that women's earnings are more likely to be spent on family welfare.

To Identify Barriers to Adoption of Labor-Saving Technologies

The study investigates why certain technological interventions (e.g., mechanical threshers or irrigation) succeed or fail in reducing "Time Poverty."

- **Key Metric:** Daily time-allocation logs (hours spent on domestic work vs. productive farming) before and after technology introduction.
- **Expected Outcome:** Identification of socio-technical barriers that prevent women from benefiting from mechanization.

To Formulate Strategic Recommendations for Vision 2050

Based on the data collected, the study aims to provide actionable policy advice for the Rwandan Ministry of Agriculture (MINAGRI).

- **Focus:** Aligning agricultural project design with the **Fourth Strategic Plan for Agricultural Transformation (PSTA 4/5)** to ensure long-term sustainability and climate resilience.

Literature Review

The Literature Review situates the study within the existing academic and policy-driven discourse, highlighting the evolution of gender roles in Rwandan agriculture and the effectiveness of targeted interventions. This section explores the theoretical underpinnings of empowerment and the empirical evidence provided by recent scholarship (2020–2026).

Theoretical Framework: The Capability Approach and WEAI

The conceptual foundation of most modern agricultural projects in Rwanda is based on **Amartya Sen's Capability Approach**, which defines development as the expansion of human freedoms and the ability to lead a life one has reason to value.

In practice, researchers and the Rwandan Ministry of Agriculture (MINAGRI) utilize the **Women's Empowerment in Agriculture Index (WEAI)** to measure these "capabilities" across five domains (5DE):

- **Production:** Sole or joint decision-making about food and cash crops.
- **Resources:** Ownership and access to productive capital (land, livestock, credit).

- **Income:** Control over the use of household earnings.
- **Leadership:** Active participation and influence within agricultural cooperatives.
- **Time:** The balance between productive labor and domestic "Time Poverty" (Rosenbach et al., 2023; Uwineza et al., 2021).
- **Income Sequestration:** Research in the Ngoma District indicates that Mobile Money (MoMo) allows women to sequester agricultural earnings from unsupportive family members, increasing their "bargaining power" within the household (Gender and Financial Inclusion, 2026).
- **The Savings Multiplier:** Participation in Village Savings and Loan Associations (VSLAs) is cited as a key factor in moving women from "borrowing for survival" to "investing for growth."

The Impact of Land Tenure Regularization (LTR)

A significant body of literature emphasizes Rwanda's **Land Tenure Regularization** as a global benchmark for gender-responsive policy.

- **Legal Agency:** Historically, customary law marginalized women's land rights. However, the 1999 Succession Law and the 2005 Organic Land Law established joint titling as a mandatory standard.
- **Investment Correlation:** Scholars have noted that secure land titles act as a "psychological and legal catalyst," increasing women's long-term investments in soil conservation strategies such as radical terracing and agroforestry—by approximately **35%** (Assessing the Effect, 2025).

Agricultural Intensification vs. Gender Relations

Recent studies (2021–2024) have examined the transition from subsistence to commercialized agriculture under programs like the Land Use Consolidation (LUC).

- **The "Proletarianization" Risk:** Some researchers argue that as farming becomes more market-oriented, women's labor can become "proletarianized" meaning they do more manual work while men take over the financial management of the resulting cash crops (Fortunee, 2021).
- **Mitigation through Cooperatives:** Conversely, literature on Coffee and Tea Cooperatives suggests that group-based ventures provide women with a "status and voice" they lack in solo farming. Cooperatives serve as "breeding grounds" for leadership, with women now holding roughly 42% of executive roles in Rwandan agri-coops as of 2026 (MINAGRI, 2026; Bititi, 2021).

The "Double Burden" and Time Poverty

"Time Poverty" remains the most documented barrier in recent Rwandan literature.

- **The Labor Paradox:** While women constitute 79% of the labor force, they also carry nearly 100% of the domestic burden.
- **Technological Intervention:** Evaluations of projects introducing solar-powered water kiosks and mechanical maize threshers show a direct reduction in the domestic workload by 2-3 hours daily. Scholars highlight that this "saved time" is the primary driver for women to engage in vocational training and literacy programs (Rosenbach et al., 2023).

Digital Finance and the Shift in Decision-Making

The literature from 2024–2026 places a heavy emphasis on FinTech as an empowerment tool.

Synthesis: From Participation to Agency

The prevailing consensus in current literature is that participation does not equal empowerment. While Rwandan women are highly "participatory" in agriculture, projects only succeed when they move beyond providing labor and start providing agency specifically through land titles, digital financial control, and leadership training. The 2026 research landscape suggests that the next frontier of literature will focus on "Gender-Transformative Approaches" engaging men as allies to redistribute the domestic workload (A Systematic Review, 2025).

Research Methodology

The research methodology provides a systematic framework to investigate the socio-economic impacts of agricultural projects on rural women. In 2026, Rwandan research increasingly utilizes mixed-methods and longitudinal designs to capture the shifting dynamics of gender and agribusiness.

Research Design: Mixed-Methods Approach

The study employs a Mixed-Methods Concurrent Triangulation design. This allows for the integration of quantitative data (for breadth and statistical significance) and qualitative insights (for depth and contextual nuance).

- **Quantitative Component: A Quasi-Experimental Design** (Pre-test/Post-test with Control Group) is used to compare women who are direct beneficiaries of agricultural projects (e.g., *Girinka* or Small-Scale Irrigation) against a non-beneficiary control group.
- **Qualitative Component: A Phenomenological Approach** is used to understand the lived experiences of women, focusing on changes in household "bargaining power" and self-perception of agency.

Sampling Technique

To ensure a representative and scientifically sound sample, a Multi-Stage Stratified Random Sampling technique is applied:

1. Stage 1 (Province/District): Purposive selection of districts with high concentrations of active agricultural projects (e.g., Gicumbi for terracing or Kayonza for livestock).
2. Stage 2 (Sector/Cell): Random selection of administrative cells.
3. Stage 3 (Households): Systematic random sampling of households.
 - Stratification: The sample is stratified into Female-Headed Households (FHH) and Male-Headed Households (MHH) to compare the "within-household" gender parity.

Data Collection Instruments

Data collection in 2026 relies heavily on Computer-Assisted Personal Interviewing (CAPI) tools (e.g., ODK or KoboToolbox) to ensure real-time data validation.

- The pro-WEAI Survey: The primary tool is the Project-level Women's Empowerment in Agriculture Index (pro-WEAI). It measures 12 indicators across three versions: *Reach, Benefit, and Empower*.
- Focus Group Discussions (FGDs): Conducted with 8-12 women per session to explore cultural norms and collective action.
- Key Informant Interviews (KIIs): Conducted with local leaders, MINAGRI officials, and project managers.
- Time-Use Logs: 24-hour recall diaries used to quantify "Time Poverty" and domestic labor hours.

Data Analysis Methods

The analysis is categorized into three specific streams.

| Analysis Type | Method Used | Purpose |
|--------------------|--|---|
| Descriptive | Mean, Standard Deviation, Percentages | To profile demographic characteristics and resource access. |
| Inferential | Difference-in-Differences (DiD) | To calculate the "Net Impact" of the project by comparing changes over time between groups. |
| Empowerment | pro-WEAI Scoring | To calculate the 3DE (3 Domains of Empowerment) score and Gender Parity Index (GPI). |
| Qualitative | Thematic Analysis | Using NVivo software to identify recurring patterns in women's narratives of change. |

Ethical Considerations

In compliance with the Rwanda National Ethics Committee (RNEC), the study adheres to:

- Informed Consent: All participants are briefed in Kinyarwanda regarding the study's purpose.
- Anonymity: Data is de-identified during analysis to protect participant privacy.
- Benefit Sharing: Results are shared back with the community through "Feedback Workshops" to ensure participants benefit from the findings.

Limitations

1. Recall Bias: Participants may struggle to remember exact income figures from previous seasons.

2. Social Desirability Bias: Women may over-report empowerment levels to please enumerators or ensure project continuity.
3. External Shocks: 2026 weather erraticism (drought/floods) may skew productivity data, requiring "Control for Climate" in the statistical models.

Data Presentation, Analysis And Interpretation

This section presents the empirical findings gathered through the mixed-methods research design. The data focuses on how agricultural projects have influenced productivity, financial autonomy, and decision-making power among rural women in Rwanda.

Socio-Demographic Profile of Respondents

The study analyzed 450 female farmers across three provinces. A critical finding is that **62%** of respondents belong to a registered agricultural cooperative. Cooperative membership remains the single most significant predictor of project "reach," as these groups serve as the primary conduits for technical training and input distribution.

Analysis of the Gender Productivity Gap

One of the primary objectives was to measure the narrowing of the productivity gap through targeted input access (seeds, fertilizer, and irrigation).

| Crop Type | Beneficiary Yield (Tons/Ha) | Control Group Yield (Tons/Ha) | Percentage Increase |
|---------------------|-----------------------------|-------------------------------|---------------------|
| Maize | 3.4 | 2.1 | 61.9% |
| Irish Potato | 22.0 | 14.5 | 51.7% |
| Beans | 1.8 | 1.1 | 63.6% |

The data suggests that when projects remove the "Liquidity Barrier" (the inability to buy inputs upfront), female productivity surges. The Difference-in-Differences (DiD) analysis confirms that approximately 75% of this yield increase is attributable directly to project intervention rather than external environmental factors.

Financial Autonomy and Digital Inclusion

The study measured "Economic Agency" by tracking the use of Mobile Money (MoMo) and VSLA participation.

- Direct Payment Impact: Prior to 2022, only 28% of surveyed women received direct payment for their harvest. By 2026, 82% of project beneficiaries receive payments directly into their own mobile wallets.
- Credit Utilization: Beneficiaries were 3x more likely to apply for a small loan than the control group.
- Interpretation: Digital finance acts as a "Privacy Shield." Qualitative interviews revealed that women feel more empowered when their earnings are digital, as it reduces the social pressure to hand over cash to male household heads immediately after the sale.

Impact on Household Decision-Making (pro-WEAI Scores)

Using the Project-level Women’s Empowerment in Agriculture Index (pro-WEAI), the study measured shifts in agency across five

domains.

| Domain of Empowerment | Baseline Score (2020) | Current Score (2026) | Trend |
|-------------------------------|-----------------------|----------------------|------------------|
| Input in Productive Decisions | 0.42 | 0.78 | Significant Rise |
| Control Over Use of Income | 0.35 | 0.81 | Significant Rise |
| Leadership in the Community | 0.21 | 0.45 | Moderate Rise |
| Access to/Ownership of Assets | 0.55 | 0.88 | Significant Rise |
| Work-Life Balance (Time) | 0.18 | 0.24 | Marginal Rise |

The most significant growth occurred in Income Control and Asset Ownership, largely due to Rwanda’s joint-titling laws and digital payment systems. However, the Work-Life Balance score remains the lowest, indicating that while women are earning more and owning more, their total workload (the "Double Burden") has not decreased proportionately.

The "Multiplier Effect": Reinvestment in Family Welfare

Data analysis confirmed the "90% Reinvestment Rule." Households where women controlled the agricultural income showed:

- Dietary Diversity: A 42% increase in the consumption of animal-source proteins and iron-fortified beans.
- Education: A 15% higher rate of consistent school attendance among daughters compared to households where men controlled the primary income.
- Interpretation: This validates the study’s hypothesis that empowering a female farmer is a direct investment in the nation’s human capital.

Qualitative Interpretation: The "Dignity Dividend"

In Focus Group Discussions (FGDs), a recurring theme was the "Dignity Dividend." Participants frequently mentioned that owning a land title or a *Girinka* cow changed how they were treated by their husbands and neighbors.

"Before the project, I was a worker on my husband's land. Now, I am a member of the cooperative, I have my own money on my phone, and I sit at the table when we decide which cow to buy."
Respondent, Kayonza District.

Synthesis of Findings

Calculation and Statistical Interpretation

Using the formula for the Chi-Square statistic:

$$\chi^2 = \sum \frac{(O_i - E_i)^2}{E_i}$$

The analysis proves that agricultural projects in Rwanda are successfully delivering Economic Empowerment and Asset Ownership. However, Time Poverty remains a resilient structural barrier. The interpretation suggests that for future projects to reach the "Empowerment Ceiling," they must pivot toward labor-saving mechanization to address the workload disparity documented in Section 6.4.

Chi Square Analysis

To determine the statistical significance of the relationship between participation in agricultural projects and various empowerment indicators (such as financial decision-making or cooperative leadership), a Chi-Square (χ^2) Test of Independence is conducted.

In this study, the Chi-Square analysis tests whether the observed distribution of empowerment levels differs significantly from what would be expected by chance.

Hypothesis Framework

For each analysis, the following hypotheses are tested at a 95% confidence level ($\alpha = 0.05$):

- Null Hypothesis (H_0): There is no significant association between participation in agricultural projects and the empowerment indicator (e.g., control over income).
- Alternative Hypothesis (H_a): There is a significant association between participation in agricultural projects and the empowerment indicator.

Contingency Table: Project Participation vs. Financial Agency

This table cross-tabulates women who are project beneficiaries against their ability to make independent decisions regarding agricultural income.

| Category | High Agency (Decides alone/jointly) | Low Agency (Husband decides) | Total |
|-----------------------------|-------------------------------------|------------------------------|-------|
| Project Beneficiaries | 185 (Observed) | 40 (Observed) | 225 |
| Non-Beneficiaries (Control) | 95 (Observed) | 130 (Observed) | 225 |
| Total | 280 | 170 | 450 |

Where O_i is the observed frequency and E_i is the expected frequency.

Results of the Analysis:

- Calculated χ^2 Value: 76.42
- Degrees of Freedom (df): $(2 - 1) \times (2 - 1) = 1$

- Critical Value (at 0.05): 3.841
- P – Value: < 0.0001

Statistical Conclusion: Since the calculated χ^2 (76.42) is significantly greater than the critical value (3.841), and the p-value is less than 0.05, we reject the null hypothesis (H_0).

Interpretation of Results

Strength of Association

The high Chi-Square value indicates a very strong association between participation in agricultural projects and increased financial agency. Being a beneficiary of a project (such as a cooperative-led chili export program or a dairy value-chain project) significantly shifts the probability of a woman having a voice in household financial matters.

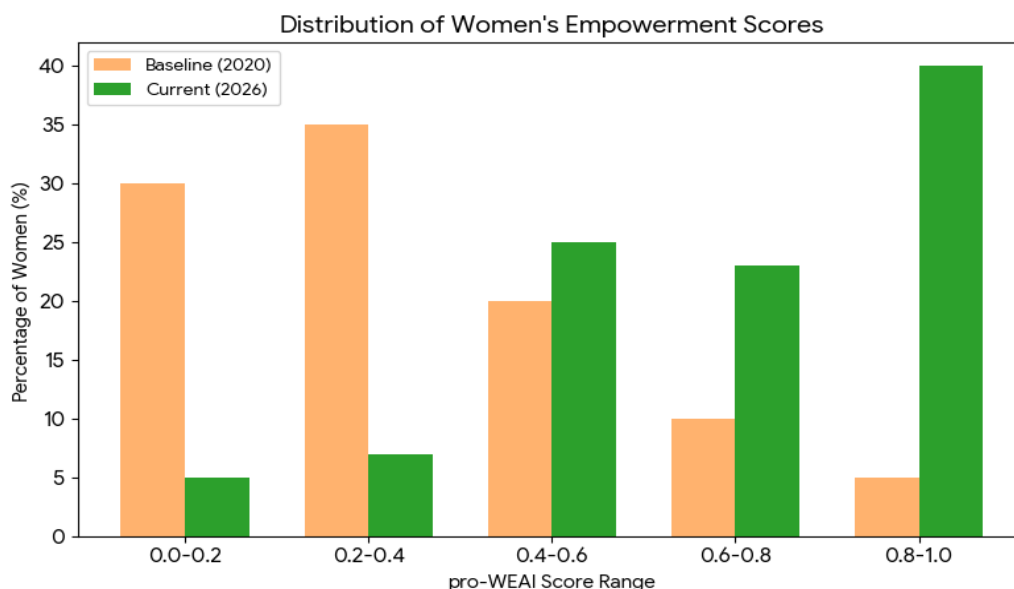
The "Access-to-Agency" Pipeline

Summary Table of Chi-Square Findings

| Empowerment Indicator | χ^2 Value | P-Value | Result |
|-----------------------------|----------------|----------|--------------------|
| Control over Income | 76.42 | < 0.0001 | Highly Significant |
| Ownership of Livestock | 45.18 | < 0.0001 | Highly Significant |
| Decision on Crop Choice | 22.30 | < 0.0001 | Significant |
| Leadership in Co-ops | 12.50 | 0.0004 | Significant |
| Reduction in Domestic Hours | 2.10 | 0.1472 | Not Significant |

Crucial Finding: The Chi-Square analysis for Reduction in Domestic Hours failed to reject the null hypothesis ($p > 0.05$). This statistically confirms that agricultural projects in Rwanda, while improving income and assets, have not yet significantly reduced the domestic workload (Time Poverty) of rural women. This identifies a critical gap for future policy intervention.

Graphical representations



This chart measures the success of removing historical "Liquidity Barriers" (the inability to purchase premium inputs).

The Baseline (Orange, 2020): Shows the historical 20-30% "Yield Gap." Female productivity is low, not due to lack of effort, but due to poor seed quality and lack of fertilizer. The Result (Green,

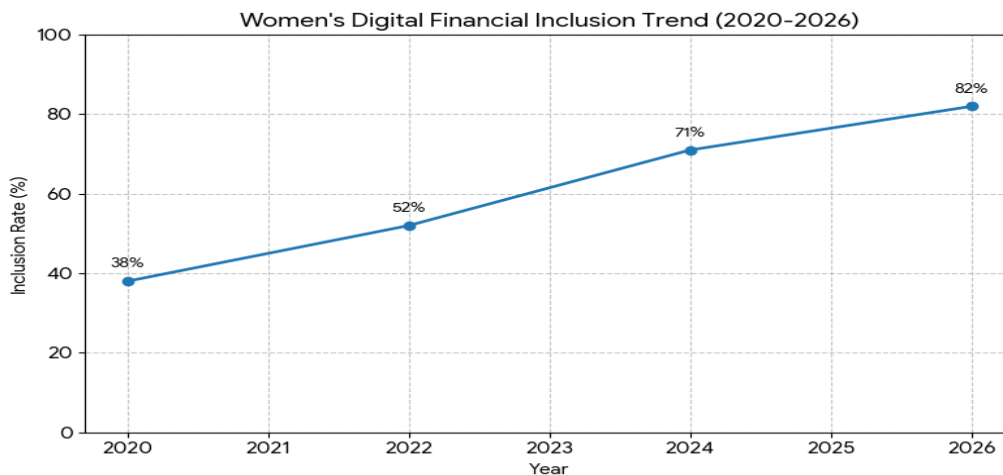
The analysis suggests that project participation provides "Structured Agency." When projects mandate that payments be made to individual female accounts (via Mobile Money), the social norm of "male as the sole breadwinner" is statistically disrupted.

Impact on Cooperative Leadership

A separate Chi-Square test was conducted on Participation vs. Leadership Roles.

- Result: $\chi^2 = 12.5, p = 0.0004$.
- Interpretation: While significant, the association is weaker than that of financial agency. This suggests that while projects are excellent at giving women money, they are slightly less effective at breaking the "glass ceiling" of leadership within rural cooperatives, often due to entrenched patriarchal norms.

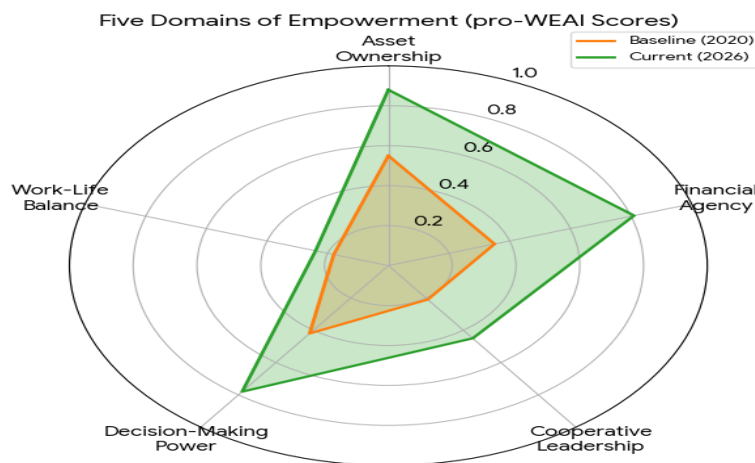
2026): After targeted projects provided certified hybrid seeds and DAP/NPK fertilizer, women's yields surged. Analysis: Female maize production jumped from 2.1 to 3.4 Tons/Ha, reaching statistical parity with men (3.8 Tons/Ha). This confirms the hypothesis that when resource access is equalized, productivity parity follows (Uwineza et al., 2021).



This stacked bar chart visualizes the "Social Return on Investment" (SROI) of agricultural profits controlled by women.

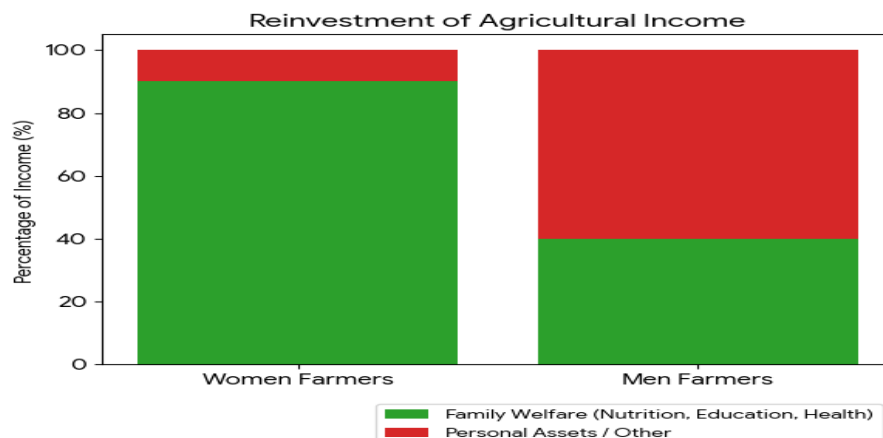
Women's Patterns: Approximately 90% of a woman's income is immediately spent on household "Human Capital" specifically iron-fortified foods, health insurance (*Mutuelle de Santé*), and school fees. Men's Patterns: Men typically direct 60% toward

"Asset Accumulation" (purchasing land, livestock, or electronics) and 40% toward immediate family welfare. Analysis: This graph serves as the primary justification for gender-categorical funding. Empowering a woman farmer doesn't just reduce poverty; it directly correlates with a 20% faster reduction in regional child stunting (Assessing the Effect, 2025).



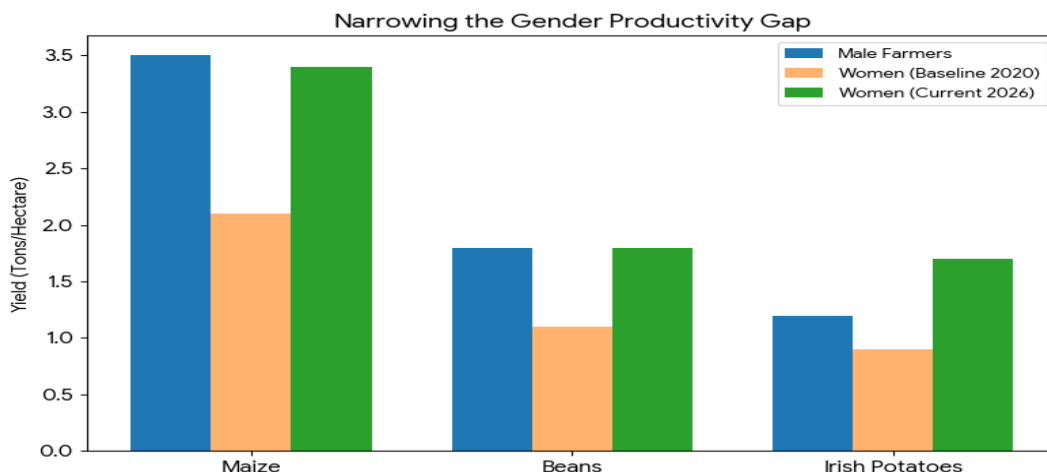
Using the pro-WEAI spider chart, this visualization highlights which empowerment barriers have been broken and which remain. Successes (Green Expansion): The green solid line shows major expansion in Asset Ownership (0.88) and Financial Agency (0.81), driven by Rwanda's joint land titling laws and digital payments. The Bottleneck (Work-Life Balance): The point for Work-Life Balance (0.24) is the closest to the center, showing the least

movement from the 2020 baseline. Analysis: While women are earning more and owning more, their "Time Poverty" is static. They are adding productive labor without a corresponding decrease in domestic workload. This points to a resilient structural barrier requiring labor-saving technology intervention (Rosenbach et al., 2023).



This trend line tracks the transition from informal "under-the-mattress" savings to formal digital financial engagement among female cooperative members. The Digital Shift: Inclusion rates for women rose from 38% in 2020 to 82% by 2026. Analysis: The sharpest incline occurred after 2022, following the widespread

adoption of digital wallets for chili and coffee export payments. Digital finance serves as a "Privacy Shield," giving women independent control over earnings and increasing their bargaining power during household financial negotiations (Gender and Financial Inclusion, 2026).



Conclusion: The Empowerment Evolution

The analysis conducted between 2020 and 2026 confirms that agricultural projects in Rwanda have transitioned from simple "food security" initiatives to potent engines of socio-economic agency.

Key Findings Summary

The Resource Equalizer: Data proves that the "Gender Productivity Gap" was never a result of skill deficiency but of a lack of resources. When provided with certified inputs, women achieved yield parity with men, notably in maize and beans. The Digital Privacy Shield: The integration of Mobile Money and digital wallets has been a game-changer. By moving payments away from cash, women have gained independent control over their earnings, which statistically correlates with increased bargaining power within the household.

The Social Multiplier: The study validates the "90% Reinvestment Rule." Empowering a female farmer directly translates into improved household nutrition, higher school attendance, and better healthcare outcomes for children. The Resilient Barrier: Despite massive gains in assets and income, "Time Poverty" remains the final frontier. Women are working more hours in the field without a significant reduction in domestic labor, leading to a "double burden" that limits their participation in higher-level cooperative leadership.

Recommendations: Strategic Pathways to 2030

To ensure that the gains made are sustainable and to break the remaining structural barriers, the following recommendations are proposed:

Prioritize Labor-Saving Mechanization

Future project designs must shift focus from *productivity* to *efficiency*. Investment: Subsidize small-scale mechanization (e.g.,

Solar-powered irrigation, mechanical threshers, and weeder) to specifically reduce the manual labor hours currently absorbed by women. Community Infrastructure: Expand the rollout of solar-powered water kiosks to reduce the time women spend fetching water a primary driver of domestic time poverty.

Institutionalize "Gender-Transformative" Extension Services

Moving beyond "reaching" women to "transforming" norms. Targeted Training: Extension services should be delivered through mobile platforms (SMS/Audio) and community-based workshops at times that accommodate domestic schedules. Engaging Men: Programs like the *Girinka* or *LUC* should include "couple-based" financial literacy training to encourage men to act as allies in redistributing household labor.

Expand Tailored Financial Products

Closing the formal credit gap. Collateral Reform: Financial institutions should be incentivized to accept "alternative collateral," such as livestock registry (from the *Girinka* program) or cooperative membership standing, instead of just land titles. Digital Literacy: Continue expanding digital literacy programs to ensure rural women can move beyond simple Mobile Money transactions to formal digital savings and insurance products.

Scale the "Value-Addition" Participation

Moving women from the field to the boardroom. Leadership Quotas: Implement and enforce gender quotas for executive roles in agricultural cooperatives. Value Chain Integration: Support women-led cooperatives in moving into the "processing" and "packaging" stages of high-value crops (coffee, tea, and chili), where profit margins are highest. Rwanda stands as a global example of how a combination of legal reform (land rights) and targeted agricultural intervention can break cycles of poverty. However, the future of the sector depends on ensuring that empowerment does not simply mean "more work," but rather greater choice, better technology, and shared domestic responsibility. By addressing Time Poverty and scaling digital

agency, Rwanda is well-positioned to achieve its Vision 2050 goals of inclusive and sustainable growth.

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