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Digital financial inclusion through extension linkages and its implications for rural women's economic agency

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Abstract

Across rural Cambodia, women handle much of the agricultural labor but remain largely excluded from formal financial services that could strengthen their economic position. This research examined how agricultural extension linkages to digital financial services affected rural women's financial inclusion and economic agency in Battambang and Banteay Meanchey provinces. A mixed-methods design surveyed 226 rural women engaged in extension programs between May 2022 and October 2023, supplemented by 22 semi-structured interviews with extension agents and financial service providers. Mobile money training through extension channels increased account ownership by 78.3% among participants. Savings group facilitation produced the strongest improvements in savings behavior (71.3%). A composite economic agency index showed significant gains in financial decision-making autonomy ($t = 4.87, p < 0.001$) and income control ($t = 3.92, p < 0.001$) among women with extension-linked financial access compared to those without. Gender norms and low digital literacy emerged as the primary barriers to sustained engagement.

Keywords: Digital financial inclusion, agricultural extension, rural women, economic agency, mobile money, savings groups, gender norms, financial literacy, Cambodia

Introduction

Rural women in Southeast Asia face a persistent paradox: they contribute an estimated 60-80% of agricultural labor yet control only a fraction of household financial resources and remain disproportionately excluded from formal financial services ^[1, 2]. In Cambodia, where agriculture employs roughly 35% of the workforce and women constitute the majority of smallholder farmers, only 22% of rural women held formal financial accounts as of 2021, compared to 38% of rural men ^[3]. This financial exclusion constrains women's ability to invest in productive assets, manage risk, and exercise meaningful economic agency within their households and communities ^[4]. Agricultural extension services represent an underexplored channel for connecting rural women to financial services. Extension agents already maintain trusted relationships with farming communities and regularly visit rural areas that banks and microfinance institutions find costly to serve ^[5]. Recent experiments in East Africa have demonstrated that embedding financial literacy and service linkages within extension programming can accelerate financial inclusion, particularly for women ^[6]. But evidence from the Southeast Asian context, with its distinct gender dynamics and rapidly expanding mobile money infrastructure, remains scarce ^[7, 8]. This research investigated: (a) how different types of extension-financial service linkages affected financial inclusion indicators among rural women in northwestern Cambodia; (b) what changes in economic agency accompanied improved financial access; and (c) what

barriers limited sustained engagement with digital financial services among extension participants ^[9, 10].

Theoretical Framework

Two theoretical perspectives guided this research. The women's empowerment in agriculture framework identifies access to and control over economic resources as a foundational dimension of empowerment, with financial inclusion serving as both an indicator and an enabler of broader agency ^[11]. Complementing this, the technology acceptance model suggests that perceived usefulness and ease of use determine whether individuals adopt digital tools, with social influence and facilitating conditions as moderating factors ^[12]. Extension agents potentially function as facilitating conditions, reducing perceived complexity of digital financial tools and providing social endorsement that counteracts gender-based hesitancy around technology use.

Materials and Methods

Materials

A concurrent mixed-methods design was employed across Battambang and Banteay Meanchey provinces between May 2022 and October 2023. The quantitative component surveyed 226 rural women who participated in extension programs offering financial service linkages, selected through purposive sampling from 14 commune-level extension groups. The structured questionnaire contained 46 items covering financial inclusion indicators (account ownership, transaction patterns, savings, credit), economic

agency measures, digital literacy, and demographic characteristics. Semi-structured interviews with 14 extension agents and 8 financial service providers explored implementation experiences. Ethics approval was obtained from the University of Battambang Research Committee (Protocol UBB-FA-2022-017, April 2022).

Instrument Development

The economic agency scale was adapted from the Women’s Empowerment in Agriculture Index, modified for the Cambodian financial context through consultation with four gender specialists. The adapted 12-item instrument was pilot-tested with 28 women in Pursat province (Cronbach alpha = 0.86). Content validity was established through expert review (CVI = 0.89). The scale measured three

dimensions: financial decision-making autonomy, income control, and asset ownership influence using a 5-point Likert format.

Methods

Quantitative analysis used paired t-tests comparing pre- and post-intervention financial inclusion and agency scores, chi-square tests for categorical outcomes, and Spearman correlations between extension linkage types and inclusion indicators. The heatmap analysis cross-tabulated five linkage types against five financial inclusion indicators to identify the strongest intervention-outcome combinations. Qualitative interviews underwent thematic analysis with two independent coders (inter-rater agreement = 0.84). Analysis used SPSS 27.0 at $p<0.05$.

Results

Table 1: Financial inclusion indicators before and after extension-linked interventions (n = 226)

Indicator	Baseline (%)	Endline (%)	Change	p-value
Mobile money account	19.5	68.1	+48.6	< 0.001
Regular savings behavior	23.9	57.3	+33.4	< 0.001
Formal credit access	11.1	34.8	+23.7	< 0.001
Insurance awareness	8.4	31.7	+23.3	< 0.001
Financial literacy score	2.14	3.67	+1.53	< 0.001

All financial inclusion indicators improved significantly from baseline to endline. Mobile money account ownership

showed the largest absolute gain (48.6 percentage points), driven by the hands-on training sessions embedded in extension meetings.

Table 2: Economic agency scores before and after intervention by dimension

Agency Dimension	Pre (mean)	Post (mean)	t-value	p-value
Financial decision-making	2.31	3.48	4.87	< 0.001
Income control	2.57	3.41	3.92	< 0.001
Asset ownership influence	2.18	2.89	3.24	0.002
Overall agency score	2.35	3.26	4.41	< 0.001

Economic agency scores improved across all three dimensions. Financial decision-making showed the largest gain (from 2.31 to 3.48), while asset ownership influence,

which involves deeper household power dynamics, showed the smallest though still significant improvement.

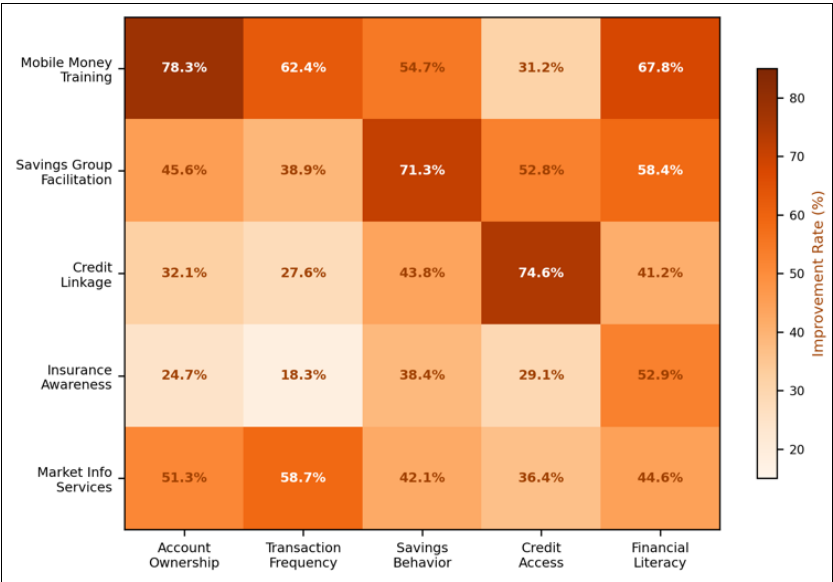


Fig 1: Heatmap showing improvement rates across financial inclusion indicators by extension linkage type

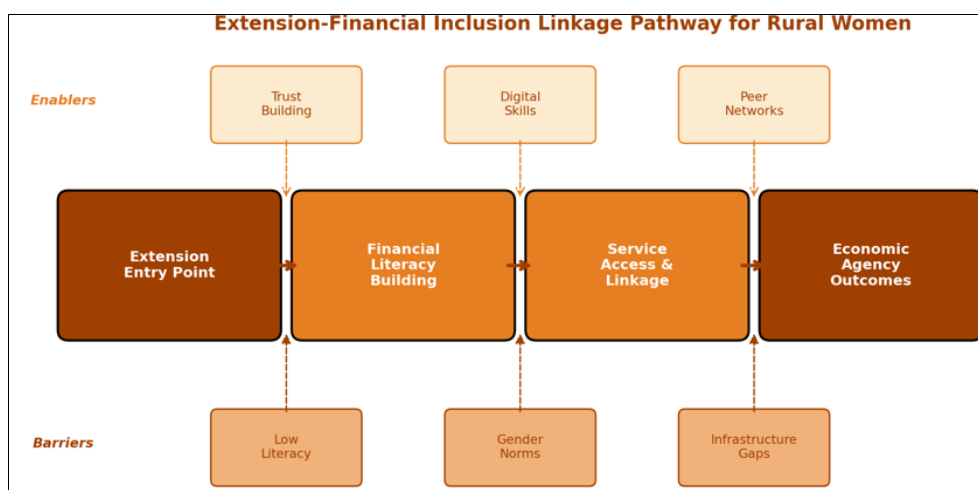


Fig 2: Extension-financial inclusion linkage pathway for rural women showing enablers and barriers

Comprehensive Interpretation

The heatmap reveals distinct intervention-outcome patterns. Mobile money training was most effective for account ownership (78.3%) and financial literacy (67.8%), while savings group facilitation excelled at changing savings behavior (71.3%) and improving credit access (52.8%).

Insurance awareness programs showed the weakest effects overall. Interview data indicated that extension agents were most comfortable delivering mobile money and savings content but felt underprepared for insurance and credit topics.

Discussion

The substantial gains in financial inclusion and economic agency support the proposition that extension services can serve as effective delivery channels for financial empowerment programming^[5, 6]. The finding that mobile money training produced the largest inclusion gains aligns with Cambodia's rapidly expanding mobile infrastructure, where network coverage now reaches over 90% of rural areas^[13]. Extension agents' existing community trust appears to reduce the adoption barriers that financial service providers face when approaching rural women directly^[12].

The differential improvement across agency dimensions is instructive. Financial decision-making, being the most directly linked to account ownership and transaction capability, responded most strongly to the intervention. Asset ownership influence, which involves negotiating household power structures shaped by deep-seated gender norms, showed smaller gains^[11, 14]. This pattern suggests that financial access is necessary but not sufficient for full economic empowerment; complementary programming addressing gender norms may be needed for deeper agency shifts.

Qualitative interviews highlighted that digital literacy remained the most persistent barrier even after training, particularly among older women and those with limited formal education^[15]. Several extension agents described adapting training approaches on the fly, using visual guides and peer mentoring when standard instruction proved insufficient. These adaptations weren't part of the formal program design, pointing to a gap between programmed and actually delivered extension content^[16].

Limitations

The absence of a control group limits causal attribution; observed changes may partly reflect broader trends in mobile money adoption. Self-reported financial inclusion indicators may overstate actual usage patterns. The research was confined to two northwestern provinces with relatively good mobile network coverage and may not represent more remote regions. The 18-month observation period may be too short to assess whether financial behavior changes persist. Future research should incorporate randomized designs and longer follow-up periods with objective transaction data.

Conclusion

Extension-linked financial service programming produced significant improvements in financial inclusion and economic agency among rural women in northwestern Cambodia. Mobile money training and savings group facilitation were the most effective intervention types. Financial decision-making autonomy showed the largest agency gains, while asset ownership influence, embedded in deeper gender dynamics, improved more modestly. Digital literacy and gender norms emerged as the primary barriers to sustained engagement.

These findings support integrating financial literacy and service linkages into agricultural extension programming as a pathway to women's economic empowerment. Extension services offer trusted community access points that can lower adoption barriers for digital financial tools, though ongoing support for digital skills and attention to underlying gender norms are needed for durable impact.

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