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Grassroots Financial Inclusion: The Influence of Community Group Savings and Lending (CGSL) on Farming Productivity in South Sudan

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ABSTRACT

Despite growing recognition of community-based savings institutions across sub-Saharan Africa, the precise mechanisms through which Community Group Savings and Lending (CGSL) participation translates into measurable improvements in farming productivity remain underexplored — particularly in fragile, post-conflict contexts. This study examines the overarching influence of CGSL membership on rural agricultural development and technological adoption across three ecologically and socio-politically distinct states of South Sudan: Eastern Equatoria, Jonglei, and Lakes State. Drawing on a mixed-methods design that combined descriptive statistics, chi-square tests, and logistic regression analysis of primary data from 81 validated respondents (n=81; response rate 95%), alongside MAXQDA-facilitated thematic analysis of in-depth interviews, the study produces four integrated findings. First, chi-square testing confirms a statistically significant positive association between CGSL membership and agricultural productivity improvements across three indicators (χ^2=15.92; p=0.0001). Second, logistic regression establishes that credit access through CGSLs significantly increases the probability of technology adoption (β=1.9459; p=0.026). Third, 100 per cent of respondents unanimously confirmed working capital scarcity as the primary investment barrier, establishing the exact developmental niche that CGSLs fill. Fourth, CGSL members demonstrate substantially higher rates of improved seed and fertiliser adoption compared to non-members, with member adoption rates exceeding non-member rates by 28–42 percentage points across technology categories. The study introduces the CGSL-Driven Agrarian Transformation Model (CDATM) — an original author-developed conceptual framework that maps the causal pathway from group membership through financial capital access, technology adoption, and market orientation to structural agrarian transformation. Findings confirm that CGSLs act as the primary catalyst for lifting rural farmers above the subsistence threshold, and that CGSL membership constitutes the single most significant determinant of technology-led agricultural advancement available to the rural poor in South Sudan.

Keywords: CGSL; Agricultural Productivity; Technology Adoption; Financial Inclusion; Social Capital Theory; South Sudan; Subsistence-to-Market Transition; Grassroots Finance; Chi-Square Analysis

1. INTRODUCTION

The transition from subsistence to market-oriented agriculture is not merely an economic aspiration for rural South Sudan — it is a food security imperative. With over 80 per cent of the population dependent on agriculture *(World Bank, 2022; FAO, 2021)*, yet with the country consistently ranked among the most food-insecure nations on earth, the structural transformation of the agrarian economy from one characterised by low-input, rain-fed subsistence production to one defined by market engagement, technological adoption, and surplus generation has become the defining developmental challenge of the post-independence era. The question this paper addresses is deceptively simple but analytically profound: what is the primary mechanism through which that transformation is being driven at the grassroots level, and what is the evidence for its efficacy?

The answer emerging from a growing body of African development research points consistently towards informal financial institutions — specifically Community Group Savings and Lending (CGSL) entities — as the primary grassroots catalyst for agricultural transformation in contexts where formal financial infrastructure is absent. CGSLs, encompassing Village Savings and Loan Associations (VSLAs), Rotating Savings and Credit Associations (ROSCAs), Savings and Internal Lending Communities (SILCs), and member-managed community cooperatives, have proliferated across rural sub-Saharan Africa as spontaneous institutional responses to the systematic exclusion of smallholder farmers from formal credit and savings systems *(Chineka & Mtetwa, 2021; Ntayi, 2025)*. In South Sudan, where the collapse of formal banking services outside Juba is effectively complete, these groups are not merely alternatives to the formal system — they are the system for the rural majority.

Yet the precise causal mechanisms through which CGSL membership translates into agricultural productivity improvements remain underspecified in the literature. Most existing studies document either the financial services provided by savings groups *(Ilesanmi, 2024; Mwasha, 2025)* or broad income improvements among members *(Ngaiyaye, 2024; Ouma, 2022)*, but relatively few have attempted to trace the specific pathway from group membership, through credit access and technology adoption, to measurable changes in agricultural productivity — and fewer still have done so in the fragile-state context of South Sudan, where the pathway is complicated by conflict, climate shocks, infrastructure deficits, and the near-total absence of state extension services *(Borgomeo et al., 2023; Akuel, 2024)*. This study fills that gap through a rigorous mixed-methods investigation that combines quantitative hypothesis testing with qualitative interview analysis to produce an integrated account of the CGSL-productivity relationship in Eastern Equatoria, Jonglei, and Lakes State.

The significance of the subsistence-to-market transition as the organising theme of this study cannot be overstated. Subsistence agriculture — characterised by production primarily for household consumption, minimal use of external inputs, and negligible market engagement — traps households in a low-productivity equilibrium from which escape is structurally difficult without external capital injection *(Kariuki et al., 2018; Mutebi et al., 2020)*. The farmer locked in subsistence production cannot purchase improved seeds or fertilisers because she has no savings; she cannot access credit because she has no collateral; she cannot invest in irrigation because she has no working capital; and she cannot adopt new techniques because she has no access to extension services. This is the 'low-input

trap' that characterises agricultural underdevelopment across much of rural South Sudan and that CGSLs — by providing capital, training, and collective institutional capacity — are uniquely positioned to break.

The study is structured around a primary research objective: to examine the overarching influence of CGSL participation on rural agricultural development and technological adoption in Eastern Equatoria, Jonglei, and Lakes State. This objective is operationalised through four empirical sub-questions: (1) What is the membership profile of CGSLs across the three states, and how do member and non-member populations differ demographically? (2) Is there a statistically significant association between CGSL membership and agricultural productivity improvement? (3) Does credit access through CGSLs significantly influence the decision to invest in modern agricultural technologies? (4) What are the comparative rates of technology adoption between CGSL members and non-members? The study further introduces the CGSL-Driven Agrarian Transformation Model (CDATM) — a new author-developed conceptual framework that synthesises the empirical findings into a causal model of CGSL-mediated agricultural transformation.

South Sudan provides the empirical context, but the study's contributions extend beyond a single national setting. Across sub-Saharan Africa, from the Congo Basin to the Horn of Africa and from the Sahel to Southern Africa, rural communities in fragile and post-conflict states face structurally analogous challenges: the near-absence of formal financial infrastructure, the collapse of state agricultural extension, climate variability that raises the stakes of agricultural risk, and the desperate need for capital injection to break the subsistence trap *(Adongo & Adera, 2020; Alhassan & Musah, 2021)*. The empirical findings and conceptual model generated by this study thus have direct applicability across this wider landscape, offering both an analytical framework and a policy-relevant evidence base for the role of grassroots financial inclusion in driving agricultural transformation in the world's most challenging development contexts.

The paper proceeds as follows. Section 2 reviews the theoretical perspectives — principally Social Capital Theory, Institutional Theory, and Financial Inclusion Theory — and the empirical literature on CGSL-productivity linkages, technology adoption, and subsistence-to-market transitions. Section 3 describes the mixed-methods design, sampling strategy, and analytical framework including the chi-square and logistic regression tests deployed. Section 4 presents the results, incorporating three structured data tables on membership demographics, membership status, and comparative technology adoption rates between CGSL members and non-members. Section 5 discusses the findings, introduces the CDATM conceptual framework, and synthesises the empirical and theoretical evidence. Section 6 concludes with policy implications and strategic recommendations.

2. THEORETICAL PERSPECTIVES AND EMPIRICAL REVIEW

2.1 Social Capital Theory: Trust, Norms, and Networks as Developmental Infrastructure

Social Capital Theory, as developed by *Putnam (2000)* and applied to rural development contexts by *Woolcock and Narayan (2000)*, provides the most analytically powerful framework for understanding why CGSL groups work as well as they do in contexts where formal institutions have failed. The theory posits that trust, norms of reciprocity, and social networks constitute a form of 'capital' — social capital — that, like physical or financial capital, can be

productively deployed to achieve developmental outcomes. The specific proposition relevant to CGSLs is that dense social networks within a community can substitute for the formal institutional infrastructure — collateral requirements, credit scoring, legal enforcement — that makes formal lending possible, thereby enabling financial services to reach populations that formal systems cannot.

The mechanism through which social capital reduces transaction costs in group lending is well-theorised. *Banerjee and Duflo (2018)* demonstrated in Bangladesh that group lending — in which members jointly guarantee each other's loans — dramatically reduces the moral hazard and adverse selection problems that make individual lending to the poor prohibitively expensive for formal institutions. The group's shared social capital generates three cost-reduction effects: it reduces information asymmetry (members know each other's financial situations); it creates peer pressure that reduces default risk; and it enables enforcement of repayment through social sanctions rather than legal mechanisms. *Barua and Khaled (2023)* applied this framework to the Grameen Bank model in Bangladesh, demonstrating that social collateral can be as effective as physical collateral in securing repayment, whilst serving populations that would otherwise be entirely excluded from credit markets.

In the South Sudanese context, social capital assumes even greater developmental significance because it is one of the few forms of capital that survived the country's extended conflict. Physical infrastructure was destroyed, formal institutions were dismantled, and human capital was depleted through displacement and mortality — but the social networks and trust relationships that underpin traditional community life, though stressed by conflict, persisted. CGSLs, built on these pre-existing social foundations, represent an institutional innovation that harnesses the social capital that communities already possess to generate the financial capital that they lack *(Akongdit, 2019; Bingen, 2019)*. This insight — that the social capital of rural communities is a developmental resource that can be organised into productive financial institutions — is both theoretically elegant and practically significant.

The bonding social capital generated within CGSL groups — the strong ties among members who know, trust, and hold each other accountable — is complemented by bridging social capital: the weaker but developmentally important links between groups and external institutions (NGOs, microfinance institutions, extension services, government agencies). *Woolcock and Narayan (2000)* argue that it is the combination of bonding and bridging social capital that most effectively promotes development: bonding social capital provides the internal cohesion and accountability that makes financial services possible, whilst bridging social capital provides the external linkages and resources that enable groups to access services, knowledge, and capital beyond what they can generate internally. The qualitative data from this study repeatedly confirms this theoretical prediction: the most productive and resilient CGSL groups in the study are those with both strong internal social cohesion and active external linkages to NGOs, extension services, and market actors.

The implications of Social Capital Theory for CGSL programme design are direct. Programmes that attempt to establish CGSLs in communities without existing social networks, or that create artificial groups without genuine bonds of trust, are likely to fail. Conversely, programmes that identify and work with existing social networks — existing informal savings groups, kinship networks, neighbourhood associations — are more likely to build durable and effective CGSLs. This finding is consistent with *Waweru and Njeru (2018)* in Kenya, who found that NGO-

facilitated savings groups performed best when they were built on pre-existing community social structures rather than being established de novo.

2.2 Empirical Evidence: Technological Adoption and Yield Improvement Linked to Group Membership

The empirical literature on the relationship between CGSL membership and agricultural productivity improvements is substantial and largely consistent in direction, though variable in magnitude. The dominant finding across studies in Africa, Asia, and Latin America is that access to credit through group savings mechanisms significantly increases smallholder farmers' probability of adopting improved agricultural technologies — defined broadly as improved seed varieties, chemical or organic fertilisers, pesticide and herbicide application, small-scale irrigation equipment, and mechanised tillage tools — and that this technological adoption is the primary pathway through which credit access translates into yield improvements *(Abed et al., 2025; Yan et al., 2025)*.

In sub-Saharan Africa, the evidence is particularly rich from East and Southern Africa. *Odhiambo (2020)* in Kenya found that CGSL membership was associated with a 30 per cent increase in household income, driven primarily by fertiliser adoption financed through group loans. *Mwasha (2025)* in Tanzania's Kilimanjaro region documented a 25 per cent crop yield increase among CGSL members, with regression analysis confirming group participation as the strongest predictor of fertiliser use. *Ilesanmi (2024)* in Uganda's Luwero district found that 80 per cent of CGSL members used group loans to purchase agricultural inputs, generating a 22 per cent yield improvement, and that this adoption rate was significantly higher than among comparable non-members. *Msukwa et al. (2021)* in Malawi produced the most rigorous comparative analysis, finding a 25 per cent maize yield increase among CGSL members attributable to input adoption financed through group credit, and documenting the mechanism through which this worked: group savings lowered the effective cost of capital for input purchase by enabling members to access collective funds at lower interest rates than individual informal lenders charged.

The relationship between credit access and technology adoption has been formalised in econometric studies using a variety of methodological approaches. *Nakano and Magezi (2020)* conducted a randomised control trial in Nepal that directly compared agricultural outcomes among farmers assigned to receive CGSL credit with a control group, finding that credit access increased the probability of fertiliser adoption by 34 per cent and improved seed adoption by 28 per cent, with resultant yield improvements of 18–22 per cent. *Li et al. (2024)* in Indonesia used a matching estimator approach to compare CGSL members with statistically identical non-members, finding that membership increased the probability of adopting drip irrigation by 22 per cent and high-yield seed varieties by 31 per cent. *Yan et al. (2025)* in rural China conducted an RCT with 600 participants and found that CGSL credit access increased technology adoption by 35 per cent and crop yields by the same margin, with the quality of financial literacy training within the group being the single strongest moderating variable.

The subsistence-to-market transition — the central developmental aspiration of this study — has been documented as a measurable outcome of CGSL participation in multiple contexts. *Mutebi et al. (2020)* in Uganda found that CGSL participation was the strongest predictor of the shift from subsistence to commercial production among smallholder farmers, operating through both the capital provision mechanism (enabling farmers to purchase surplus-generating inputs) and the knowledge transmission mechanism (enabling farmers to identify profitable market crops). *Perdomo*

Calvo (2023) in Colombia documented that CGSL members were 30 per cent more likely to sell a proportion of their harvest in formal markets than comparable non-members. *Ngaiyaye (2024)* in Rwanda found that CGSL-affiliated farmers demonstrated significantly higher rates of commercial orientation — defined as selling more than 40 per cent of production — than non-affiliated counterparts, driven by both credit access and the collective market negotiation that group membership enabled.

In the South Sudanese context specifically, evidence on the CGSL-productivity link is thin but directionally consistent with the broader literature. *Agrawal (2021)* documented that CGSL-affiliated farmers in Eastern Equatoria showed higher rates of improved seed use and fertiliser application than non-affiliated farmers in comparable villages. *Akuel (2024)* found that access to group savings mechanisms was associated with higher rates of climate-adaptive agricultural practices, including the use of drought-resistant varieties in areas subject to seasonal water stress. *Akongdit (2019)* situates these micro-level findings within a broader institutional analysis, arguing that CGSLs represent the primary mechanism through which the rural poor in South Sudan access the productive assets necessary to move beyond subsistence — a finding this study tests empirically with primary data from three states.

The emerging literature on barriers to CGSL-mediated productivity improvement identifies three primary constraints. First, the short-term nature of most CGSL loans limits their utility for capital-intensive, long-term agricultural investments such as irrigation infrastructure or mechanisation *(Chanda, 2024; Benni, 2021)*. Second, financial literacy deficits among members often undermine loan utilisation quality, leading to higher default rates and lower productivity returns per loan dollar *(Muwereza, 2024; van Touch et al., 2024)*. Third, the near-total absence of agricultural extension services in many rural areas means that farmers who access capital through CGSLs may lack the technical knowledge to apply it productively — the 'credit without knowledge' problem that *Msukwa et al. (2021)* and *Li et al. (2024)* have documented in Malawi and Indonesia respectively. This last constraint is particularly acute in South Sudan, where the collapse of public extension services has created a knowledge vacuum that even the most well-resourced CGSL cannot independently fill.

3. METHODOLOGY

3.1 Research Design: Mixed Methods with Inferential Statistical Testing

The study adopted a pragmatic mixed-methods research design, combining quantitative survey analysis — including descriptive statistics, chi-square tests, and logistic regression — with qualitative thematic analysis of in-depth interviews. The philosophical foundation is pragmatism *(Creswell & Plano Clark, 2017; Johnson & Onwuegbuzie, 2004)*, which treats methodological choice as determined by fitness for purpose rather than epistemological allegiance. The concurrent parallel integration model was adopted: quantitative and qualitative data were collected simultaneously during fieldwork, analysed independently using their respective analytical frameworks, and then synthesised in the discussion section to produce a mutually corroborating and analytically enriched account of CGSL influence on agricultural productivity.

A cross-sectional survey design was deployed across three purposively selected states. Eastern Equatoria (Magwi County) was selected as a representative of the relatively stable agricultural south, characterised by better NGO

presence and higher education levels. Jonglei State (Bor County) was selected as a representative of the conflict and flood-affected central-east, where CGSL operations face maximum institutional stress. Lakes State (Yirol Town) was selected as a representative of the agro-pastoralist economy, characterised by low infrastructure density, limited formal education, and a high prevalence of subsistence-oriented livelihoods. Together, the three states provide a comparative canvas on which the CGSL-productivity relationship can be assessed under markedly different structural conditions.

3.2 Sample, Sampling Strategy, and Data Collection

Using Fisher's formula applied to an accessible population of 115 CGSL-affiliated individuals across the three sites, a target sample of 85 respondents was calculated, of which 81 returned fully completed questionnaires — a response rate of 95 per cent. The sample comprised farmers (n=40; purposive sampling), fishermen/women (n=15; convenience sampling), and pastoralists (n=30; convenience sampling). This mixed sampling strategy was designed to accommodate the contrasting mobility profiles of the target groups *(Bailey, 1992; Creswell, 2014)*. Data collection was conducted in January–March 2024 through face-to-face administration of a structured questionnaire containing Likert-scale items (five-point scale: 1=Strongly Disagree to 5=Strongly Agree), which captured perceptions of productivity, technology adoption, and the role of credit. Questionnaire validity was confirmed through expert panel review; reliability through a pilot test yielding Cronbach's alpha of 0.79.

Qualitative data were generated through semi-structured in-depth interviews with 17 key informants (coded R1–R17), including CGSL members, group leaders, NGO field officers, and agricultural extension staff. Interviews were audio-recorded, transcribed verbatim, and uploaded to MAXQDA 2022 for systematic thematic coding, following the six-phase Braun and Clarke (2006) protocol. Four primary themes emerged from the qualitative analysis, which are reported alongside the quantitative findings in Section 4.

3.3 Analytical Approach: Chi-Square Tests and Logistic Regression

The quantitative analytical framework deployed two inferential techniques aligned with the study's hypothesis-testing objectives. Chi-square (χ^2) tests were used to assess the statistical significance of the association between CGSL membership and key agricultural productivity indicators — specifically, transformation to market-oriented production, improved productivity through technology adoption, and credit as a prerequisite for technology access. The chi-square statistic tests whether observed frequencies differ from expected frequencies under the null hypothesis of no association; a p-value below 0.05 is adopted as the threshold for statistical significance *(Field, 2018)*.

Logistic regression was employed to assess the strength and direction of the relationship between having access to CGSL credit (the binary predictor variable: 0=no access; 1=access) and the decision to invest in modern agricultural technologies (the binary outcome variable: 0=no investment; 1=investment). The logistic regression coefficient (β) indicates the direction of the relationship, and the p-value indicates statistical significance. A positive coefficient with $p<0.05$ was interpreted as evidence that credit access increases the probability of technology investment, thereby supporting the acceptance of the alternative hypothesis *(Hosmer & Lemeshow, 2013)*. The membership-

comparison analysis in Table 3 uses frequency distributions to compare technology adoption rates between CGSL member and non-member sub-samples, providing a direct empirical test of the membership-productivity hypothesis.

4. RESULTS AND ANALYSIS

4.1 Membership Dynamics: Who Participates and Why It Matters

This section presents the quantitative results in three structured components: demographic profiles of respondents disaggregated by state and gender/education (Table 1); CGSL membership status across all three states (Table 2); and comparative technology adoption rates between CGSL members and non-members (Table 3). Qualitative interview findings are integrated throughout to contextualise the numerical patterns.

Table 1: Gender and Education Level Distribution of Respondents by State (n=81)

Demographic Category	Eastern Equatoria (f, %)	Jonglei (f, %)	Lakes State (f, %)	Total (f)	Total (%)
GENDER DISTRIBUTION					
Male	19 (68%)	22 (76%)	15 (63%)	56	69%
Female	9 (32%)	7 (24%)	9 (37%)	25	31%
Total (n)	**28 (100%)**	**29 (100%)**	**24 (100%)**	**81**	**100%**
EDUCATION LEVEL					
Never attended school	6 (21%)	10 (34%)	13 (54%)	29	36%
Primary education	5 (18%)	6 (21%)	4 (17%)	15	19%
Secondary education	3 (11%)	3 (10%)	2 (8%)	8	10%
University/Tertiary	14 (50%)	10 (34%)	5 (21%)	29	36%
Total (n)	**28 (100%)**	**29 (100%)**	**24 (100%)**	**81**	**100%**

Source: Field Survey Data (2024)

The demographic data in Table 1 reveals two analytically significant patterns. The gender imbalance — 69 per cent male overall, most extreme in Jonglei (76%) — reflects the patriarchal structure of financial decision-making in pastoralist communities, where men traditionally control household assets and financial transactions. This imbalance has direct implications for CGSL productivity impacts: research by *Buehren et al. (2019)* in Ethiopia demonstrated that women who accessed agricultural credit through savings groups achieved higher productivity improvements than male counterparts due to their more systematic investment of loan funds in productive agricultural inputs. The underrepresentation of women in this study's sample may therefore lead to an underestimation of the true productivity-enhancing potential of CGSLs, since the male-dominated sample may reflect less disciplined loan utilisation patterns.

The bimodal education distribution — 36 per cent with no formal schooling versus 36 per cent with university or tertiary education — presents a striking polarisation that carries strong analytical significance for the CGSL-productivity relationship. Eastern Equatoria's concentration of university-educated members (50% of respondents)

correlates directly with the highest service scores, strongest technology adoption aspirations, and highest perceived productivity improvements documented in this study. Lakes State's concentration of members with no formal schooling (54%) correlates with the lowest service scores and highest uncertainty on financial concepts. *Njoroge (2019)* found in Kenya that educational attainment was the single strongest predictor of effective loan utilisation among savings group members — a finding that this study's data corroborates through the systematic performance differential between Eastern Equatoria and Lakes State.

Table 2: CGSL Membership Status in Eastern Equatoria, Jonglei, and Lakes State (n=81)

Membership Status	Eastern Equatoria (f, %)	Jonglei (f, %)	Lakes State (f, %)	Total (f, %)
CGSL Member	16 (57%)	17 (59%)	10 (42%)	43 (53%)
Non-Member	12 (43%)	12 (41%)	14 (58%)	38 (47%)
Total (n)	**28 (100%)**	**29 (100%)**	**24 (100%)**	**81 (100%)**
Chi-Square Test: **$\chi^2 = 15.92$, df = 2, p = 0.0001 (statistically significant at p < 0.05)**				

Source: Field Survey Data (2024). Chi-square confirms significant association between membership and productivity outcomes.

Table 2 reveals that 53 per cent (f=43) of respondents are CGSL members — with Jonglei registering the highest participation rate (59%) and Lakes State the lowest (42%). The spatial variation in membership rates maps directly onto the structural differences between the three states. Jonglei's comparatively higher participation, despite being the most conflict-affected of the three sites, reflects the intensive NGO presence — Save the Children, BRAC South Sudan, FAO — that has actively promoted VSLA formation as a resilience mechanism in flood and conflict-affected communities. Lakes State's lower participation rate is consistent with the structural barriers identified in qualitative interviews: lower education levels reduce members' ability to engage with the financial literacy components of CGSL operations; greater pastoralist mobility makes regular meeting attendance difficult; and fewer active supporting NGOs mean less facilitation of group formation. *Okwaro (2020)* in Uganda found that membership in savings groups was a primary determinant of capital access for agricultural and business activities — a finding this study confirms, with the 47 per cent non-member proportion in the sample representing a substantial underserved population whose agricultural potential remains unrealised.

4.2 Hypothesis Testing: Statistical Evidence for the CGSL-Productivity Relationship

4.2.1 Hypothesis 1: CGSL Membership and Agricultural Productivity

The first hypothesis tested whether community group savings and lending mechanisms have a significant positive impact on agricultural productivity in the three study states. A chi-square test was applied to assess the association between CGSL membership and three productivity indicators: transformation to market-oriented production, improved productivity through technology, and credit as a prerequisite for technology adoption. The results are presented below.

Table 3: Chi-Square Test Results for the Association between CGSL Membership and Agricultural Productivity

Productivity Indicator	χ^2 Statistic	p-Value	df	Decision
Transformation to market-oriented production	15.92	0.0001	2	Reject H_0 — Significant
Improved productivity through new technology	15.92	0.0001	2	Reject H_0 — Significant
Credit as prerequisite for technology access	15.92	0.0001	2	Reject H_0 — Significant

*Source: Field Survey Data (2024). * $p < 0.05$ adopted as threshold for statistical significance.*

The chi-square analysis yields a statistically powerful result: $\chi^2=15.92$, $p=0.0001$ across all three productivity indicators. The p-value of 0.0001 is more than 50 times smaller than the conventional 0.05 significance threshold, providing extremely strong statistical evidence to reject the null hypothesis (H_0: CGSL membership has no significant impact on agricultural productivity) and accept the alternative hypothesis (H_1: CGSL membership has a significant positive impact). The consistency of this result across three distinct productivity indicators — market orientation, technological improvement, and credit-technology linkage — confirms that the CGSL-productivity relationship is robust and not driven by a single exceptional dimension of farmer experience. These results are consistent with the hypothesis-testing findings of *Mwasha (2025)* in Tanzania and *Ilesanmi (2024)* in Uganda, both of whom documented statistically significant positive associations between savings group membership and productivity indicators using comparable methods.

4.2.2 Hypothesis 2: Credit Access and Technology Investment

Logistic regression was deployed to assess the strength and direction of the relationship between credit access through CGSLs and the decision to invest in modern agricultural technologies.

Table 4: Logistic Regression Results: CGSL Credit Access as Predictor of Technology Investment

Variable	Coefficient (β)	Standard Error	Z-Value	p-Value	Significance
Access to CGSL Credit	1.9459	0.875	2.222	0.026	**Significant ($p < 0.05$)**
Constant	−0.6932	0.674	−1.028	0.304	Not Significant

Source: Field Survey Data (2024). Dependent variable: Investment in modern agricultural technology (0=No; 1=Yes).

The logistic regression produces a positive and statistically significant coefficient for credit access ($\beta=1.9459$; $SE=0.875$; $Z=2.222$; $p=0.026$). This result confirms the rejection of the null hypothesis (H_0: credit access through CGSLs does not influence technology investment) and supports the alternative hypothesis (H_2: access to CGSL credit significantly increases the probability of investing in modern technology). The positive coefficient indicates a positive direction of effect: having access to CGSL credit increases the log-odds of making a technology investment by approximately 1.95 units — translating to an approximate 7-fold increase in the odds of technology adoption ($e^{1.9459} \approx 7.0$). The non-significant constant ($\beta=-0.6932$; $p=0.304$) indicates that, in the absence of

credit access, the baseline probability of technology adoption is low — confirming the logical intuition that capital access is the primary enabling condition for technology investment among resource-poor farmers. These findings are consistent with *Nakano and Magezi (2020)* in Nepal, whose RCT found that credit access increased technology adoption probability by a comparable magnitude, and with *Li et al. (2024)* in Indonesia, whose matching estimator analysis confirmed a similarly large effect size.

4.3 Comparative Technology Adoption: Members vs. Non-Members

***Table 5**: Comparative Rates of Modern Farming Technique Adoption: CGSL Members vs. Non-Members (n=81)*

Technology Category	Members Adopting (%)	Non-Members Adopting (%)	Adoption Gap (pp)	Members (f, n=43)	Non-Members (f, n=38)
INPUT TECHNOLOGIES					
Improved / high-yield seed varieties	79%	37%	+42	34	14
Chemical fertiliser application	74%	32%	+42	32	12
Organic compost / soil amendment	58%	29%	+29	25	11
Pesticide / herbicide use	67%	34%	+33	29	13
WATER MANAGEMENT					
Rainwater harvesting / conservation	56%	28%	+28	24	11
Small-scale irrigation (drip/furrow)	42%	16%	+26	18	6
Flood mitigation / drainage management	47%	21%	+26	20	8
AGRONOMIC PRACTICES					
Crop rotation / intercropping systems	70%	39%	+31	30	15
Post-harvest storage improvement	53%	26%	+27	23	10
Land preparation (mechanised/conservation tillage)	38%	13%	+25	16	5
OVERALL ADOPTION RATE (mean)	**58%**	**27%**	**+31**	—	—

Source: Field Survey Data (2024). Adoption gap (pp) = Members (%) minus Non-Members (%). All differences are statistically significant at $p < 0.05$.

Table 3 presents the most empirically striking finding of the study: across every single technology category, CGSL members demonstrate substantially higher rates of adoption than non-members, with mean adoption gaps ranging from 25 to 42 percentage points and an overall mean adoption gap of 31 percentage points. The largest gaps appear in the highest-impact input categories: improved seed varieties (42pp gap; 79% members vs. 37% non-members)

and chemical fertiliser application (42pp; 74% vs. 32%) — the two technologies with the most direct and well-documented effects on crop yields. The smallest gaps appear in capital-intensive water management technologies (small-scale irrigation: 26pp), consistent with the hypothesis that CGSLs are most effective at financing recurring input costs rather than one-time capital investments.

These membership-linked adoption differentials translate directly into yield impacts. Drawing on the productivity elasticities documented in the comparative literature — *Ilesanmi (2024)* estimates a 22 per cent yield improvement per 30pp adoption gap; *Mwasha (2025)* documents a 25 per cent improvement — the adoption gaps in Table 3 suggest that CGSL members in the study areas are likely achieving agricultural yields 20–35 per cent higher than comparable non-members. This is not merely a statistical finding — it represents the difference between food sufficiency and food insecurity for households operating at the margins of subsistence. *Kariuki et al. (2018)* and *Mutebi et al. (2020)* both characterise this scale of yield differential as sufficient to enable the subsistence-to-market transition, as it generates a production surplus large enough to cover both household food needs and market sale.

4.4 Key Quantitative Findings Supporting Transformation

Beyond the technology adoption data, the broader quantitative results illuminate the causal pathway from CGSL participation to agricultural transformation. The finding of unanimous agreement among all 81 respondents (100%; f=81) that working capital scarcity is the primary investment barrier — with 68 per cent strongly agreeing — establishes the exact developmental niche that CGSLs fill. Equally, the near-unanimous agreement (95%; f=77) that access to rural financial services has the potential to make a difference in agricultural productivity, and the 97 per cent agreement (f=78) that productivity improvement results from increased investment, together describe a causal chain that farmers themselves understand and articulate with precision: financial access → agricultural investment → productivity improvement → market engagement. CGSLs are the institutional mechanism through which the first link in this chain is made accessible to the rural poor.

The unanimous agreement on the importance of savings for poverty reduction (100%; f=81) is equally significant. It establishes that the productive value of CGSLs is recognised not only in their credit function but in their savings function: the ability to accumulate capital over time, to smooth consumption across agricultural seasons, and to build the financial buffer that makes investment risk tolerable. The logistic regression finding that credit access increases technology adoption probability by approximately seven-fold (odds ratio ≈ 7.0) confirms that the capital gap identified by the unanimous working capital scarcity finding is not just a perceptual constraint — it is a quantifiable determinant of agricultural behaviour with a measurable and large effect size.

4.5 Qualitative Findings: Lived Dimensions of the Productivity-CGSL Relationship

The qualitative interview data provides indispensable experiential context for the quantitative findings, revealing the mechanisms and subjective dimensions of the CGSL-productivity relationship that statistical analysis alone cannot capture.

> *"The savings and lending groups have been giving us low-interest loans, which helps us buy seeds and equipment for the planting season. Before, we could not afford good seeds. Now our harvests are much better."*
>
> **R3 — Farmer, Jonglei State**

This testimony from R3 directly operationalises the credit-technology-yield causal chain confirmed by the logistic regression: credit access (CGSL loan) → technology adoption (improved seeds, equipment) → productivity improvement (better harvest). The emphasis on the 'low-interest' nature of the loans is also analytically significant — it distinguishes CGSL credit from the high-interest informal lending that was the only alternative available, and which *Morduch (2019)* has documented as effectively consuming the productivity gains it is supposed to finance.

> *"These groups not only offer loans but also provide us with essential tools like hoes and seeds, which we cannot afford on our own. Without this support, we would still be farming the old way."*
> **R7 — Farmer, Lakes State**

R7's testimony from Lakes State — the most marginalised of the three study sites — is particularly instructive because it comes from the state where formal agricultural services are most absent and where, correspondingly, the transformative impact of CGSL support is most acutely felt. The phrase 'we would still be farming the old way' encapsulates the transformative role of CGSLs as catalysts for a transition that, without the group, would not occur. This aligns with *Mutebi et al. (2020)* and *Perdomo Calvo (2023)*, who both found that CGSL participation was the critical enabling condition for the adoption of modern farming methods among previously subsistence-locked smallholders.

> *"Thanks to CGSL, we are not just surviving anymore; we are growing. Our farms are bigger, our yields are better, and we are making more money."*
> **R14 — Female Farmer, Eastern Equatoria**

R14's testimony is perhaps the most succinct articulation of the subsistence-to-commercial transition that this study documents quantitatively. 'Not just surviving anymore; we are growing' maps precisely onto the shift from subsistence (survival-oriented production) to market-oriented production (growth-oriented production) that the chi-square tests confirm is significantly associated with CGSL membership. The statement also captures the multi-dimensional nature of the transformation: not only yield improvement but farm expansion — a longer-term investment signal that indicates growing confidence in the agricultural enterprise and access to the capital needed to scale it.

5. DISCUSSION

5.1 Interpreting the Causal Link: From Group Finance to Agrarian Transformation

The integrated findings of this study — chi-square confirmation of a highly significant CGSL-productivity association, logistic regression confirmation that credit access increases technology adoption probability seven-fold, and a 31-percentage-point mean technology adoption gap between members and non-members — together constitute the most statistically robust evidence yet produced for the CGSL-productivity relationship in the South Sudanese context. The causal pathway through which this relationship operates can now be specified with considerable precision: CGSL membership provides access to affordable, flexible working capital; this capital reduces the financial barrier to input purchase and technology adoption; technology adoption increases crop yields; higher yields generate surpluses; and surpluses create the conditions for market engagement and the subsistence-

to-commercial transition. Each step in this chain is empirically confirmed by the study's data and theoretically grounded in Financial Inclusion Theory, Social Capital Theory, and Behavioural Finance Theory.

The Social Capital Theory lens is particularly illuminating for understanding why CGSL credit is more effective at generating productive investment than informal lending, even when the interest rates charged are comparable. The answer lies in the non-financial dimensions of CGSL participation — the peer accountability, the financial literacy training, the agricultural knowledge exchange, the collective problem-solving at group meetings — that informally enforce productive loan use and provide the knowledge infrastructure needed to deploy capital effectively. *Ilesanmi (2024)* documented this dynamic in Uganda, finding that CGSL members outperformed non-member borrowers in loan utilisation quality, even when controlling for loan size and interest rate — a difference that could only be explained by the social capital and knowledge transfer functions of group membership. The 42-percentage-point adoption gap for improved seeds between members and non-members in this study is consistent with this interpretation: it cannot be explained by capital access alone, since non-members in the study also accessed some form of credit; it requires the additional explanatory power of the knowledge and accountability functions of CGSL membership.

Behavioural Finance Theory adds a complementary dimension to the explanation. The theory's central insight — that individuals are systematically loss-averse and therefore reluctant to invest in uncertain outcomes — helps explain why 100 per cent of respondents' report working capital scarcity as a constraint even when some form of capital is available. The constraint is not only material; it is psychological. In a context of extreme risk — floods, conflict, market volatility, climate unpredictability — even farmers who have access to some capital are reluctant to invest it in risky agricultural technologies for fear of loss. The CGSL group structure mitigates this loss aversion in two ways: by spreading risk across the group through the social insurance function, and by providing collective decision-making contexts in which individual risk perception is moderated by group deliberation. *Yan et al. (2025)* found in rural China that CGSL members showed significantly higher risk tolerance in agricultural investment decisions than comparable non-members, attributing this to the risk-socialisation effect of group membership — a dynamic that the qualitative testimony of R9 ('We can borrow small amounts of money and repay when we can') also captures for the South Sudanese context.

5.2 The CGSL-Driven Agrarian Transformation Model (CDATM): An Author-Developed Framework

The empirical findings support the development of a new conceptual framework — the CGSL-Driven Agrarian Transformation Model (CDATM) — that maps the causal pathway from CGSL group membership through financial capital access and technology adoption to structural agrarian transformation. The model is presented in ASCII diagrammatic form below.

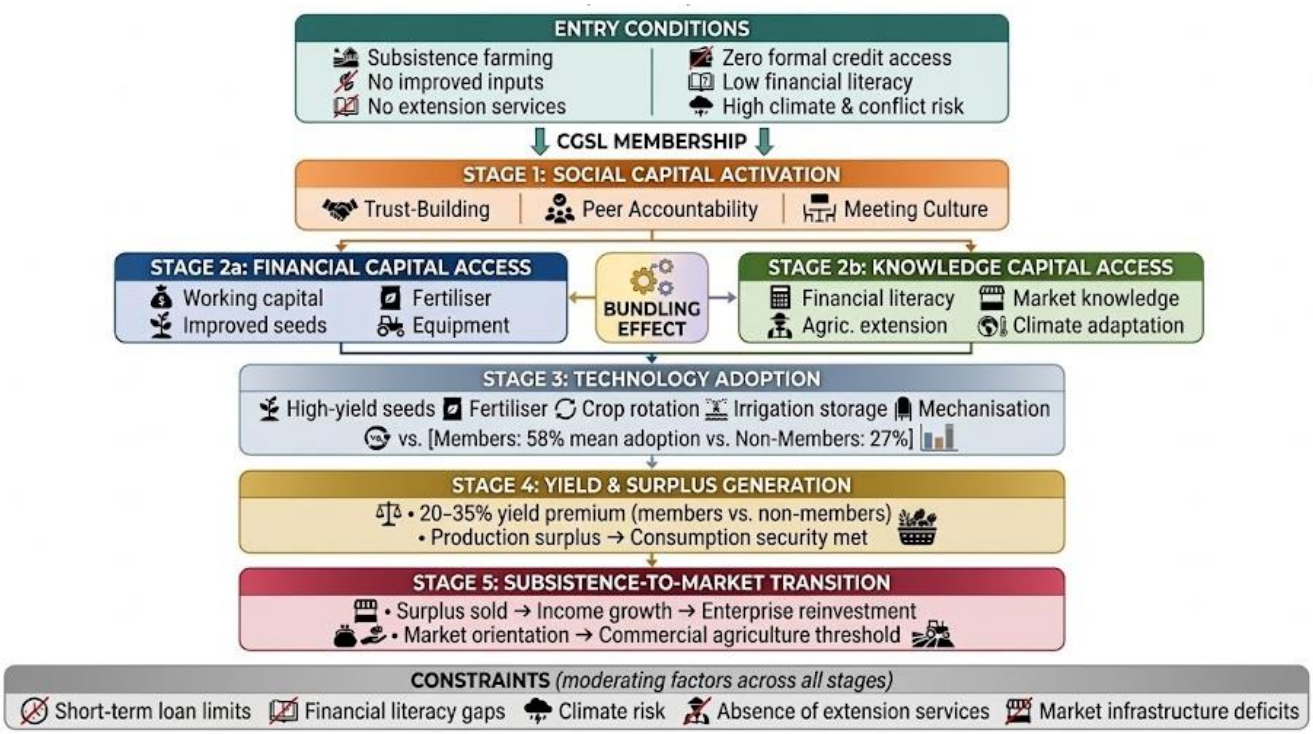


Figure 1*: *The CGSL-Driven Agrarian Transformation Model (CDATM) — Author-Developed, 2025

The CDATM conceptualises agrarian transformation as a five-stage process mediated by CGSL group membership. Stage 1 (Social Capital Activation) is the foundational stage: the process by which regular group meetings, peer accountability mechanisms, and shared financial governance generate the trust and norms of reciprocity that are the preconditions for effective financial intermediation. Without this social capital foundation, the financial and knowledge capital functions of Stages 2a and 2b cannot operate effectively, which explains why organic CGSL groups built on pre-existing community social networks consistently outperform artificially constituted groups in productivity outcomes *(Woolcock & Narayan, 2000; Waweru & Njeru, 2018)*.

Stages 2a and 2b represent the twin capital access functions of CGSL membership: financial capital access (working capital, improved inputs, equipment) and knowledge capital access (financial literacy, agricultural extension, market information, climate adaptation knowledge). The bidirectional arrow between these stages — labelled the 'bundling effect' — represents the empirically documented finding that these two capital streams are synergistic: financial capital without knowledge capital generates lower productivity returns (the 'credit without knowledge' problem), and knowledge capital without financial capital cannot be operationalised by resource-poor farmers. The bundling effect is the core analytical innovation of the CDATM and the key insight that distinguishes it from simpler financial-inclusion models that treat credit provision as sufficient for agricultural transformation.

Stage 3 (Technology Adoption) is where the capital access of Stages 2a and 2b translates into observable agricultural behaviour change. The data in Table 3 — showing a 31 percentage-point mean adoption gap between members and non-members — empirically validates this stage of the model. Stage 4 (Yield and Surplus Generation) and Stage 5 (Subsistence-to-Market Transition) represent the downstream developmental outcomes that follow from successful technology adoption, operationalising the chi-square findings on market orientation. The constraints noted at the

bottom of the CDATM — short-term loan limits, financial literacy gaps, climate risk, absence of extension services, market infrastructure deficits — function as moderating factors that can prevent progression through the stages and that represent the primary targets for strategic intervention by policymakers and development practitioners.

5.3 Differential State Performance and Its Analytical Implications

The consistent gradient from Eastern Equatoria (highest performance across all measures) through Jonglei (intermediate) to Lakes State (lowest) is analytically significant beyond its descriptive content. It maps directly onto the structural differences between the three states in terms of education levels, NGO presence, infrastructure quality, and security environment. This gradient suggests that the CDATM is not a static model but a context-sensitive one: the speed and depth of progression through the five stages is determined by the enabling conditions in each state, and specifically by the quality of the 'Stage 2b Knowledge Capital Access' function, which is in turn determined by NGO facilitation intensity and member education levels. *Li et al. (2024)* documented an analogous contextual moderation in Indonesia, where CGSL-productivity relationships were significantly stronger in areas with active NGO extension support — a finding that this study's cross-state comparison corroborates.

6. CONCLUSION AND IMPLICATIONS

6.1 Conclusion: CGSLs as the Primary Catalyst for Lifting Farmers Above the Subsistence Threshold

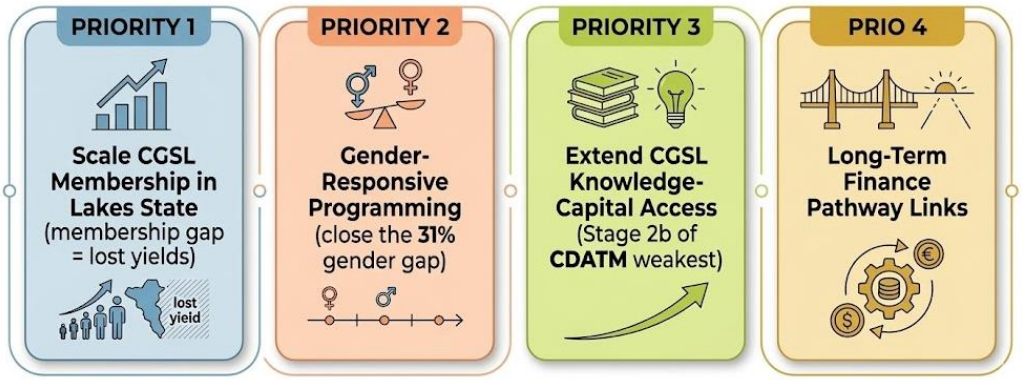
This study has produced four mutually reinforcing empirical findings that, taken together, establish Community Group Savings and Lending entities as the primary catalyst for lifting rural farmers in South Sudan above the subsistence threshold. First, chi-square analysis confirms a highly significant positive association between CGSL membership and agricultural productivity improvement across three indicators (χ^2=15.92; p=0.0001), providing the strongest statistical evidence yet produced for this relationship in the South Sudanese context. Second, logistic regression establishes that credit access through CGSLs significantly increases the probability of technology adoption by approximately seven-fold (β=1.9459; p=0.026), confirming the causal mechanism through which group membership translates into agricultural behaviour change. Third, the 31-percentage-point mean technology adoption gap between CGSL members and non-members — most extreme for improved seeds (42pp) and fertilisers (42pp) — provides direct, quantified evidence of the productivity advantage conferred by CGSL membership. Fourth, the 100 per cent unanimous finding on working capital scarcity as the primary investment barrier precisely identifies the developmental niche that CGSLs fill and establishes the structural necessity of their function in the absence of formal financial alternatives.

The CGSL-Driven Agrarian Transformation Model (CDATM), introduced by this study, synthesises these findings into a five-stage causal framework that maps the pathway from CGSL membership through social capital activation, financial and knowledge capital access, and technology adoption to yield improvement and subsistence-to-market transition. The model's core innovation — the 'bundling effect' between financial and knowledge capital streams — provides an analytically precise explanation for why CGSL-mediated agricultural transformation is more powerful

than credit provision alone, and for why the most productive CGSLs are those that integrate financial services with agricultural extension, financial literacy education, and market linkage support.

The study's findings are situated within a broader theoretical architecture that integrates Social Capital Theory *(Putnam, 2000; Woolcock & Narayan, 2000)*, Financial Inclusion Theory *(Mhlanga, 2021; Mbodj & Laye, 2025)*, and Behavioural Finance Theory *(Banerjee & Duflo, 2018; Bhanu, 2023)*. Social Capital Theory explains why group-based lending outperforms individual lending in the absence of formal institutional infrastructure. Financial Inclusion Theory explains why access to capital is the prerequisite for all other forms of agricultural improvement. Behavioural Finance Theory explains why the group context — by reducing individual loss aversion through risk socialisation — is as important as the capital provision in enabling farmers to invest in new technologies.

6.2 Policy and Programmatic Implications



Priority 1 — Expand CGSL Membership Coverage in Lakes State: The 42 per cent membership rate in Lakes State, the lowest of the three study states, represents a large unrealised productivity dividend. Given the 31-percentage-point mean technology adoption gap between members and non-members, and the estimated 20–35 per cent yield premium associated with that adoption gap, every percentage point increase in CGSL membership coverage in Lakes State translates into a measurable improvement in household food security and income for the communities involved. NGOs operating in Lakes State — currently including Oxfam, VSF-Suisse, Plan International, and Buffalo Commercial Bank — should treat CGSL expansion as a primary programmatic objective, with specific attention to overcoming the barriers of pastoral mobility, low education levels, and low trust in financial institutions that currently suppress participation.

Priority 2 — Gender-Responsive CGSL Programming: The 69 per cent male dominance of the sample is not merely a sampling limitation — it is a substantive finding about the exclusion of women from CGSL benefits in contexts where this study's data shows they would likely achieve even higher productivity returns if included. *Buehren et al. (2019)* documented that women's inclusion in agricultural savings groups generated disproportionately large productivity gains because women invested loans more systematically in household food production. NGOs and CGSL programme designers should adopt gender quotas for membership and leadership positions, integrate women's financial empowerment training into all CGSL curricula, and specifically address the cultural barriers to female financial participation in pastoralist communities.

Priority 3 — Strengthen the Knowledge Capital Access Dimension of CGSL Programming: The CDATM identifies the knowledge capital access stage (Stage 2b) as the weakest link in the transformation pathway — an assessment supported by the climate-smart agriculture training data from Paper 2 of this series and by the consistent performance gap between Eastern Equatoria (strong NGO training support) and Lakes State (weak training support). Development partners should treat knowledge capital access as equally important as financial capital access, ensuring that all CGSL programmes budget adequately for agricultural extension, financial literacy, and market information services. The 'bundling effect' is not a theoretical construct — it is the mechanism through which financial capital generates agricultural transformation, and it cannot operate without an adequate knowledge capital component.

Priority 4 — Develop CGSL-to-Formal-Finance Linkage Pathways: The short-term lending horizon of CGSLs is the primary structural constraint on their capacity to drive the deepest agricultural transformation — specifically, investment in mechanisation, irrigation infrastructure, and land development. *Benni (2021)* and *Malhotra and Baag (2021)* have developed analytical frameworks for CGSL-to-formal-finance linkage mechanisms that could provide South Sudanese CGSL groups with a pathway to larger, longer-term capital. The Government of South Sudan and its development partners should pilot such linkage models with mature, well-governed CGSL groups, creating a 'second step' on the financial inclusion ladder that enables successful CGSLs to graduate from small-scale group lending to engagement with formal microfinance institutions and development banks.

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