

Experiential Learning, Sugarcane Productivity and Loan Repayment Among Smallholder Farmers in Migori County, Kenya

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Abstract

Smallholder sugarcane farmers require both effective crop-management support and financing arrangements that reflect the long interval between production expenditure and harvest income. This study examined associations between experiential learning-based technical assistance, perceived sugarcane productivity, and loan repayment patterns in Awendo and Uriri sub-counties of Migori County, Kenya. A convergent parallel mixed-methods design combined farmer questionnaires, key-informant interviews, and focus-group discussions. Paired productivity ratings were available for 81 farmers and were measured on a five-point ordinal scale. Median perceived productivity increased from 3 (moderate) before technical assistance to 4 (high) afterwards (Wilcoxon signed-rank statistic was 44.00, $p < 1.3 \times 10^{-12}$). Service providers characterized productivity improvement as significant in 39% of responses and moderate in 56%. Across five numbered participation levels, the proportion reported as fully repaying loans increased from 30% to 95%, while reported default declined from 30% to 0%. Institutional respondents described repayment improvement as moderate in 61% of responses and substantial in 28%. Because repayment-group counts and harmonized participation coding were unavailable, repayment percentages were interpreted descriptively rather than inferentially. The findings show an association between practical agricultural learning and more favourable perceived productivity and repayment patterns, but they do not establish causal effects. Programmes linking extension and agricultural finance should combine field-based agronomic learning with cash-flow planning, timely input access, transparent credit terms, and repayment schedules aligned with sugarcane harvest and payment cycles. Future evaluations should use measured yields, consistent exposure measures, and lender-verified repayment records.

Keywords: agricultural credit; agricultural extension; experiential learning; loan repayment; smallholder farmers; sugarcane; Kenya

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I. Introduction

Agricultural extension and rural finance address interdependent constraints in smallholder production. Credit finances land preparation, inputs and labour, while technical assistance supports decisions that determine how effectively those resources are used. Extension performance depends on accessibility, institutional incentives and responsiveness to farmers' needs [1]. In sugarcane systems, the interval between production expenditure and harvest income makes coordination between technical advice and financing particularly relevant.

Experiential learning connects practical experience with reflection, conceptual understanding and further application [2]. Demonstration plots, on-farm instruction, exchange visits and farmer field schools allow farmers to assess recommendations under local conditions. Effective programmes require appropriate facilitation, sustained support and locally relevant activities [3]. These features can strengthen decisions on fertilizer application, variety selection, pest management and harvesting.

Evidence from East Africa associates farmer field schools with improvements in productivity and agricultural income [4]. A systematic review nevertheless identifies uneven evaluation quality and uncertainty about sustained benefits at scale [5]. Research in Peru found improved pest-management knowledge and suggestive productivity benefits, whereas an Indonesian evaluation found no significant performance gains [6, 7]. Broader farmer capabilities also matter when evaluating field-school outcomes [8]. These contrasting results justify context-specific investigation rather than assuming uniform gains from practical instruction.

Financial outcomes depend on knowledge, liquidity and production risk. Relaxing credit and risk constraints can change agricultural investment decisions [9], while value chain finance links lending with production and marketing [10]. Financial education can improve knowledge and behaviour [11]; simplified financial rules may support better business practices [12]. However, the price of financial services and access

conditions also influence uptake [13]. Consequently, financial literacy alone cannot be assumed to prevent default when yields, crop prices or payment timing are unfavourable.

This study examines whether farmers reported higher sugarcane productivity after experiential learning-based technical assistance and whether repayment patterns differed across participation levels in Migori County. Its contribution is the joint examination of agronomic and financial outcomes, supported by institutional perspectives. The proposed pathway links learning, practice adoption, productive performance, cash income and repayment capacity. The analysis evaluates the reported productivity and repayment endpoints; it does not estimate mediation along that pathway. The findings inform the design of coordinated extension and credit support for smallholder sugarcane production.

II. Materials And Methods

The study was conducted in Awendo and Uriri sub-counties, Migori County, Kenya, using a convergent parallel mixed-methods design. Quantitative and qualitative evidence was collected during the same study phase and interpreted together to provide complementary perspectives on technical assistance, productivity, and credit repayment. The study locations were selected purposively because of their importance to smallholder sugarcane production.

Multistage stratified sampling combined purposive selection of study locations with random selection of farmers within location and participation categories. The farmer survey was reported to include 97 respondents, while complete paired productivity ratings were available for 81 farmers. Outcome specific denominators were retained because not all analyses contained the same number of observations. A pilot study involving 30 farmers in Rongo was conducted before the main survey; pilot participants were excluded from the final sample.

Farmer questionnaires were administered using Kobo Toolbox and complemented by key-informant interviews and focus-group discussions. Instruments underwent expert review and pilot testing. The overall reliability coefficient reported for the survey instrument was Cronbach's $\alpha = 0.78$, indicating acceptable internal consistency for the combined items. Qualitative accounts were used to contextualize the quantitative patterns and to identify perceived constraints affecting productivity and repayment.

Perceived sugarcane productivity was recorded on a five-point ordinal scale ranging from 1 (very low) to 5 (very high). The measure therefore represents respondents' ratings rather than physical yield in tonnes per hectare. Loan repayment was summarized as the percentage reported as fully repaid, partially repaid, or defaulted across five numbered participation levels. Because participation was coded using four levels elsewhere in the source dataset and group-specific counts were unavailable for the repayment summary, these percentages were treated as descriptive patterns rather than borrower-level inferential evidence. Service-provider percentages represent institutional assessments and should not be interpreted as farmer-level prevalence estimates.

Before and after technical assistant productivity ratings were summarized using medians and analyzed using the reported paired Wilcoxon signed-rank test, which is appropriate for paired ordinal observations. Statistical significance was interpreted as evidence of a difference in the distribution of ratings, not as a percentage increase in physical yield and not as evidence of causality. Repayment percentages were summarized descriptively because the underlying group counts and harmonized exposure coding were unavailable. Qualitative findings from key informants and focus groups were integrated narratively with the quantitative results to explain perceived mechanisms and implementation constraints. Missing observations were not imputed because the missing-data mechanism and complete individual-level records were not established [11].

III. Results

Productivity before and after technical assistance

Among the 81 farmers with paired observations, median perceived productivity increased from 3 (moderate) before technical assistance to 4 (high) afterwards, representing a one-category shift on the five-point ordinal scale. The reported paired Wilcoxon signed-rank statistic was 44.00 ($p < 1.3 \times 10^{-12}$). The result indicates a statistically detectable change in reported productivity ratings; it does not quantify a percentage change in harvested yield or establish that technical assistance caused the change.

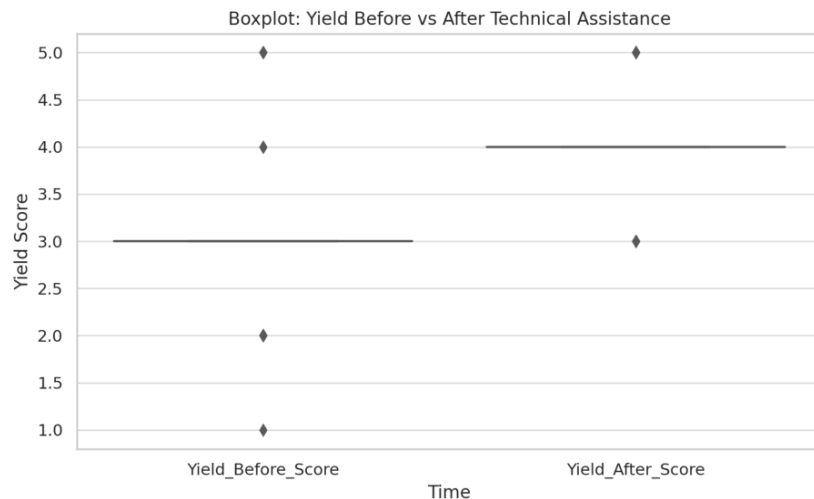


Figure 1. Self-reported sugarcane productivity before and after technical assistance (n = 81). Scores range from 1 (very low) to 5 (very high).

Institutional assessments of productivity

Service providers characterized productivity improvement following experiential training as significant in 39% of responses and moderate in 56%; 5% reported no observable improvement. Fertilizer application, variety selection, land preparation, and pest management were identified as relevant training topics. These institutional assessments support the direction of the farmer-reported pattern but do not constitute independent measurements of harvested output.

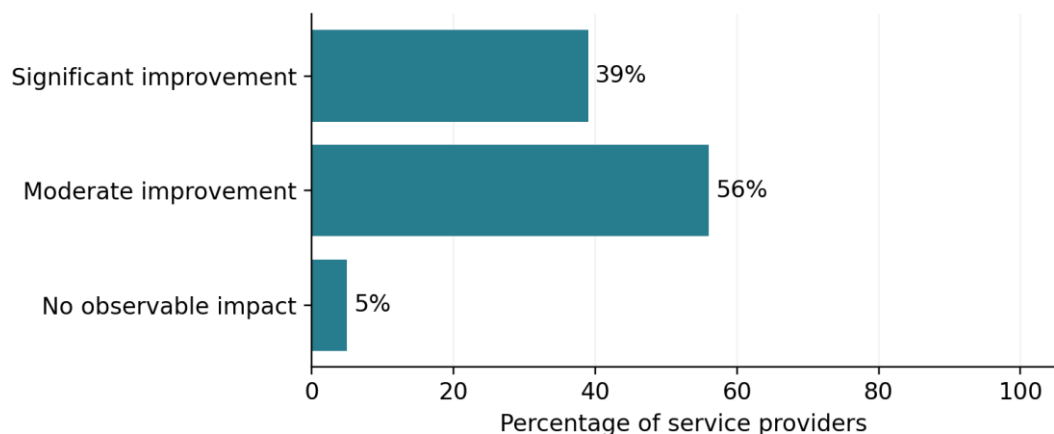


Figure 2. Service-provider assessments of productivity changes following experiential training.

Repayment across participation levels

Reported full repayment increased across participation levels 1–5 from 30% to 45%, 65%, 85%, and 95%, respectively. Partial repayment declined from 40% at level 1 to 5% at level 5, while default declined from 30% to 0%. Thus, the difference between the first and fifth participation levels was 65 percentage points for full repayment and 30 percentage points for default. Because the number of borrowers in each level was unavailable and participation categories were not consistently coded across the source material, no inferential test of this gradient was undertaken.

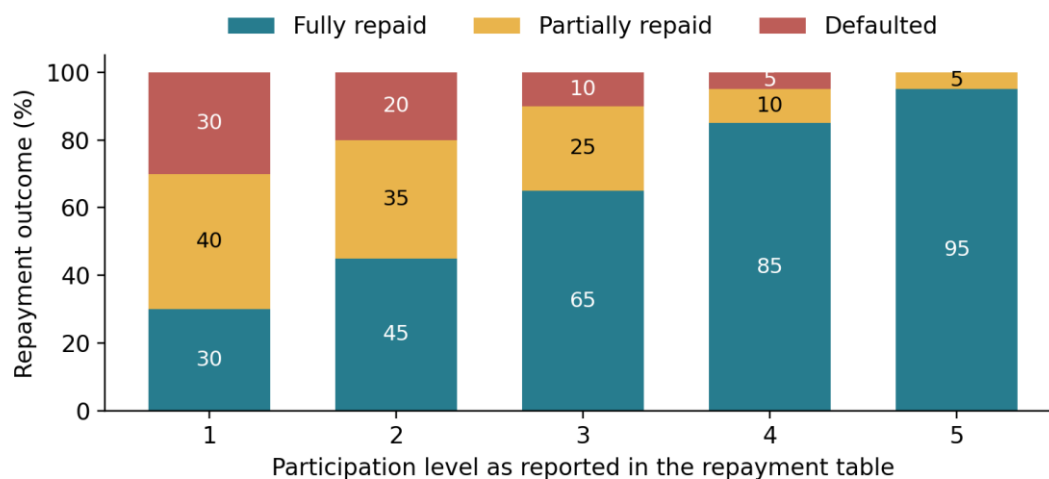


Figure 3. Loan repayment composition across five numbered participation levels.

Institutional assessments of repayment and constraints

Service providers reported moderate repayment improvement in 61% of responses, substantial improvement in 28%, and minimal change in 11%. Credit advisory services and financial literacy were reported by 83% and 72% of extension providers, respectively. Among surveyed credit institutions, training covered record keeping in 92%, financial literacy in 83%, and business planning in 75%. These percentages refer to the respective institutional respondent groups rather than to the proportion of farmers receiving each service.

Institutional respondents identified low yields, diversion of borrowed funds, household financial pressures, high input costs, and unstable crop prices as repayment constraints. Farmers additionally emphasized high interest rates, delayed inputs, and harvesting delays. Taken together, these accounts indicate that repayment capacity is shaped by both farm management and the timing and conditions under which sugarcane production generates cash income.

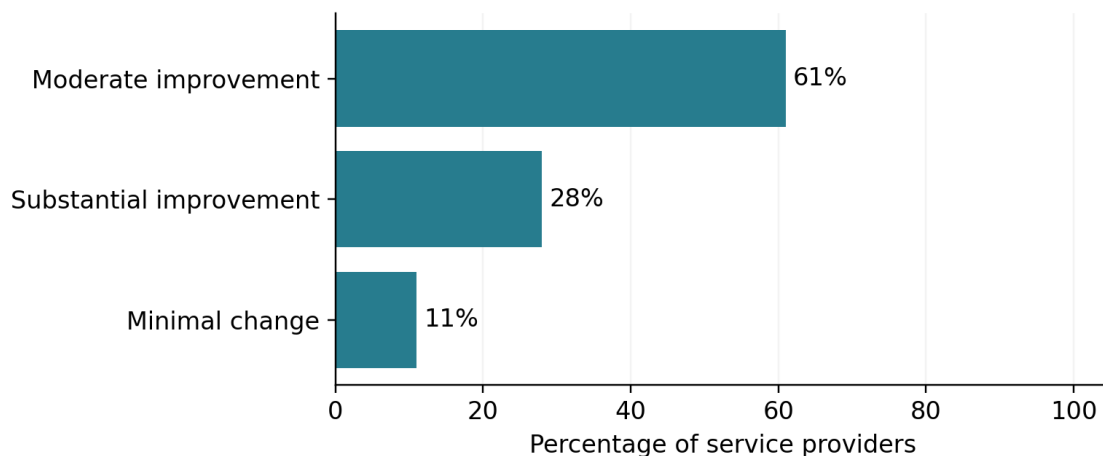


Figure 4. Service-provider assessments of changes in loan repayment.

IV. Discussions

The increase in median productivity rating from moderate to high is consistent with the premise that practical learning can help farmers translate recommendations into field-level decisions. This interpretation is compatible with evidence from farmer field schools in East Africa [3] and with recent Kenyan experimental evidence showing that experiential learning can improve knowledge and affect subsequent economic choices [5]. In the sugarcane context, recent evidence from Awendo also indicates that targeted farmer training can reduce losses during cane loading [6]. The present findings extend this discussion by linking experiential support not only to perceived productive performance but also to financial outcomes.

Nevertheless, the productivity outcome in this study was self-reported on an ordinal scale. The one-category median increase should therefore not be translated into tonnes per hectare or a percentage yield gain. Nor does the very small p-value establish a large or causal effect; statistical significance and substantive magnitude

are distinct concepts [12, 13]. Future evaluations should combine farmer perceptions with field- or mill-verified cane yields, input records, ratoon age, plot size, and production costs.

The association between technical learning and productivity is also likely to depend on farmers' ability to implement recommendations. Evidence from Kenya shows that liquidity and purchase timing can constrain fertilizer use even when farmers understand its value [14]. Recent work in Uriri similarly reports positive associations between labour devoted to key operations and sugarcane productivity [7]. These observations suggest that training is unlikely to achieve its full effect when farmers lack timely inputs, labour, credit, or access to harvesting services.

The repayment pattern is potentially important because it points toward a coordinated extension–finance model. A plausible pathway is that improved crop management raises saleable output, while budgeting, record keeping, and cash-flow planning help households allocate proceeds to debt obligations. The present study did not test that pathway at the borrower level, and the repayment data should therefore be interpreted cautiously. Even so, the finding is consistent with the broader logic of agricultural value-chain finance, in which production support, market coordination, and lending are treated as connected rather than separate services [9].

Financial education may strengthen this model but cannot by itself remove structural repayment risks. Meta-analytic evidence shows that financial education can improve financial knowledge and downstream behaviour [10]. In sugarcane systems, however, loan performance also depends on harvest timing, cane prices, buyer payment, input costs, and credit terms. This is especially relevant in Migori, where recent farmer concerns have included delayed payments for delivered cane. Extension and lending institutions should therefore coordinate technical advice with transparent credit charges, realistic cash-flow forecasts, timely input delivery, and repayment schedules that begin after expected cane payment rather than before it.

Programme delivery should also support repeated communication and farmer-to-farmer learning. Social-learning evidence shows that incentives and network structure can influence experimentation, information exchange, and technology diffusion [15, 16]. Digital advisory tools may complement rather than replace field-based learning when messages are actionable and appropriately timed [17]. Recent evidence also suggests that private input suppliers can function as information agents, although their commercial incentives require attention [18].

Taken together, the findings support integrated service models but not a claim that experiential learning alone caused either higher yields or improved repayment. The strongest policy implication is therefore one of programme design and evaluation: agronomic demonstrations, financial planning, input access, harvesting coordination, and credit scheduling should be delivered as mutually reinforcing components and assessed using harmonized participation measures, objective production records, and lender-verified repayment outcomes.

V. Conclusion

Experiential learning-based technical assistance was associated with higher perceived sugarcane productivity and more favourable descriptive loan-repayment patterns among smallholder farmers in Migori County. Median productivity ratings shifted from moderate to high, while the reported proportion of full repayment increased and default declined across numbered participation levels. The evidence supports closer integration of practical agronomic learning with financial planning and coordinated credit services, but it does not establish that training caused measured yield gains or individual repayment improvements. Programmes should align input provision, harvesting, farmer payment, and loan repayment with the sugarcane production cycle. Future research should use objectively measured yields, consistent measures of training exposure, borrower-level repayment records, and a comparison or longitudinal design capable of stronger causal inference.

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