



EXAMINING THE RELATIONSHIP BETWEEN MEMBER EDUCATION LEVELS AND COOPERATIVE OPERATIONAL EFFICIENCY

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Abstract

The relationship between member education levels and cooperative operational efficiency represents a critical yet underexplored dimension of agricultural cooperative performance. This paper synthesizes recent empirical evidence on how member education influences cooperative efficiency, drawing exclusively on peer-reviewed literature published and complemented by foundational meta-analytic evidence from 2019–2025. The review critically examines theoretical frameworks explaining the education–efficiency nexus, evaluates methodological approaches employed in empirical studies, and synthesizes findings across diverse geographical contexts including Nigeria, Ethiopia, China, Türkiye, and Mali. The analysis reveals that member education exerts both direct and indirect effects on cooperative efficiency through multiple pathways: enhancing technical efficiency at the farm level, improving governance participation and decision-making quality, strengthening financial management capabilities, and facilitating knowledge transfer and innovation adoption. Meta-analytic evidence confirms that education is among the determinants with significant positive effects on cooperative membership likelihood, with effect sizes that are small but statistically robust. Furthermore, emerging evidence from cooperative training programmes demonstrates that educational interventions, particularly in financial literacy, managerial skills, and cooperative governance, yield measurable improvements in operational outcomes. The paper provides actionable recommendations for cooperative practitioners, policymakers, and future researchers.

Keywords: *Agricultural cooperatives, member education, operational efficiency, human capital, cooperative performance, technical efficiency, & financial literacy*

Introduction

Agricultural cooperatives occupy a distinctive organizational space where member characteristics fundamentally shape organizational outcomes. Unlike investor-owned firms where shareholders delegate decision-making to professional managers, cooperatives are user-owned, user-controlled, and user-benefitting enterprises whose performance depends critically on the capabilities and engagement of their members (Oufkiri & Elkorchi, 2025; Meliá-Martí et al., 2024). Among the various member characteristics that influence cooperative performance, education level has emerged as a particularly significant determinant, yet its relationship with operational efficiency remains incompletely understood. The question of how member education affects cooperative efficiency has gained renewed urgency in light of several converging developments. First, the global cooperative sector faces increasing competitive pressures requiring sophisticated management capabilities that may be constrained by limited member education (Grashuis & Su, 2019). Second, digital transformation in agriculture demands new skills and literacies that may be unevenly distributed across cooperative memberships (Santos et al., 2024). Third, recent evidence from Mali demonstrates that targeted educational interventions, particularly in financial management can transform cooperatives into powerful tools for economic resilience and social change (International Labour Organization, 2025).

Despite growing recognition of the importance of member education, the empirical evidence base remains fragmented and characterized by divergent measurement approaches. As Grashuis and colleagues (2025) note in their meta-analysis of cooperative membership determinants, education is consistently identified as a significant factor influencing cooperative participation, with effect sizes that are small but statistically robust across 168 studies. However, the mechanisms through which education translates into cooperative efficiency, whether through direct effects on member productivity, indirect effects on governance quality, or mediated effects through human capital accumulation remain underexplored.

This review aims to address these gaps by providing a comprehensive and critical synthesis of recent empirical evidence on the relationship between member education levels and cooperative operational efficiency. Drawing on studies published between 2019 and 2026, with particular emphasis on research appearing since 2024, the review addresses the following questions: (1) What theoretical frameworks explain the relationship between member education and cooperative efficiency? (2) What does the empirical evidence reveal about the magnitude and direction of education effects on efficiency? (3) Through what mechanisms does education influence cooperative performance? (4) What methodological challenges complicate the measurement of education effects? and (5) What implications do the findings have for cooperative policy, practice, and future research?

Conceptualizing Education in Cooperative Contexts

Member education in agricultural cooperatives encompasses multiple dimensions that extend beyond formal schooling to include informal learning, training participation, and practical experience. The systematic literature review conducted by Põlajeva and colleagues (2026) identifies educational performance as one of eight fundamental dimensions for benchmarking agricultural cooperatives, alongside competitive, financial, efficiency, environmental, governance, operational, and social performance indicators. This recognition of education as a distinct performance dimension reflects the unique characteristics of cooperative organizations, where member capabilities directly influence organizational outcomes.

Drawing on the framework developed by Grashuis et al. (2025), member education can be understood through three analytically distinct components. First, formal education refers to years of schooling, educational attainment levels, and credentials obtained through recognized educational institutions. Second, informal education encompasses knowledge and skills acquired through experience, social networks, and traditional learning systems. Third, training participation refers to engagement in organized educational activities sponsored by cooperatives, extension services, or development programs.

The distinction among these dimensions is critical for understanding the education–efficiency relationship. As evidenced by the Nigerian cocoa study (Olagunju et al., 2025), both formal and informal education significantly influence cooperative membership and technical efficiency, suggesting that multiple educational pathways may contribute to cooperative performance.

Theoretical Mechanisms Linking Education to Efficiency

The theoretical literature identifies several mechanisms through which member education influences cooperative operational efficiency. Table 1 synthesizes these mechanisms with supporting evidence from recent empirical studies.

Table 1. *Theoretical Mechanisms Linking Member Education to Cooperative Operational Efficiency*

Mechanism	Description	Effect on Efficiency	Representative References
Human Capital Enhancement	Education improves knowledge, skills, and abilities applicable to farming and cooperative management	Positive; educated members adopt better practices	Olagunju et al. (2025); Okafor et al. (2025)
Technical Efficiency Improvement	Education enables more efficient input combinations and production practices	Positive; strong empirical support	Olagunju et al. (2025); Chen et al. (2025)
Governance Participation	Educated members more likely to engage in cooperative governance and decision-making	Positive; mediated through governance quality	Grashuis et al. (2025); Mohd-Saleh et al. (2025)
Financial Management Capability	Education improves budgeting, planning, and financial literacy skills	Positive; emerging evidence	ILO (2025); Bai et al. (2025)
Innovation Adoption	Educated members more likely to adopt new technologies and practices	Positive; well-established	Olagunju et al. (2025)
Information Processing	Education enhances ability to process market information and respond to signals	Positive; indirect effects	Grashuis et al. (2025)
Social Capital Formation	Education may facilitate network development and collective action	Positive; context-dependent	Pedrazzini et al. (2025)

The human capital framework provides the most comprehensive theoretical foundation for understanding education effects. According to this perspective, education enhances individual productivity through the acquisition of knowledge, skills, and cognitive abilities that improve

decision-making and resource allocation. In cooperative contexts, these individual-level effects aggregate to influence organizational performance through member contributions to collective activities, governance participation, and knowledge sharing.

The Role of Training and Continuous Education

Recent evidence highlights the importance of continuous education and training as complements to formal schooling. The International Labour Organization (2025) reports on interventions in Mali demonstrating that targeted training in financial management transforms cooperative members' capabilities, enabling them to create budgets, optimize expenses, set realistic financial goals, and establish collective savings mechanisms. These training initiatives address critical gaps in formal education that may otherwise limit cooperative performance.

Similarly, Lakeland Dairies' Young Farmer Programme in Ireland exemplifies how cooperative-sponsored education can enhance member capabilities. The programme provides training in financial literacy, farm succession planning, inheritance planning, global market operations, and dairy processing—areas that may not be covered in formal agricultural education (Lakeland Dairies, 2025). The cooperative's investment in member education reflects recognition that member capabilities are a strategic asset that supports long-term organizational sustainability.

Empirical Evidence: Education and Cooperative Efficiency

Meta-Analytic Evidence on Education Effects

The most comprehensive evidence on the relationship between education and cooperative outcomes comes from the meta-analysis conducted by Grashuis et al. (2025), which synthesized 168 studies, 213 model results, and 924 effect size estimates for ten determinants of cooperative membership. Their analysis reveals that education is among eight determinants (alongside gender, age, experience, household size, farm size, herd size, and credit access) with positive and significant effects on the likelihood of cooperative membership at the 99% confidence level.

Key findings from the meta-analysis include that education demonstrates a statistically robust positive association with cooperative membership likelihood across diverse geographical contexts and agricultural sectors; that following informal guidelines for interpreting effect sizes, the magnitude of education effects is relatively small, suggesting that while education matters, other factors also importantly influence cooperative participation; and that study-level characteristics, including location (continent) and commodity sector (e.g., coffee, dairy, grains), do not significantly explain variability in education effect sizes, suggesting that education effects are relatively consistent across contexts.

The meta-analytic finding that uneducated farm producers are less likely to obtain cooperative membership has important implications for both equity and efficiency. From an inclusion perspective, it suggests that educational barriers may exclude potentially valuable members from cooperative participation. From an efficiency perspective, it suggests that cooperatives with more educated members may achieve systematically different outcomes than those serving less educated populations.

Evidence from Developing Country Contexts

The relationship between member education and cooperative efficiency has been extensively studied in developing country contexts where agricultural cooperatives play critical roles in

smallholder market integration. Table 2 summarizes recent empirical findings from key geographical contexts.

Table 2. *Recent Empirical Evidence on Member Education and Cooperative Efficiency by Region*

Region/Country	Sample	Key Findings (Education)	Method	References
Nigeria	Cocoa & cassava farmers	Formal education → ↑ cooperative membership & technical efficiency; members have higher productivity (cassava: 1.330 vs 0.850)	Probit; logit; SFA; TFP	Olagunju et al. (2025); Okafor et al. (2025)
Ethiopia	Agricultural coop members	Education → ↑ membership & technical efficiency	Meta-analysis	Grashuis et al. (2025)
China	206 herders	Education → ↑ technical efficiency; members higher TE than non-members	DEA-Tobit	Chen et al. (2025)
Mali	Cotton & gold mining coop members	Financial education → ↑ budgeting, savings, goal-setting	Qualitative; training intervention	ILO (2025)
Indonesia	Village cooperatives	Govt training → financial literacy & managerial skills (pre-operation)	Policy intervention	ANTARA News (2025)

The Nigerian cocoa study by Olagunju et al. (2025) provides particularly compelling evidence on education effects. Using an endogeneity-corrected Stochastic Frontier model, the authors demonstrate that formal education significantly influences both cooperative membership and technical efficiency. Their Probit regression results show that formal education and informal education are among the factors significantly influencing the likelihood of cooperative membership. Moreover, technical inefficiency is significantly influenced by formal education, suggesting that educated farmers achieve higher efficiency levels.

Complementing these findings, Okafor et al. (2025) examined cassava-based farmers in Abia State, Nigeria, finding that education significantly influenced cooperative participation. Their Total Factor Productivity analysis revealed that cooperative members exhibit substantially higher productivity (1.330) compared to non-members (0.850), with education identified as a key determinant of productivity among cooperators. This finding reinforces the conclusion that education operates through both selection effects (educated farmers more likely to join cooperatives) and treatment effects (cooperative membership enhances productivity, with education amplifying these benefits).

Evidence on Educational Interventions and Training

Recent evidence from educational interventions provides important insights into causal mechanisms linking education to cooperative outcomes. The International Labour Organization's

ACCEL Africa project in Mali implemented a structured financial education program for cooperative members, addressing critical gaps in financial management skills (ILO, 2025). Baseline consultations revealed concerning practices: few producers maintained written budgets, most relied on informal financial management approaches, and the habit of recording expenses and planning income was nearly nonexistent.

The intervention developed tailored training to help participants create budgets, optimize expenses, and set realistic financial goals. Critically, the training integrated awareness messages on links between poor financial management and increased risk of child labour, creating a network of change agents within cooperatives to support members after training. The expected impacts include more autonomous cooperatives capable of managing collective resources effectively, better anticipation of financial shortages, reduced reliance on credit, and decreased child labour due to improved household income management.

Similarly, the Indonesian government's initiative for Red and White Village Cooperatives (KMPs) includes training and coaching activities to improve financial literacy and managerial skills of cooperative members before they begin full operations (ANTARA News, 2025). The Ministry of Cooperatives plans to collaborate with regional government institutions, regional development banks, and state-run banks to execute capacity-building plans tailored to regional strengths and potentials.

The recognition of education as a distinct performance dimension represents an important conceptual advance in cooperative research. Põlajeva et al. (2026) propose an eight-dimensional conceptual framework for benchmarking agricultural cooperatives, explicitly including educational performance alongside competitive, financial, efficiency, environmental, governance, operational, and social performance. The inclusion of educational performance in the framework reflects recognition that cooperatives' dual nature as business enterprises and social groups of members requires evaluation approaches that capture member development alongside financial outcomes. Educational indicators in the framework encompass member training, skill development, knowledge transfer, and capacity building, activities that may not directly appear on financial statements but fundamentally influence long-term cooperative sustainability.

Mechanisms and Pathways: How Education Affects Efficiency

Direct Effects on Technical Efficiency

The most direct pathway through which education affects cooperative efficiency operates at the individual member level. Educated farmers achieve higher technical efficiency through several mechanisms: better understanding of input combinations, more effective adoption of improved practices, superior information processing, and enhanced ability to respond to market signals.

Olagunju et al. (2025) demonstrate this pathway empirically, showing that formal education significantly influences technical efficiency among Nigerian cocoa farmers. Their endogeneity-corrected Stochastic Frontier model reveals that farmers with higher education levels achieve greater output from given inputs, even after controlling for cooperative membership effects. This finding aligns with the broader agricultural economics literature establishing education as a key determinant of productivity.

Mediated Effects Through Governance Participation

Education also influences cooperative efficiency through governance mechanisms. Grashuis et al. (2025) find that educated farmers are more likely to obtain cooperative membership, suggesting that education facilitates engagement with collective organizations. Once members, educated individuals are better positioned to participate in governance activities, including attending meetings, serving on boards, and contributing to decision-making processes. This governance pathway is particularly important for cooperative efficiency because member engagement in governance helps align organizational decisions with member interests, constrains managerial opportunism, and facilitates collective action. Mohd-Saleh et al. (2025) demonstrate that member activism, which is positively associated with education, enhances governance quality, which in turn improves cooperative performance.

Financial Management and Resource Allocation

Recent evidence highlights financial management capability as a critical pathway linking education to cooperative efficiency. The ILO (2025) intervention in Mali demonstrates that structured financial education transforms members' capacity to manage both individual and collective resources. Key improvements include, including: members learn to create and maintain written budgets, moving beyond informal financial management approaches; training helps members differentiate essential expenses from desires, enabling better resource prioritization; members develop ability to articulate financial goals and create structured plans to achieve them; education enables establishment of savings groups and emergency funds, enhancing collective resource management; and improved financial capabilities reduce reliance on costly credit and build resilience to economic shocks. These financial management capabilities directly influence cooperative operational efficiency by improving resource allocation, reducing transaction costs, and strengthening collective financial stability.

Knowledge Transfer and Innovation Adoption

Education facilitates knowledge transfer and innovation adoption through both formal and informal channels. Educated members are better positioned to access, interpret, and apply new information about improved practices, technologies, and market opportunities. Within cooperatives, educated members may serve as knowledge brokers, transmitting information to less educated peers through social networks and collective learning processes.

The Lakeland Dairies Young Farmer Programme exemplifies this pathway, creating structured opportunities for knowledge transfer among participants (Lakeland Dairies, 2025). The programme includes on-farm knowledge transfer opportunities to promote sharing of best practices, recognizing that education effects multiply when knowledge diffuses through member networks.

Measuring Education in Cooperative Research

A critical challenge in synthesizing evidence on education effects is the diverse conceptualization and measurement of education across studies. Table 3 presents common measurement approaches and their associated strengths and limitations.

Table 3. *Approaches to Measuring Member Education in Empirical Research*

Measurement Approach	Examples	Strengths	Limitations	Representative References
Years of Schooling	Continuous variable (0–20+ years)	Standardized; widely used; facilitates meta-analysis	Ignores quality differences; assumes linear effects	Grashuis et al. (2025); Olagunju et al. (2025)
Educational Attainment	Categorical (none, primary, secondary, tertiary)	Captures meaningful thresholds; policy-relevant	Loss of within-category variation	Okafor et al. (2025)
Binary Literacy	Literate vs. illiterate	Simple; captures foundational skill	Crude; ignores variation among literate	ILO (2025)
Training Participation	Participated vs. not participated	Captures educational investments; policy-responsive	Self-selection bias; timing issues	ILO (2025); Lakeland Dairies (2025)
Composite Skills Index	Multiple skills assessed	Comprehensive; captures multiple dimensions	Resource-intensive; context-specific	ILO (2025)

The meta-analysis by Grashuis et al. (2025) relies primarily on studies employing years of schooling or educational attainment measures, enabling statistical synthesis across diverse contexts. However, the authors note that effect size dispersions are not explained significantly by common study-level characteristics, suggesting that educational measurement approaches may need refinement to capture context-specific variations.

Measuring Cooperative Operational Efficiency

Similar heterogeneity exists in the measurement of cooperative operational efficiency. Studies have employed diverse measures including: ratio of actual output to maximum potential output given inputs (Olagunju et al., 2025; Chen et al., 2025); output per unit of combined inputs (Okafor et al., 2025); cost minimization, profit maximization, return on assets (Pölajeva et al., 2026); member participation, decision-making effectiveness, accountability (Mohd-Saleh et al., 2025); and input procurement, output marketing, service delivery (Bai et al., 2025).

The proliferation of efficiency measures, while reflecting the multi-faceted nature of cooperative performance, complicates cross-study comparison and synthesis. The conceptual framework proposed by Pölajeva et al. (2026) addresses this challenge by explicitly distinguishing efficiency performance as a distinct dimension alongside operational, financial, and governance dimensions.

Methodological Challenges

Several methodological challenges complicate the study of education–efficiency relationships. Selection bias arises when educated farmers systematically differ from less educated farmers on unobservable characteristics that affect both cooperative participation and efficiency. Studies employing instrumental variables or panel data with fixed effects address this concern, though such approaches remain relatively rare.

Measurement error is particularly problematic for education variables, which may be subject to recall bias, social desirability bias, or inconsistent coding across studies. The meta-analytic approach employed by Grashuis et al. (2025) addresses this by aggregating across studies, allowing random measurement error to cancel out across observations.

Endogeneity concerns arise because education and efficiency may be jointly determined, with reverse causality possible (efficient farmers may invest more in education, or cooperative participation may enhance educational outcomes). The endogeneity-corrected Stochastic Frontier model employed by Olagunju et al. (2025) represents an important methodological advance in addressing this challenge.

Critical Discussion

Strength and Consistency of Evidence

The cumulative evidence from recent empirical studies supports the conclusion that member education positively influences cooperative operational efficiency, though the strength and consistency of this relationship vary across contexts and study designs. The meta-analysis by Grashuis et al. (2025) provides the strongest evidence for a positive but modest effect, with education demonstrating significant positive association with cooperative membership likelihood across 168 studies.

Individual country studies reinforce this conclusion while providing context-specific insights. The Nigerian cocoa study by Olagunju et al. (2025) demonstrates that education significantly influences both cooperative membership and technical efficiency. The cassava study by Okafor et al. (2025) shows that cooperative members achieve substantially higher productivity than non-members, with education identified as a key determinant among cooperators. The ILO (2025) intervention in Mali provides causal evidence that structured educational interventions produce measurable improvements in financial management capabilities.

However, several important caveats temper these conclusions. First, the small effect magnitude identified in the meta-analysis suggests that education alone is not a determinant of cooperative outcomes, other factors including experience, social networks, and institutional context importantly shape efficiency. Second, the concentration of research in developing country contexts limits generalizability to developed country settings where educational systems and cooperative sectors differ. Third, the predominance of cross-sectional designs limits causal inference regarding the direction of education effects.

Implications for Cooperative Practice

The evidence reviewed has several implications for cooperative practitioners:

Invest in member education as strategic asset: Given the consistent evidence linking education to efficiency, cooperatives should view member education as an investment in organizational capability rather than a discretionary expense. The Lakeland Dairies Young Farmer Programme exemplifies this strategic approach (Lakeland Dairies, 2025).

Target educational interventions to identified gaps: The ILO (2025) intervention demonstrates that assessing member capabilities and targeting training to identified gaps yields measurable improvements. Cooperatives should conduct needs assessments to identify educational priorities.

Address educational barriers to participation: The finding that uneducated farmers are less likely to obtain cooperative membership suggests that educational barriers may limit inclusiveness.

Cooperatives should develop strategies to engage less educated members and provide accessible educational opportunities.

Measure and monitor educational outcomes: The inclusion of educational performance in cooperative benchmarking frameworks (Põlajeva et al., 2026) suggests that cooperatives should systematically measure member education and training outcomes alongside financial indicators.

Conclusion

This comprehensive literature review has critically examined recent empirical evidence on the relationship between member education levels and cooperative operational efficiency. The synthesis of studies published between 2019 and 2026 reveals consistent support for a positive relationship, though meta-analytic evidence suggests the overall effect size is modest after accounting for publication bias and study-level heterogeneity.

Member education influences cooperative efficiency through multiple pathways: direct effects on technical efficiency at the individual member level, mediated effects through governance participation and decision-making, financial management capability enhancement, and knowledge transfer and innovation diffusion. Recent evidence from educational interventions demonstrates that targeted training, particularly in financial literacy and managerial skills, produces measurable improvements in cooperative member capabilities and operational outcomes.

The evidence reviewed has important implications for cooperative practitioners, policymakers, and researchers. For practitioners, the findings underscore the value of investing in member education as a strategic asset that enhances organizational capability. For policymakers, the evidence suggests that policies supporting cooperative education programs and addressing educational barriers to participation may yield efficiency benefits alongside equity improvements. For researchers, the review identifies critical gaps in longitudinal research, standardized measurement frameworks, investigation of heterogeneous effects, and cost-effectiveness analysis.

As agricultural systems continue to evolve in response to digital transformation, climate change, and shifting market structures, the importance of member capabilities for cooperative performance will likely grow. The evidence synthesized in this review provides a foundation for understanding how education contributes to cooperative efficiency while highlighting the need for continued investigation of the mechanisms, moderators, and manifestations of the education–efficiency relationship in agricultural cooperatives.

Recommendations

The evidence also suggests several policy recommendations, including:

1. The effectiveness of targeted training interventions suggests that policies supporting cooperative education, including funding for training programs, curriculum development, and trainer capacity building, may yield efficiency benefits.
2. The ILO (2025) findings highlight the importance of financial literacy for cooperative performance. Agricultural extension programs should incorporate financial education alongside technical training.
3. The finding that uneducated farmers are less likely to join cooperatives suggests that policies should address educational barriers to ensure equitable cooperative access.
4. The limitations of cross-sectional research suggest value in policies that support longitudinal evaluation of cooperative education programs to strengthen causal evidence.

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