Current Science Research Bulletin
Volume 03 (02), February 2026, pp. 55-58
CrossRef DOI: 10.55677/csrb/05-V03I02Y2026
Available on: https://csrbjournal.org/
e-ISSN: 3050-7103
p-ISSN: 3050-709X

Ecology - Oriented Performance of Agricultural Cooperatives Incorporating Local Wisdom: Evidence from the Lake Toba Region, Indonesia

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ABSTRACT: Most studies on agricultural cooperatives have primarily concentrated on economic outcomes, often neglecting ecological and socio - cultural aspects, particularly in environmentally sensitive areas. This study examines agricultural cooperative performance by integrating economic, ecological, socio- cultural, and spatial dimensions within the Lake Toba National Strategic Area. Using a qualitative single-case study approach, the research focuses on the Maju Jaya Agricultural Cooperative, selected through institution-based purposive sampling and official recommendation from the North Sumatra Provincial Office of Cooperatives and SMEs. Data were gathered through in - depth interviews, field observations, and analysis of institutional documents, and were validated through source triangulation, institutional verification, and thick description. Cooperative performance was evaluated using a context - specific Key Performance Indicator (KPI) framework encompassing agribusiness performance, ecological sustainability of Lake Toba, Batak socio-cultural values, and the spatial characteristics of a mountainous economy. The results indicate that the cooperative demonstrates generally good to very good performance, particularly in harvest absorption, value-added generation, environmentally responsible farming practices, democratic governance, and member cohesion. The study advances the conceptualization of agricultural cooperatives as socio-ecological institutions and provides practical insights for sustainable cooperative development in national strategic and ecologically sensitive regions.

KEYWORDS: agricultural cooperatives; Lake Toba; performance; sustainability; local wisdom

INTRODUCTION

The Lake Toba region constitutes a national strategic area with substantial ecological, socio-cultural, and economic significance. As the largest volcanic lake in Southeast Asia, Lake Toba functions not only as a vital natural ecosystem but also as a primary livelihood space for surrounding communities who rely heavily on agriculture, fisheries, and tourism. Over the past two decades, however, the region has experienced increasing structural pressures, including environmental degradation, land - use conversion, fragmentation of smallholder agricultural enterprises, and weak integration within agribusiness value chains (Sirait, N., 2025; B. Sirait & N. Sirait, 2026).

Within the framework of rural development, agricultural cooperatives are widely recognized as collective economic institutions capable of aligning farmers' economic interests with broader objectives of environmental sustainability and social empowerment (Kementerian Koperasi dan Usaha Kecil dan Menengah Republik Indonesia, 2015[a]; Kementerian Koperasi dan Usaha Kecil dan Menengah Republik Indonesia. 2015[b]; Ostrom, E, 1990; Putnam, R. D., 1993; Republik Indonesia, 1992; Republik Indonesia. 1995; Birchall, 2014; Bijman et al., 2016). International scholarship emphasizes that cooperatives operate not merely as business entities but also as social institutions that foster economic democracy, reinforce social capital, and enhance community resilience. Nevertheless, much of the existing literature on agricultural cooperatives remains predominantly focused on financial performance and economic efficiency (Birchall, 2014; Chloupkova, J., Svendsen, G. L. H., & Svendsen, G. T., 2003; Creswell, J. W., 2013) while ecological and socio-cultural dimensions are frequently treated as peripheral or analyzed in isolation (Sirait, N., 2025; B. Sirait & N. Sirait, 2026; Putnam, 1993; Chloupkova et al., 2003).

Cite the Article: *Sirait, N., Sirait, B., Sitorus, R.O., Sirait, B. (2026). Ecology - Oriented Performance of Agricultural Cooperatives Incorporating Local Wisdom: Evidence from the Lake Toba Region, Indonesia. Current Science Research Bulletin, 3(2), 55-58. https://doi.org/10.55677/csrb/05-V03I02Y2026*

Publication Date: *February 11, 2026*

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In the Lake Toba context, agricultural development challenges are closely intertwined with the region's mountainous ecology, deeply rooted Batak cultural values, and national commitments to protecting the lake as a strategic ecosystem. Consequently, there is a need for an analytical framework that captures the multidimensional nature of cooperative performance. This study addresses this gap by examining ecology - and local wisdom - based cooperative performance through an in-depth case study of the Maju Jaya Agricultural Cooperative.

The selection of the Maju Jaya Cooperative followed a rigorous institutional screening process involving consultation with the North Sumatra Provincial Office of Cooperatives and SMEs and assessment of operational performance, governance quality, and institutional recognition. Rather than pursuing statistical generalization, this research seeks analytical generalization by providing a contextualized understanding of how agricultural cooperatives can function as agents of sustainable development in national strategic areas.

MATERIALS AND METHODS

Research Design. This research used a qualitative approach with a single case study design. This approach was chosen because it allowed the researcher to explore the phenomenon of cooperative performance in depth within a specific social, cultural, and ecological context (Yin, 2018).

Research Location. The research was conducted in the Lake Toba region, encompassing eight regencies: Samosir, Toba, Humbang Hasundutan, North Tapanuli, Dairi, Karo, Simalungun, and Pakpak Bharat. This area represents the characteristics of a mountainous region with a dryland farming system and strong Batak cultural values. Determination of Research Subjects. The research subject was the Maju Jaya Agricultural Cooperative, selected through institution-based purposive sampling based
on the following criteria:

- Consistent financial and operational performance over the past three years;
- Implementation of good cooperative governance and regulatory compliance;
- Active involvement in agricultural businesses and the agribusiness value chain;
- Official recommendation from the North Sumatra Provincial Cooperatives and SMEs Office.

Data Collection Techniques. Data were collected through in - depth interviews with cooperative administrators and members, field observations of business activities and agricultural practices, and analysis of institutional documents such as financial reports, articles of association, and cooperative work programs. In addition, consultations and validation of findings were conducted with the North Sumatra Provincial Office of Cooperatives and SMEs.

Data Validity. Data validity was ensured through source triangulation, institutional validation, and the application of thick description to enhance the transferability of the findings to similar agricultural cooperative contexts (Creswell, 2013).

Data Analysis Techniques. Data analysis was conducted thematically, referring to a contextually developed Key Performance Indicators (KPI) framework for cooperatives. The KPIs cover four main dimensions: (1) agricultural business performance, (2) Lake Toba ecology,
(3) Batak socio-cultural context, and (4) the spatial economy of the mountainous region.

RESULTS AND DISCUSSION

The findings corroborate international evidence indicating that agricultural cooperatives play a critical role in strengthening the bargaining position of smallholder farmers within agribusiness systems (Kementerian Koperasi dan Usaha Kecil dan Menengah Republik Indonesia, 2015[a]; Kementerian Koperasi dan Usaha Kecil dan Menengah Republik Indonesia. 2015[b]; Ostrom, E, 1990; Putnam, R. D., 1993; Republik Indonesia, 1992; Republik Indonesia. 1995; Birchall, 2014; Bijman et al., 2016). The descriptive results across performance dimensions are presented as follows.

Agricultural Business Performance**.** The Maju Jaya Cooperative exhibits strong performance in harvesting absorption, marketing coordination, and value-added creation reflecting its effectiveness as a collective economic organization (Bijman et al., 2016; Sirait, N., 2004). By functioning as a production aggregator, the cooperative enhances market access for member farmers and contributes to greater price stability particularly for smallholders operating at the margins of the value chain (Birchall, 2014). This role is consistent with international studies highlighting the capacity of cooperatives to improve smallholder integration within agribusiness value chains (Bijman et al., 2016).

Ecological Dimension of Lake Toba. From an ecological perspective, the cooperative adopts conservation-oriented agricultural practices, including agricultural waste management, reduced reliance on chemical inputs, and the application of environmentally friendly farming methods (Sirait, N., 2025; B. Sirait & N. Sirait, 2026). These practices reflect a collective awareness among members of the importance of safeguarding the Lake Toba ecosystem and align with arguments emphasizing the

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role of local institutions in managing shared natural resources.

Batak Socio-Cultural Dimension. Batak cultural values such as deliberation, collective leadership, and mutual solidarity are embedded within the cooperative's governance structure and decision-making processes (Putnam, 1993; Chloupkova et al., 2003). The cooperative serves as a platform for economic democracy and contributes to the reinforcement of social trust and cohesion among its members (Sirait, B., 2025[a,b];Birchall, 2014; Chloupkova, J., Svendsen, G. L. H., & Svendsen, G. T., 2003; Creswell, J. W., 2013).

Mountainous Spatial Economic Dimension. Geographical constraints associated with the mountainous terrain pose challenges, particularly in terms of high logistical costs and limited economies of scale. Nevertheless, the cooperative demonstrates adaptive capacity through business diversification and the integration of agro-ecotourism initiatives, illustrating institutional innovation in response to structural spatial limitations (Sirait, N., 2004; B. Sirait, 2025[a,b]).

NOVELTY AND THEORETICAL CONTRIBUTION

This research contributes theoretically by proposing a socio-ecological performance framework for agricultural cooperatives that simultaneously integrates economic, ecological, socio-cultural, and spatial dimensions. Unlike prior studies that treat these dimensions separately, this study conceptualizes cooperatives as embedded socio-ecological institutions, particularly relevant for environmentally sensitive and culturally distinctive regions. The framework extends cooperative performance analysis beyond firm-level efficiency toward sustainable area governance.

ACKNOWLEDGMENTS

The author expresses his deepest gratitude to the leadership and staff of the North Sumatra Provincial Cooperatives and SMEs Office for their institutional support, official recommendations, and facilitation of data access, which greatly assisted in the smooth conduct of this research. Sincere appreciation is also extended to the management and all members of the Maju Jaya Agricultural Cooperative for their time, valuable information, and openness during interviews, field observations, and document collection. Appreciation is further extended to various stakeholders in the Lake Toba area who provided contextual insights and local perspectives that enriched the analysis. This research received no specific funding from public, commercial, or non-profit funding agencies. All views, interpretations, and conclusions presented in this article are solely the responsibility of the author.

Statement on the Use of Artificial Intelligence

In writing this article, the author used artificial intelligence - based tools in a limited and responsible manner, solely to assist with grammar checking and editorial clarity. All scientific content, including the formulation of the research problem, conceptual framework, research design, data collection and analysis, interpretation of results, and conclusions, is entirely the result of the author's own thinking, analysis, and academic responsibility.

CONCLUSION

The Maju Jaya Agricultural Cooperative demonstrates resilient and sustainable performance across economic, ecological, and socio-cultural dimensions. Beyond its function as an economic organization, the cooperative operates as a socio-ecological institution that actively supports the sustainability of the Lake Toba region. The findings suggest that in ecologically sensitive areas, agricultural cooperatives can serve not only as instruments of economic coordination but also as institutional platforms for integrating sustainability, local wisdom, and community resilience.

RECOMMENDATIONS

1. Local governments should strengthen the replication of cooperative models based on ecological principles and local wisdom.
2. Cooperatives should enhance digitalization efforts to expand market access and improve operational efficiency.
3. The integration of cooperatives with Lake Toba conservation programs and the development of sustainable agro-ecotourism initiatives is strongly recommended.

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