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INTERNATIONAL COMMUNITY PARTNERSHIP: STRENGTHENING LIVESTOCK COOPERATIVE INSTITUTIONS THROUGH PHILIPPINES–INDONESIA KNOWLEDGE TRANSFER ON ANIMAL WASTE MANAGEMENT

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Abstract

Background. This Community Service Program (PKM) focuses on an international community partnership aimed at strengthening livestock cooperative institutions through Philippines–Indonesia knowledge transfer on animal waste management.

Methods. Service activities are centered on the beef cattle and dairy farming hub in Kuningan Regency. The main problems faced by the partner, the Karya Nugraha Jaya Multi-Purpose Cooperative (KSU

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KNJ), include suboptimal management of cattle manure waste, limited knowledge among members and administrators regarding biogas technology, weak institutional capacity to provide educational services, and high dependence of farmers on conventional energy. Poorly managed livestock waste causes significant environmental pollution and represents a lost economic opportunity.
Result. The proposed solution is a participatory and educational community empowerment approach centered on strengthening cooperative institutions. Key strategies include intensive outreach on the role of cooperatives in biogas technology and strengthening cooperative institutional mechanisms covering management, participatory decision-making, transparency, and partnerships. Mandatory program outputs include scientific publication in an ISSN-registered journal, publication in mass media, and a joint publication presenting the Indonesia–Philippines case study.
Conclusion. Key success indicators are the controlled management of accumulated waste, improved post-training knowledge assessment scores on biogas among participants, and the cooperative's ability to independently manage its operations.
Implementation. This program is expected to improve farmers' economic welfare through energy cost savings and additional income from liquid organic fertilizer (LOF), while also supporting national renewable energy mix targets.

Keywords: Institutions, Farmers, Manure, Animals, Economy

INTRODUCTION

In Indonesia, the cattle farming sector is one of the growing supplementary livelihoods, ranging from household-scale ownership of 3–4 heads to tens of heads among commercial farmers (Rizaldi & Ali, 2024). A single adult cow can produce 15–20 kg of manure per day; when multiplied by the number of farmers across the three service locations, this yields an enormous cumulative volume of waste (Ritonga et al., 2025). Fossil energy consumption in Indonesia, particularly in the household sector, continues to rise. Indonesia has set a renewable energy mix target of 23% of the national primary energy mix by 2025 and 31% by 2050 (Dewan Energi Nasional, 2024). By the end of 2023, the achieved renewable energy mix still stood at only 13.29% of the expected target. The main problem is that most cattle manure waste has not been optimally utilized and has instead become a source of environmental pollution. This waste generates greenhouse gases that are released directly into the atmosphere and contaminates groundwater, surface water, and air, with negative impacts on environmental quality and public health (June & Sarvina, 2024).

In the Philippines, animal waste management is a significant concern because the livestock sector — particularly pigs and poultry — is quite large and contributes substantially to the rural economy. Improperly managed animal waste can contaminate rivers, soil, and air,

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prompting the government and various international organizations to encourage the adoption of more environmentally friendly waste treatment systems. One widely used method is the biodigester or biogas installation. In this system, animal waste is placed into a sealed tank to be fermented by anaerobic bacteria, producing methane gas that can be used as fuel for cooking or small-scale electricity generation. The remaining sludge and liquid can also be used as organic fertilizer for agricultural land. This technology is widely used in pig farming because pig waste generates relatively high amounts of methane. However, the system also carries contamination risks if pond capacity is inadequate or leaks occur, especially during rainy seasons and floods. The Philippine government, through the Department of Agriculture and the Department of Environment and Natural Resources, has established various regulations on livestock waste management: large-scale farms are required to maintain waste treatment systems, and oversight ensures that discharged waste meets water and environmental quality standards.

This Community Service Program (PKM) is focused on Cipari Village, Cigugur District, Kuningan Regency — an area that serves as a hub for beef cattle and dairy farming with a significant cattle population and high livestock density. Based on an in-depth situational analysis, the main partners of this program — the Karya Nugraha Jaya Multi-Purpose Cooperative (KSU KNJ) and independent farmers at the service locations — face several critical challenges.

This article contributes a new model of international community partnership by combining Philippines–Indonesia knowledge transfer on animal waste management with the institutional strengthening of livestock cooperatives. Unlike conventional programs that focus mainly on biogas technology, this study emphasizes cooperative governance, leadership, participatory decision-making, and farmer empowerment as key mechanisms for sustainable technology adoption.

METHOD

This Community Partnership Program employs an Educational approach — incorporating a structured body of knowledge to help the target community better understand the issues being addressed — alongside a Participatory approach that emphasizes community involvement throughout program implementation. Specifically, the program adopts a modern, learner-centered agricultural extension model known as *participatory learning and action*.

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The program is implemented in Cipari Village, Cigugur District, Kuningan Regency, targeting cattle farmers, cooperative administrators, and extension workers affiliated with KSU KNJ. Educational activities are facilitated by the Head of the Environmental Agency of Kuningan Regency, the Head of the Cooperative, SMEs, Industry and Trade Agency of Kuningan Regency, and the Dean of the Graduate School of The Master's Theological Seminary, Philippines. This international collaboration is essential to overcome local resource limitations and expand the program's reach through South–South knowledge exchange.

The extension methods employed include:

- Interactive lectures delivered by the Dean of the Graduate School, The Master's Theological Seminary, Philippines, covering the Philippine experience in animal waste management and organizational governance
- Presentation of material on cooperative governance concepts and leadership principles
- Question-and-answer sessions and open discussion to increase participant engagement and contextualize knowledge to local conditions
- Use of visual media — presentation slides, videos, photographs, and diagrams — to aid comprehension
- A time allocation of approximately 30–40% for lecture delivery and 60–70% for discussion and participatory activities

Program implementation proceeds in two phases. In the first phase, an initial needs assessment was conducted through direct meetings with farmers and cooperative administrators to identify existing waste management practices and knowledge gaps. In the second phase, educational and institutional strengthening activities are carried out based on the assessment findings, with continuous monitoring to track progress toward program objectives.

DISCUSSION

This Community Partnership Program targets the application of knowledge and technology from the Philippines in animal waste management, channeled through the strengthening of organizational leadership and governance within KSU KNJ.

Suboptimal Livestock Waste Management

Cooperative members, particularly beef and dairy cattle farmers, still manage manure waste using traditional methods. Waste is piled around enclosures or channeled into waterways without further treatment, resulting in: (a) significant environmental pollution; (b) health risks

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for farmers and their families; and (c) loss of economic potential from waste that could otherwise be productively utilized.

Limited Knowledge and Skills of Cooperative Administrators and Farmers

Farmers and cooperative administrators have limited knowledge about converting livestock waste into biogas and organic fertilizer. They do not yet understand: (a) the technical process of constructing a biogas installation; (b) operational management of a biogas digester; (c) how to process biogas residue into quality LOF; or (d) the potential economic value of adopting this technology.

Weak Cooperative Institutional Capacity for Educational Services

The KSU KNJ still faces limitations in: (a) human resource capacity to deliver sustained technical extension services; (b) availability of structured training materials and educational modules; (c) a monitoring and evaluation system for technology adoption by members; and (d) cooperative networks with educational or research institutions for technology transfer.

Inadequate Strengthening of Cooperative Institutions

The formation of KSU KNJ, with its cooperative institutional mechanisms relating to: (a) collective decision-making; (b) effective communication systems; (c) transparency in managing cooperative assets; and (d) coordination among members in joint programs, still requires strengthening (Group Dynamics Evaluation, 2025).

Initial Assessment: Problem Identification in Animal Waste Management

Prior to the knowledge transfer activities, an initial assessment was conducted through direct meetings with cattle farmers in Cipari Village, Kuningan Regency. The assessment revealed that current waste management practices remain predominantly traditional: manure is piled around enclosures or discharged into waterways without treatment, generating greenhouse gas emissions and contaminating local water sources. Farmers and cooperative administrators reported limited familiarity with biogas technology and expressed uncertainty about the technical and financial requirements of installation. At the cooperative level, the assessment identified gaps in governance capacity, including the absence of structured training materials, limited inter-institutional networks, and underdeveloped mechanisms for collective decision-making.

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These findings confirmed the need for the two-pronged intervention designed for this program: knowledge transfer on animal waste management technology drawing on Philippine experience, and institutional strengthening of the cooperative as the vehicle for sustained technology adoption.

As a contextual reference for the knowledge transfer design, the Philippine experience offers several relevant models. The Philippines employs three main approaches to animal waste management: biodigesters that convert waste into methane gas and organic fertilizer through anaerobic fermentation; composting of cattle and poultry manure with organic materials such as rice husks and straw; and lagoon systems for liquid waste on larger farms. Despite the relative maturity of these systems, small-scale Filipino farmers face challenges due to the high cost of modern treatment technologies and the rapid pace of growth in the livestock sector. These practical lessons from the Philippine context directly informed the design of the program's educational content for Kuningan Regency.

Figure 1. Pig Pen in the Philippines

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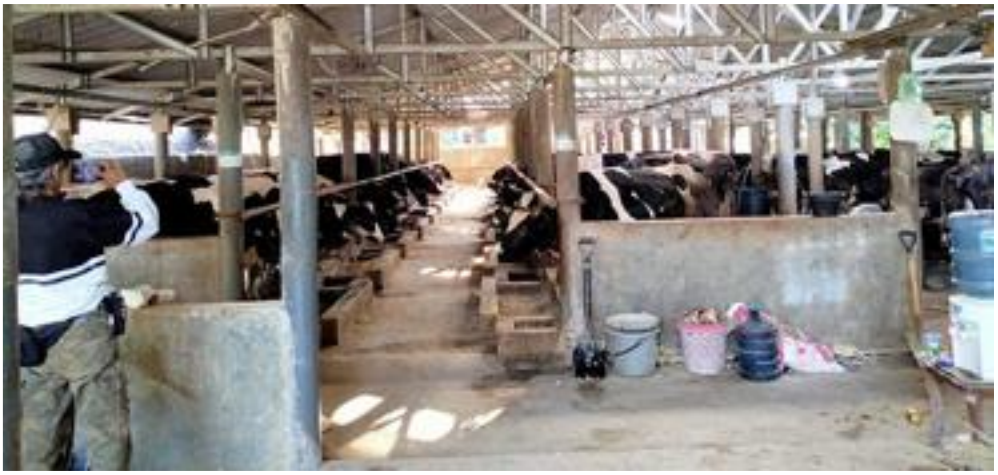

Figure 2. Cattle Enclosure in Cipari Village

Strengthening Cooperative Institutional Mechanisms

Based on the assessment findings, educational activities address four interconnected institutional dimensions.

The Strategic Role of Cooperatives in Facilitating Technology Adoption

Cooperatives play a strategic role in facilitating technology adoption, particularly for communities and small businesses that frequently face limitations in capital, knowledge, and access to technological developments. Through cooperatives, members can more readily learn about and utilize technologies that support their economic activities. Cooperatives function not only as economic institutions but also as vehicles for community empowerment, helping members adapt to changing conditions. In practice, cooperatives can provide training and technical assistance on technologies such as online marketing platforms, electronic payment systems, and business management applications, while also facilitating access to financing so that members can acquire the necessary equipment without bearing the full cost individually.

Understanding Cooperative Governance

Sound cooperative governance is essential for operating a cooperative effectively, transparently, and responsibly. Cooperative governance reflects the manner in which an organization regulates, manages, and oversees all activities to align with its objectives and applicable principles — and is necessary to maintain member trust and ensure that every decision is made in the collective interest. Cooperative governance involves the balanced roles of administrators, supervisors, and members. Administrators manage the cooperative's business activities and administration; supervisors oversee operations to ensure compliance

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with rules; and members exercise decision-making rights through the general assembly, the cooperative's highest authority. The program emphasizes four governing principles: transparency, so members can access information on the cooperative's financial condition; accountability, so administrators can be held responsible for the policies they implement; participation, as the cooperative's core source of organizational strength; and fairness, realized through the equitable distribution of benefits and services in accordance with each member's rights and responsibilities.

Leadership as a Key Factor in Cooperative Management

Leadership in a livestock cooperative differs fundamentally from leadership in a commercial enterprise, because a cooperative is *"owned by members, managed by members, for members."* The leader, therefore, acts as a facilitator and agent of change, mobilizing members — mostly small-scale farmers — toward collective action across the full production chain, from feed and cattle health to milk production and sales.

Three key roles define effective cooperative leadership in livestock farming. As an Educator, the leader acknowledges that many cattle farmers are not yet familiar with business practices, production records, or the Indonesian National Standard (SNI) for milk quality. As a Negotiator, the leader facilitates access to processing factories, secures funding through government assistance programs and banking channels, and advocates for fair pricing on behalf of members. As a Guardian of Cooperative Values, the leader ensures that the cooperative's purpose of advancing its members is upheld through participatory decision-making processes, with the general assembly serving as the primary forum for organizational communication.

Three leadership approaches are particularly effective in livestock cooperative contexts:

- Servant Leadership: The leader serves the members by visiting enclosures, listening to concerns about input costs, and facilitating access to social protection programs.
- Transformational Leadership: The leader shifts the collective mindset from traditional farming toward entrepreneurial farming — for example, developing bulk milk sales into packaged products manufactured to factory standards.
- Participatory Leadership: Major decisions are made through deliberation with members, building consensus and minimizing inter-member conflict.

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Collaboration and Partnership

The program's collaborative architecture is designed to address institutional resource limitations through two complementary tracks. The first is an international knowledge transfer track, in which the Dean of the Graduate School of The Master's Theological Seminary, Philippines, contributes expertise on animal waste management and organizational governance drawn from the Philippine context. The second is a local partnership track, in which KSU KNJ is supported in building networks with: (a) the district agriculture and livestock service; (b) educational institutions such as universities and polytechnics; (c) marketing institutions and larger cooperatives; and (d) companies with an interest in renewable energy development.

Research on cooperative institutional development consistently demonstrates that sustained engagement through meetings, knowledge transfer, and training significantly improves the institutional functions of farmer and livestock groups, particularly in terms of coordination capacity and information access. The expected outcome of this program is the development of KSU KNJ administrators' capacity to disseminate knowledge to cooperative members, with broader ripple effects on the surrounding community.

Aspect	Description
State of the Art	Current livestock waste management studies emphasize biogas, composting, lagoon systems, and circular bioeconomy approaches to reduce pollution and produce renewable energy. Existing community service models also highlight farmer training, cooperative governance, participatory extension, and institutional strengthening as important strategies for rural technology adoption.
Research Gap	Most previous work focuses on the technical conversion of livestock waste into biogas or fertilizer, but gives limited attention to the cooperative as an institutional vehicle for sustained technology adoption. There is also limited discussion of international South–South knowledge transfer, especially in the Philippines–Indonesia context, in strengthening livestock cooperative capacity for animal waste management.
Novelty	This article presents a community partnership model that integrates animal waste management technology, cooperative institutional strengthening, participatory education, and knowledge transfer between the Philippines and Indonesia. Its novelty lies in positioning the livestock cooperative not only as an economic organization, but also as a learning institution, technology-transfer platform, and driver of renewable energy adoption among smallholder farmers.

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CONCLUSION

This program carries several important implications across institutional, economic, environmental, and policy dimensions.

At the institutional level, the program demonstrates the potential of cooperative organizations to serve as effective conduits for the dissemination of technology in rural agricultural communities. By strengthening the governance and leadership capacity of KSU KNJ through structured knowledge transfer and participatory training, the program provides a replicable model for other livestock cooperatives in Indonesia facing comparable challenges in waste management and energy transition.

At the economic level, the adoption of biogas technology and the production of LOF are expected to reduce household energy expenditure and generate supplementary income for participating farmers. These outcomes directly address the economic vulnerability of small-scale cattle farmers who remain heavily dependent on conventional energy and chemical inputs.

At the environmental level, converting cattle manure into biogas will reduce the volume of unmanaged waste that currently contributes to greenhouse gas emissions and groundwater contamination in Kuningan Regency. This represents a concrete, locally grounded contribution to Indonesia's national renewable energy mix targets.

At the policy level, the Philippines–Indonesia knowledge exchange model illustrated in this program demonstrates how South–South cooperation can complement national agricultural extension systems. The regulatory and institutional frameworks already in place in the Philippines — including mandatory waste treatment requirements for large-scale farms and the government-supported adoption of environmentally friendly technology — offer policy reference points for Indonesian regencies with high livestock density seeking to strengthen their waste management governance.

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