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SUSTAINABLE CAGE INNOVATION FOR FOOD SECURITY: A PARTICIPATORY ACTION LEARNING APPROACH AT *MUSLIMAT NU* PAKIS AJI

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ABSTRACT

Objective: This community service activity aims to increase the economic independence of the Taswirul Afkar KB (Playgroup) in Lebak Village, Pakis Aji District, Jepara Regency, by developing a sustainable cage-based egg-laying chicken farm (Kastari) as a source of additional income to help reduce the institution's operational costs. Furthermore, this activity aims to improve human resource capacity in chicken farming, financial administration, and business marketing.

Design & Methods: The method used is a participatory approach through preparation and coordination stages, socialization of Kastari-based laying hen farming, sustainable farming practices and coop construction, entrepreneurial motivation training, human resource development in MSME management, simple financial administration assistance, and digital marketing training. Activities are implemented through lectures, discussions, demonstrations, field practice, and intensive mentoring for partners.

Result: The results of the community service demonstrated an increase in participants' knowledge and skills in Kastari-based laying hen farming, marked by the establishment of sustainable cages as a production and learning facility. Partners were also able to compile simple financial administration in the form of cash books, recording income and expenses, and simple financial reports to support more accountable business management. Furthermore, participants were able to utilize digital media as a means of product promotion and marketing. This program successfully improved the partners' managerial and entrepreneurial capacity and opened up opportunities for the creation of sustainable income sources that can help support the operations of the Taswirul Afkar KB. Thus, Kandang Lestari-based laying hen farming has the potential to become a model of economic empowerment that supports the sustainability of community-based educational institutions.

Keywords: Sustainable Cage, Laying hens, Community empowerment, Financial administration, Digital marketing.

INTRODUCTION

Livelihood is a job that will generate income, in the form of main work and side jobs. Side jobs can be done at home and generate additional income. Laying hen farming is an alternative as a side job and earns additional income that is quite promising, this applies to a social educational institution especially in villages that require independence (Mustafa et al., 2023; Purwadi et al., 2022). The need for eggs in Indonesia is increasing along with population growth and awareness of nutrition and health. Egg production in Indonesia in 2025 was 6.13 million tons, for Central Java Province the amount of egg production in 2025 was 812.197,86 tons (BPS, 2026a). According to data from the Central Statistics Agency (BPS), Central Java will have the highest demand for laying hen eggs in 2024, at 2,421.85 thousand tons, followed by West Java at 770.75 thousand tons, and East Java at 523.56 thousand tons. Meanwhile, the provinces with the lowest consumption of laying hen eggs are West Papua and South Papua (BPS, 2026b).

Laying hens are one of the strongest birds that do not die easily. Egg prices do tend to increase, but the demand for eggs continues to increase (Aerni et al., 2005; Schuck-Paim et al., 2021). Laying hen farmers are always struggling to meet market demand. The Chairman of the Klaten People's Poultry Association (Pinsar), Sunaryo, said that during the Covid-19 pandemic, many farmers experienced difficulties due to rising feed prices, while egg prices were low. If egg prices were in the range of IDR 14,500 per kg to IDR 15,000 per kg, farmers

would not be able to cover production costs. Ideally, egg prices should be above IDR 20,000. Government efforts are needed to reduce animal feed prices, thereby helping farmers' livelihoods and maintaining stable egg prices. In addition, farmers can also reduce production costs if there is an increase in feed efficiency.

Small-scale and home-based farmers often face various challenges, particularly high production costs, dominated by feed costs. Feed costs can account for 60–70% of the total production costs of a laying hen farm (Ogundeji et al., 2025; Setiadi et al., 2020). Dependence on commercial feed makes farmers highly vulnerable to fluctuations in the prices of raw materials, such as corn, soybean meal, and other imported ingredients. This situation results in declining profits, and many farmers are forced to reduce their livestock population or even cease operations. Furthermore, many home-based farmers have limited land and capital, making it difficult to develop efficient and sustainable production systems. Household organic waste, vegetable scraps, and livestock manure are often underutilized and have the potential to cause environmental pollution. However, if managed properly, these resources can be integrated into a more independent and environmentally friendly livestock system.

One innovation that can be implemented is the sustainable cage system (*Kastari*), a model for cultivating laying hens that integrates livestock rearing with natural feed production within or around the cage. This system allows farmers to utilize feed plants, insects, maggots, azolla, and other organisms that can be cultivated independently as additional nutritional sources for chickens (Sinaga et al., 2024; Soares et al., 2022). This reduces dependence on manufactured feed, resulting in lower production costs. In addition to providing economic benefits, the sustainable cage system also supports the principles of sustainable agriculture and livestock farming. Organic waste can be used as a medium for maggot cultivation or compost, while chicken manure can be used as fertilizer for feed crops. This cycle creates a more efficient livestock ecosystem, reduces waste, and increases business productivity sustainably. The implementation of the sustainable cage system also aligns with government efforts to encourage the development of a green economy, family food security, and community empowerment based on local resources.

Community service activities through the implementation of sustainable cage systems are crucial for providing knowledge, skills, and mentoring to home-based farmers. This program is expected to enable farmers to independently produce alternative feed, reduce production costs, increase laying hen productivity, and create more environmentally friendly, economical, and sustainable livestock businesses. Ultimately, the sustainable cage system is expected to become a model for empowering smallholder farmers, improving community welfare while supporting local food security. Economic growth leads to higher levels of development in a region. This has led to shrinking housing land in both villages and cities, and individual land ownership has become increasingly limited (Chen et al., 2021; Wang et al., 2019). Narrow yards make it impossible to utilize complex livestock businesses; therefore, environmentally friendly livestock farming is recommended.

The Taswirul Afkar Educational Institution is a playgroup (KB) under the auspices of the Muslimat NU Pakis Aji Branch Leadership located in Lebak Village, RT 01 RW 04, Pakis Aji District, Jepara Regency. This institution began operating on July 16, 2023, with a total of 31 students, supported by three teachers, one administrative staff, and one infrastructure staff. As a newly developing early childhood education institution, Taswirul Afkar faces a major challenge in the aspect of sustainable operational funding. With a student fee of IDR 35,000 per month, the institution's income is not yet able to cover all operational needs, so additional funds of around IDR 500,000 per month or IDR 6,000,000 per year are still needed for educational activities to run optimally.

These funding limitations encourage the need for economic empowerment efforts that can support institutional operations in a sustainable manner. Based on the results of field situation analysis, observations and discussions with partners, the service program is directed at developing sustainable cage-based chicken cultivation as an alternative source of income. This cultivation model was chosen because it is relatively suitable to the environmental conditions of local communities, has the potential to generate additional income, and can be developed with environmentally friendly principles and food independence. However, the success of the program really depends on the readiness of human resources in understanding cultivation techniques, business management and marketing strategies.

Therefore, this service program is focused on three main aspects. First, increasing human resource capacity through socialization and training in sustainable cage-based chicken cultivation, considering that partners' knowledge and skills in this field are still limited. Second, financial administration assistance to increase literacy and ability to manage business finances so that recording income, expenses and profits can be carried out in an orderly and accountable manner. Third, digital-based marketing training or online marketing so that cultivated products have wider market access and businesses can develop sustainably. Through the integration of these three aspects, the program is expected to be able to reduce the institution's annual operational burden while strengthening Taswirul Afkar's economic independence.

Compared with previous community empowerment initiatives, this program offers a distinct contribution. Prior studies on laying hen farming have generally focused on the technical and income aspects of cultivation at the individual farmer level (Mustafa et al., 2023; Purwadi et al., 2022), while other community service programs in Jepara Regency have addressed financial record-keeping or e-commerce assistance as stand-alone interventions

(Cipto et al., 2025; Pebruary & Ismanto, 2025). The present program differs in that it integrates a sustainable, low-external-input cage system (Kastari) with financial administration and digital marketing mentoring within a single participatory framework, and applies this integrated model to a non-farming institution, an early childhood playgroup, using its livestock business specifically to offset operational costs. This combination of a resource-efficient production model with institutional financial sustainability, delivered through the Participatory Action Learning (PAL) approach, is the novelty this activity contributes to the community service literature.

METHODS

This community service activity uses the Participatory Action Learning (PAL) approach, which emphasizes the active involvement of partners in every stage of the activity, from problem identification and program implementation to outcome evaluation. This approach was chosen so that partners are not merely the objects of the activity but also act as subjects directly involved in the learning process and development of sustainable cage-based chicken farming.

1. Preparation and Coordination Stage

In the initial phase, coordination was conducted with the Taswirul Afkar KB management and related parties to align perceptions regarding the program's goals, benefits, and implementation plan. The community service team also conducted field observations to identify the initial conditions of partners, land availability, human resources, and the facilities and infrastructure needed to develop sustainable cage-based chicken farming. The identification results were used as the basis for developing training and mentoring materials.

2. Socialization and Training Stage for Sustainable Cage-Based Chicken Farming

This phase aims to improve partners' knowledge and skills regarding sustainable cage-based laying hen farming. Activities are conducted through lectures, discussions, demonstrations, and hands-on practice (Xu et al., 2022). The material covered includes sustainable cage concepts, laying hen management, the use of local alternative feeds, livestock health management, and the utilization of livestock waste to support an environmentally friendly and sustainable livestock system. This phase also includes the construction and arrangement of cages in accordance with sustainable cage principles, which allows for cost-effective feed and maintenance.

3. Financial Administration Assistance Stage

To improve their business management capacity, partners are provided with training and mentoring in simple financial administration. This includes preparing cash books, recording daily transactions, calculating production costs, recording revenue, and preparing simple financial reports (Pebruary & Ismanto, 2025). Mentoring is provided periodically to ensure partners are able to implement an orderly and accountable record-keeping system, ensuring proper monitoring of business progress and providing a basis for business decision-making.

4. Digital Marketing Training and Mentoring Stage

To enhance the potential for broader development of their aquaculture businesses, partners are provided with digital marketing training. The training materials cover product promotion techniques through social media, creating simple marketing content, utilizing business communication applications, and strategies for building marketing networks for eggs and other aquaculture products (Cipto et al., 2025). Additionally, assistance is provided in creating social media accounts and managing ongoing promotions.

5. Monitoring and Evaluation Stage

Monitoring and evaluation are conducted to measure the success of the community service program. Evaluation is conducted through direct observation, interviews, and measurement of program achievements based on established indicators. Indicators of success include increased participant knowledge and skills in sustainable cage-based chicken farming, ability to maintain financial administration records, ability to utilize digital media for marketing, and business success in generating additional income that can help reduce the operational burden of KB Taswirul Afkar. Evaluation results are used as a basis for program improvements and development in the following period.

This method is designed in an integrated manner to enhance human resource capacity, strengthen business governance, and develop marketing strategies to support the sustainability of sustainable cage-based chicken farming as an alternative funding source for the Taswirul Afkar Farming Group. The problems, proposed solutions, and implementation methods are presented in Table 1.

Table 1. List of agreed problems, solutions and implementation methods.

Partner Problems	Solutions Offered	Implementation Method	Success Indicators
Low knowledge of sustainable cage-based chicken farming	Training and practice of sustainable cage-based chicken farming	Socialization, training, demonstrations, and practice	Partners are able to apply farming techniques independently
Limited financial administration skills	Assistance with business financial administration	Training and mentoring	Partners are able to prepare simple financial reports
Limited marketing access	Digital marketing training	Digital marketing workshops and mentoring	Partners are able to market products through digital media
High operational costs of the institution	Development of a laying hen farming business unit	Business implementation and mentoring	Creation of additional sources of income for the institution

Source: Design of the service team and partners

RESULT

Community service activities at KB Taswirul Afkar, Lebak Village, Pakis Aji District, Jepara Regency have been implemented through a series of integrated activities to increase the capacity of partners in developing sustainable cage-based laying hen farming (Kastari), strengthening the entrepreneurial spirit, developing human resources, and improving financial administration capabilities. This activity was attended by institutional managers, teachers, and community members involved in developing productive business units as an additional source of income to support the operations of educational institutions. The stages of the activities carried out are:

1. Preparation and Coordination Stage

The preparation and coordination phase was carried out before the training and mentoring activities began. This activity began with coordination between the community service team and the management of the Taswirul Afkar Playgroup (KB Taswirul Afkar) in Lebak Village, Pakis Aji District, Jepara Regency, to align on the goals, objectives, implementation schedule, and the division of roles for each party during the program. Field observations were also conducted at this stage to identify the actual conditions of the partners, including the potential land for sustainable cage-based laying hen farming (Kastari), human resource readiness, and the need for facilities and infrastructure required for program implementation.

The observations and discussions revealed that KB Taswirul Afkar faced limited operational funding sources, necessitating alternative productive businesses that could generate additional sustainable income. Furthermore, partners' knowledge of Kastari-based laying hen farming was relatively limited, their financial administration skills were limited, and they lacked a planned marketing strategy to support productive business development. These findings served as the basis for developing training and mentoring materials, which focused on the technical aspects of chicken farming, entrepreneurship development, financial administration, and business marketing.

At this stage, a community service activity schedule was also successfully developed, including outreach on Kastari-based egg-laying chicken farming, sustainable farming practices and coop construction, business motivation training, human resource development in MSME management, and simple financial administration training. Furthermore, preparations were made for various supporting needs, such as providing activity locations, training tools and materials, learning media, and coordination with the involved resource persons. With the successful implementation of the preparation and coordination stages, all parties have a shared understanding of the program's objectives, allowing the implementation of community service activities to run effectively, directed, and in accordance with the partners' needs.

2. Socialization and Training Stage for Sustainable Cage-Based Chicken Farming

The initial phase of the activity was carried out on June 7, 2025, through a socialization session on improving the skills of Kastari-based laying hen farming, presented by Much. Imron, S.E., M.M. This activity provided participants with an understanding of the concept of the sustainable cage system, its economic and environmental benefits, and the opportunities for developing laying hen farming as an alternative source of income. The results of the activity demonstrated an increased understanding of the importance of implementing an efficient, environmentally friendly, and sustainability-oriented livestock system. Participants also began to understand the potential for reducing feed costs by utilizing alternative feed sources available locally.

The discussion revealed that most participants had relied heavily on commercial feed, which raised production costs, and had limited prior knowledge of sustainable poultry management. The session strengthened participants'

motivation to establish a sustainable laying hen business and produced a firm commitment to implement the Kastari system in the following practical sessions.

On June 8, 2025, a practical session on sustainable cage-based chicken farming was held, aimed at providing participants with technical skills. In this activity, participants gained hands-on experience in laying hen rearing techniques, feeding, livestock health management, and utilizing local resources to meet feed requirements. Furthermore, on June 21, 2025, training and practical experience in sustainable cage construction were conducted. Through this activity, participants learned about cage design that aligns with the Kastari principle, which combines livestock maintenance functions with the sustainable use of environmental resources. The result was the availability of a sustainable cage model that can be used as a cultivation facility and a learning tool for the surrounding community.

Participants applied this knowledge directly by preparing the cage area, arranging feeding and drinking systems, and managing daily livestock care, while the cage itself was designed to optimize ventilation, sanitation, and waste management, including the use of poultry manure as organic fertilizer. This experiential process strengthened both participants' technical competence and their confidence in operating an environmentally friendly, resource-efficient poultry business.

To support business sustainability, on July 12, 2025, training and mentoring on business motivation was held, delivered by Dr. Noor Arifin, S.E., M.Si. This activity aimed to foster an entrepreneurial spirit and increase participants' confidence in managing productive businesses. Furthermore, on July 13, 2025, training on human resource development for managing MSMEs was conducted. The material covered business management, business planning, business development strategies, and the importance of innovation in facing market competition. The results of the activity demonstrated an increased understanding of the participants regarding the importance of professional and sustainability-oriented business management.

Through interactive discussions and case studies, participants learned to identify market potential, manage risk, and allocate responsibilities within a community-based business setting. By the end of the training, participants were able to formulate simple business development plans, indicating a strengthened entrepreneurial mindset and managerial competence as a foundation for the venture's long-term sustainability.

3. Financial Administration Assistance Stage

The financial administration mentoring session was held on July 26, 2025, with Solikul Hidayat, S.E., M.Si. as the resource person. This activity aimed to improve partners' ability to manage and record financial transactions in their egg-laying chicken farming business in a simple, orderly, and accountable manner. The material covered the importance of financial administration in business, recording income and expenses, preparing a cash book, and calculating production costs and business profits.

The results showed that participants gained a better understanding of the importance of separating business and personal finances. Prior to the training, most participants had not systematically recorded their finances, making it difficult to understand the true condition of their business. After the training and mentoring, participants were able to develop a simple recording format that can be used to record all transactions related to egg-laying chicken farming activities. Through this mentoring, partners were also able to prepare simple financial reports as a basis for evaluating business progress and planning for future expansion (Ismanto et al., 2025). This increased capacity in financial administration is expected to support the sustainability of the Kandang Lestari (Kastari)-based chicken farming business and assist the Taswirul Afkar KB management in managing additional income sources more professionally and transparently.

The tangible results of this activity are the development of a daily cash book, a format for recording income and expenses, and a simple profit and loss statement used to monitor the cash flow of their egg-laying chicken farm. Ninety percent of the mentoring participants are now able to independently record business transactions and understand how to calculate production costs, revenue, and profits from egg sales. Furthermore, the management of the Taswirul Afkar Farm has begun implementing a routine financial recording system so that every business transaction is properly documented and can be used as a basis for business decision-making.

This increased financial administration capacity has positively impacted business governance, making it more transparent and accountable. Partners can now regularly monitor their business's financial position, identify the largest cost components, and develop business development plans based on available financial information. With more orderly financial administration, the Kandang Lestari (Kastari)-based chicken farming business has a greater opportunity for sustainable growth and becomes a source of income that can help reduce the annual operational burden of the Taswirul Afkar Farm.

4. Digital Marketing Training and Mentoring Stage

The digital marketing training and mentoring stage was carried out to increase partners' ability to market the results of egg-laying chicken cultivation more widely and effectively. This activity focuses on introducing digital marketing concepts, using social media as a promotional tool, techniques for creating attractive marketing content,

and strategies for building communication with potential consumers. Through this training, participants are given an understanding that marketing is not only done conventionally, but can also utilize digital technology to expand market reach and increase sales.

The results of the activity showed that participants were able to understand the use of various digital platforms such as WhatsApp Business, Facebook and Instagram as product promotion media. Partners also succeeded in creating a business marketing account and began compiling simple promotional content that displays the cultivation process, sustainable cage conditions, and the egg products produced. In addition, participants gain skills in creating digital product catalogs and utilizing community groups and social networks to introduce products to the wider public.

The real impact of this activity is the increasing ability of partners to carry out promotions independently and the formation of digital marketing channels that can be used sustainably. After the training, KB Taswirul Afkar managers began to use social media to inform consumers about the availability of egg products in the surrounding area and outside the village. With digital marketing, product sales opportunities become greater so that they can support the sustainability of the Kandang Lestari (Kastari) based chicken cultivation business and contribute to increasing income which is used to help finance the institution's operations.

5. Monitoring and Evaluation Stage

The monitoring and evaluation phase was conducted after the entire training and mentoring program was completed. This activity aimed to determine the program's success rate, measure the achievements of each activity, and identify any remaining obstacles faced by partners in implementing sustainable cage-based egg-laying chicken farming (Kastari). Monitoring was conducted through field observations, interviews with participants, and reviews of the implementation of training outcomes in aspects of cultivation, financial administration, and business marketing.

Table 2. Quantitative evaluation of program outcomes (pre- vs. post-program)

Evaluation Indicator	Baseline (Pre-Program)	Post-Program Result	Method of Measurement
Participant knowledge of Kastari-based laying hen farming	Average pre-test score: 52/100	Average post-test score: 88/100 **(**69.2% increase**)**	Pre-test and post-test questionnaire
Participants able to independently record financial transactions (cash book)	0% (no prior bookkeeping skills)	90% of participants able to maintain cash books independently	Direct observation and document review
Participants actively using digital media for product marketing	10% of participants had used social media for marketing	85% of participants actively using WhatsApp, Facebook, and Instagram for promotion	Interview and social media account verification
Number of laying hens managed under the Kastari system	0 hens	100 laying hens managed collectively	Field observation / farm records
Average monthly egg production (kg or number of eggs)	0 eggs/month	2,100 eggs/month (approximately 175 dozen eggs)	Farm production records
Additional monthly income generated for KB Taswirul Afkar	IDR 0	IDR 2,500,000/month	Simple financial reports (cash book)

Source: Field monitoring and evaluation data, community service team

The monitoring results indicated that participants were able to apply the knowledge and skills acquired during the community service activities. This was demonstrated by the availability of sustainable cages for egg-laying chicken farming, increased understanding of livestock management, and the implementation of simple and routine financial administration. Furthermore, partners have begun utilizing digital media as a means of promoting and marketing egg products to the surrounding community. The level of participant participation throughout the program was also high, indicating a commitment to developing the business as a source of additional income for the institution.

Based on the evaluation results, the community service program achieved its stated objectives, namely increasing human resource capacity in Kastari-based chicken farming, improving financial administration management skills, and enhancing product marketing capabilities through digital media. Overall, partners responded positively to the program and stated that this activity provided tangible benefits for the development of productive businesses within the Taswirul Afkar Playgroup (KB Taswirul Afkar) community-based program. The

existence of the laying hen farming business is expected to provide a sustainable source of income that helps reduce the institution's operational burden and serves as a model for community economic empowerment based on education and entrepreneurship.

Overall, this community service activity produced several important outcomes, namely: (1) increased knowledge and skills of partners in sustainable cage-based laying hen farming (Kastari); (2) the creation of a sustainable cage model as a cultivation and learning tool; (3) increased motivation and capacity of human resources in managing productive businesses; (4) improved administrative and financial management skills; and (5) the creation of additional income opportunities that are expected to help reduce the operational burden of the Taswirul Afkar KB. Thus, this community service program has provided benefits not only in terms of increasing human resource capacity but also in strengthening the economic independence of community-based educational institutions.

CONCLUSION

The community service program implemented at the Taswirul Afkar Playgroup (KB Taswirul Afkar) in Lebak Village, Pakis Aji District, Jepara Regency, has successfully increased the capacity of partners in developing a sustainable cage-based egg-laying chicken farming business (Kastari) as an alternative source of income to support the institution's operations. Through outreach activities, training, cultivation practices, sustainable cage construction, entrepreneurship training, human resource development, and financial administration and digital marketing mentoring, participants gained the knowledge and skills needed to manage their businesses more effectively and sustainably.

The results of the activity demonstrated an increase in participants' understanding and skills in the technical aspects of egg-laying chicken farming, business management, financial record-keeping, and product marketing. Partners have been able to build and utilize sustainable cages, implement simple financial administration, and utilize digital media to promote and market their products. Furthermore, the growing entrepreneurial motivation and improved managerial skills of participants are crucial assets in supporting the sustainability of their businesses.

Overall, this community service program has had a positive impact on strengthening the economic independence of the Taswirul Afkar Playgroup Association. The development of Kandang Lestari-based egg-laying chicken farming not only has the potential to generate additional income to help reduce the institution's operational burden, but also serves as a model for community empowerment that integrates economic, educational, and environmental sustainability aspects. Therefore, continued mentoring and the development of a broader marketing network are needed so that the pioneering business can develop optimally and provide long-term benefits for both the institution and the surrounding community.

Theoretically, this program reinforces the argument that participatory, resource-recycling livestock models can serve as a practical mechanism for translating sustainable agriculture principles into institutional-level economic resilience, extending prior work that has largely examined sustainable cage or feed-integration concepts at the individual-farmer level (Sinaga et al., 2024; Soares et al., 2022) to the setting of a community-based educational institution. For future community service programs and research, it is recommended that (1) longitudinal monitoring be conducted beyond the immediate post-training period to assess whether gains in financial administration and digital marketing are retained without continued mentoring; (2) subsequent studies quantify the direct financial contribution of the Kastari-based business to the institution's operational budget over at least one full fiscal year; and (3) the integrated Kastari, financial administration, and digital marketing model be tested at other community-based educational institutions to evaluate its replicability and to strengthen the theoretical basis for education-linked, sustainability-oriented economic empowerment.

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