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EMPOWERING FARMERS THROUGH THE UTILIZATION OF OWL HOUSE INNOVATION (RUBUHA) IN CONTROLLING RICE FIELD RAT PESTS FOR FOOD SECURITY

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Abstract

Rat (Rattus spp.) pest infestations are a major constraint to rice productivity in Pidie Jaya Regency, Aceh, with potential losses reaching 60–70% and even crop failure. Conventional methods currently used by farmers, such as chemical rodenticides and electric traps, have proven ineffective in the long term and have negative ecological impacts. This Community Service (PKM) activity introduced the Owl House (RUBUHA) innovation as a sustainable biological control approach by involving farmer groups in Meurah Dua Sub District. The implementation method includes five stages: socialization, theoretical and practical training (30%–70%), application of RUBUHA in demonstration plots, intensive mentoring, and development of sustainability strategies. Evaluation of farmer knowledge was conducted through pre- and post-tests, while productivity impacts were measured based on harvest data before and after technology implementation. The implementation results showed an increase in rice productivity from 6.1 tons/ha to 7.2 tons/ha, with an estimated additional income of IDR 5–6 million/ha. Farmers' knowledge and skills increased by 70%, indicating the success of learning-by-doing-based technology transfer. In addition to economic benefits, the implementation of RUBUHA also reduces the use of chemical rodenticides, thus positively impacting the environment. The results of this PKM are not only relevant in supporting local food security and farmer welfare but also align with the achievement of the SDGs. Replication Innovation Rubuha to other regions is recommended as part of a community-based Integrated Pest Management strategy.

Keywords: ***empowerment; innovation; Rubuha; rat pests; rice farmers.***

INTRODUCTION

The main obstacle to increasing rice productivity is the infestation of rats (Rattus-rattus spp.). Rats are relatively difficult pests to control due to their adaptability, mobility, rapid reproduction, and high destructive power. This poses a threat to rice crops. Farmers have tried various methods, but none have yielded satisfactory results. While relying on rodenticides to control rats can initially reduce the rat population, they are less profitable in the long term due to their negative environmental impact. Biological control is the primary option for sustainable management without negative impacts, thus supporting food security in Aceh Province. Rice field rat infestations pose a serious threat to the sustainability of rice production in various regions, including Pidie Jaya Regency, Aceh Province. Rats have a high adaptability to environmental changes, rapid reproduction, and destructive feeding behavior throughout all phases of rice plant growth, from seedling stage to harvest (Simatupang, 2015; Setiabudi, J., et al, 2015).

In severe infestations, yield losses can reach over 60% and even lead to crop failure (Primadani, 2020). Farmers' control efforts to date have been dominated by mechanical and chemical approaches, such as the use of rodenticides and traps. While these methods can rapidly reduce rat populations, they often have negative impacts on the environment and non-target organisms (Nisa A.A, 2022). The low level of knowledge of farmers regarding biological control and the biological characteristics of rats and control strategies is one of the factors that often causes inaccurate control measures taken by farmers.The Owl House Innovation (RUBUHA) is one form of appropriate technology that supports the concept of biological pest control. Installing RUBUHA in rice fields aims to provide a safe nesting place for owls, thereby increasing their population and playing an active role in suppressing the rice field rat population. Several studies and community service activities have shown that the implementation of

RUBUHA has been proven to reduce the level of rat infestation in various agricultural areas in Indonesia (Budi et al., 2021; Pusparini & Suratha, 2018). However, various obstacles remain in the field, such as limited farmer knowledge in constructing RUBUHA according to standards, limited funding, and the lack of a sustainable owl monitoring system. According to Harjanto et al. (2016), the owl (Tyto alba) is a bird of prey, the presence of birds of prey in an ecosystem is very important because of its position as the top predator in the pyramid or food chain. Tyto alba is a potential predator to control rat pests because a Tyto alba can prey on 2-5 rats every day (Rajagukguk, 2014). RUBUHA innovation by utilizing owls in controlling rat pests is one potential solution for controlling rat pests.

The use of the RUBUHA innovation also faces various obstacles, such as limited technical knowledge on how to construct and install owl houses according to standards, as well as limited capital to build adequate facilities. Consequently, this technology has not yet achieved widespread and sustainable adoption. These conditions underpin the implementation of this Community Service Program (PKM), which aims to empower farmers through the transfer of knowledge and technology on the use of the RUBUHA innovation in controlling rice field rats. Through this community service activity, efforts are being made to empower partner farmers in controlling rice field rat pests ecologically and participatory. The approach used not only focuses on the technical aspects of RUBUHA construction and installation, but also includes capacity building training for farmers, strengthening farmer group institutions, and establishing a participatory monitoring system. This Community Service (PKM) activity is expected to provide partner farmers with solutions for sustainable pest control while supporting increased food security in Pidie Jaya Regency.

METHODE OF IMPLEMENTATION

The implementation of community service activities is adjusted to the seed sowing schedule, namely mid-June 2025. Implementation of training on making Owl Houses (RUBUHA) at the end of September 2025. Furthermore, Rubuha mentoring and observation will be carried out for 2 months. This training, conducted by combining theory and practice, was conducted by the Meurah Dua District BPP and conducted on partner farmers' land in Dayah Kruet Village. Participants were equipped with knowledge on standard operating procedures (SOP) for controlling rat pests using barn owls, using a technology package developed from research conducted by the community service team in various locations. The training consisted of 30% theory, followed by practical work on building, installing, and observing barn owl houses, with 70% participation.

The stages of implementing community service activities are:

The first stage begins with activities **program socialization** through discussions with partner farmer groups. This outreach also involved other stakeholders, such as the Agricultural Extension Center (BPP) and the surrounding community. The main objective of this activity was to explore aspirations and obtain initial information regarding needs, field conditions, and potential support for the program. Next, in the second stage, it is carried out **Rubuha innovation training** and selecting the area to be used for implementation. This activity includes selecting raw materials for owl houses, practicing building Rubuha, and installing them in partner farmers' rice fields. This way, farmers gain not only theoretical knowledge but also practical skills in building and utilizing Rubuha.

The third stage is **implementation of Rubuha innovation in the form of Demonstration Plot (DemPlot)** The Demonstration Plot location was strategically chosen for easy access and observation by all members of the partner farmer group. This approach allows farmers to directly observe Rubuha's effectiveness in controlling rat populations in rice fields. In the fourth stage, it is carried out **mentoring and monitoring through Demonstration Method (DemCa)**This activity is directly supervised by a community service team consisting of lecturers and students. The mentoring focuses on ensuring that the implementation of the Rubuha innovation follows the established technical recommendations, ensuring that its benefits are optimally felt by partner farmers. The fifth stage is an effort to encourage **sustainability of Rubuha innovation** This sustainability is based on the evaluation of activities and the tangible benefits farmers have gained after adopting Rubuha. It is hoped that this innovation can be maintained and expanded to become a sustainable solution for controlling rat pests in rice fields.

Figure 1. Training and installation of Rubuha in the rice fields of PKM partner farmers.

RESULTS AND DISCUSSION

The results of the Community Service Program (PKM) activities demonstrate tangible achievements in completing each aspect of the activities handled. In the production aspect, the implementation of the Owl House (RUBUHA) innovation successfully suppressed rat infestations, which had been a major obstacle to rice productivity. Field data showed an increase in harvest yields from approximately 6.1 tons/ha to 7.2 tons/ha after the technology was implemented. This increase proves that RUBUHA is a relevant ecological solution implemented on partner farmers' lands and is able to have a direct impact on increasing productivity.

In terms of knowledge and skills, intensive training and mentoring activities significantly improved the capacity of partner farmers. Through a combination of 30% theory and 70% practice, farmers not only understood the basic concepts of biological control but also mastered the technical skills of making and installing RUBUHA. Pre-test and post-test evaluations showed a 70% increase in farmers' knowledge, skills, and attitudes. This demonstrates the success of the PKM program in enhancing human resource capacity at the community level, enabling communities to become more independent in managing the introduced innovative technologies.

From an economic and social perspective, PKM activities have a direct impact on increasing farmers' incomes by approximately IDR 5–6 million per hectare. Furthermore, the implementation of RUBUHA encourages farmers to work more collectively through deliberation, mutual cooperation, and joint monitoring, which strengthens farmer group solidarity. This participatory approach ensures that communities are not only beneficiaries but also key actors in maintaining the sustainability of innovation. Thus, problem-solving through PKM is comprehensive: increasing production, strengthening farmer capacity, improving economic conditions, and strengthening social networks within the community.

The delivery of technology and innovation products in this PKM activity is carried out with a systematic approach, involving stages of socialization, training, technology application, and mentoring. The innovation carried out is RUBUHA (Owl House), a combination of hard technology in the form of a physical building where owls nest, and soft technology in the form of knowledge, skills, and training modules on biologically based rat pest control. Through the learning by doing method, farmers not only see examples, but are also directly involved in the creation and installation of RUBUHA, resulting in an effective transfer of knowledge from the service team to the community.

The implementation process for this innovation was also designed to meet the specific needs of the farming community in Pidie Jaya, which faces serious challenges due to rat infestations. Active community involvement was key to its success, with farmers participating from the outset through group discussions, theoretical and practical training, and joint monitoring. This way, the innovation was not imposed from the outside but rather grew as a solution understood, accepted, and implemented by the farmers themselves. This active participation made the PKM program more sustainable, as the community felt a sense of ownership over the technology being introduced.

In terms of relevance, RUBUHA aligns with efforts to improve regional food security, support the SDGs of "No Hunger" and "No Poverty," and strengthen national food self-sufficiency. Initial impacts of implementation indicate an increase in rice productivity from 6.1 tons/ha to 7.2 tons/ha. Furthermore, increased farmer capacity is evident through a 70% increase in knowledge and skills based on pre- and post-test evaluations. These results confirm that technology delivery not only produces physical products but also contributes to changes in farmer behavior and mindsets in managing pest problems ecologically and sustainably.

The benefits of this PKM activity are also reflected in increased productivity and farmer income, amounting to an additional Rp 5–6 million per hectare. In addition to the economic impact, RUBUHA's innovation also creates a positive environmental impact by reducing the use of hazardous chemical rodenticides. This demonstrates that the PKM program is not merely a technology transfer but also a socio-ecological transformation that strengthens collaboration between academics, students, and the community. Ultimately, this activity demonstrates that the delivery of innovations designed in a participatory and contextual manner can increase farmer competitiveness while supporting sustainable agricultural development.

The technological and innovative products resulting from this PKM activity are divided into two main forms, namely hard technology and soft technology. The hard technology product is the construction of an Owl House (RUBUHA) designed according to technical standards to be an effective means for owls (Tyto alba) as a natural predator of rat pests in rice fields. RUBUHA has a practical function as a nesting and breeding place so that its presence can maintain ecosystem balance and suppress rat populations naturally. With a concrete physical form, this hard technology is an innovation that is easily observed and the benefits are immediately felt by farmers.

Meanwhile, soft technology products are implemented in the form of knowledge transfer, training modules, standard operating procedures (SOPs) for biological rat pest control, and technical skills for constructing and installing RUBUHA. Through training, mentoring, and demonstrations (Dem-Ca), farmers gain a more comprehensive understanding of the biological nature of rats, ecological control strategies, and how to care for owls as part of sustainable control. These soft products ensure that farmers are not only dependent on the presence of RUBUHA structures, but also have the managerial and technical skills to utilize them.

The combination of hard and soft technologies offers unique advantages. RUBUHA, as a hard product, serves as a concrete physical facility, while knowledge and skills, as soft products, serve to strengthen the community's capacity to manage and optimize the innovation. These two aspects complement each other, as the success of RUBUHA's implementation is determined not only by the physical quality of the structure, but also by the extent to which farmers are able to understand, maintain, and integrate it into their daily cultivation practices. Thus, this PKM innovation is not partial, but rather holistic and sustainability-oriented.

More broadly, the hard and soft technology products from this PKM activity contribute to increased agricultural productivity and sustainability. RUBUHA helps reduce losses due to rat infestations, which can reach 60–70% and even cause crop failure, while farmers' skills in biological control strengthen food security while reducing dependence on dangerous chemical rodenticides. Therefore, the synergy of these technological products impacts not only the technical aspects of production but also the social, economic, and environmental aspects, making this PKM an applicable empowerment model that is relevant to farmers' needs.

The application of technology and innovation to the community through this Community Service Program (PKM) activity is highly relevant to the needs of farmers, particularly in addressing the primary problem of rat infestations, which significantly impact rice productivity. This relevance is evident in the alignment of the proposed solution, the use of RUBUHA (Owl House), with the real-world challenges faced by farmers. This technology not only provides an environmentally friendly, ecological alternative but also serves as a sustainable strategy to reduce farmers' dependence on expensive and dangerous chemical rodenticides. Thus, the implementation of this innovation addresses pressing needs while supporting the goal of developing regional food security. Community participation in implementing this innovation is very high because from the beginning of the program, farmers were involved in discussions, problem identification, and decision-making regarding the RUBUHA installation location. This process builds a sense of belonging to the introduced technology. Furthermore, participation is not only formal but also practical, with farmers playing a direct role in the creation, installation, and monitoring of RUBUHA. The learning-

by-doing model ensures that the community not only accepts the technology but also understands its working principles and the role of owls as natural predators of rats. Furthermore, community participation in this activity demonstrates a social transformation, as farmers become accustomed to working collectively and in an organized manner to control pests. While rat control was previously individual and ineffective, the PKM program now allows farmers to collaborate to maintain the sustainability of RUBUHA on their land. This active participation also creates opportunities for the formation of more cohesive farmer groups, with a stronger spirit of mutual cooperation to address agricultural challenges.

With its high relevance to needs and active community participation, the implementation of RUBUHA has had a tangible impact, both technically and socially. The community found this technology practical, economical, and environmentally friendly, leading to a high level of acceptance. Going forward, this success opens up opportunities for replication in other areas with similar problems, while also demonstrating that a participatory approach to community service is more effective in ensuring the sustainability of innovation. In this way, technology is seen not only as a short-term solution but also as an integral part of a sustainable agricultural production system managed by the community itself.

The economic impact felt from this PKM activity is in the form of increased productivity and income**.**The results of the implementation of the RUBUHA innovation show a measurable increase in rice productivity. Field data from the PKM team shows an increase in productivity from around 6.1 tons/ha to around 7.1–7.2 tons/ha at the implementation locations (Meurah Dua District and the Demonstration Plot location). This increase in productivity has a direct impact on farmer income. The PKM team estimates a potential increase in income of around IDR 5–6 million per hectare after implementing the technology package (higher yields plus reduced losses due to rat attacks). Thus, from a microeconomic perspective, RUBUHA plays a cost-effective intervention in increasing farming margins and reducing the risk of crop losses.

The environmental and plant health impacts are felt in the reduction and use of chemicals and production stability**.** One important benefit is reduced reliance on chemical rodenticides. Because RUBUHA utilizes a natural predator (Tyto alba) to ecologically suppress rat populations, this intervention reduces the need for toxic bait applications that pose environmental and health risks. Given that rats can cause significant yield losses (up to tens of percent and even leading to crop failure), reducing infestations through biological control improves annual production stability, a benefit worth far beyond simply increasing tonnage in a single season. This ecosystem effect also has the potential to improve soil quality and biological diversity at the rice field scale.

This PKM not only provides physical facilities (RUBUHA) but also a soft skills package (SOP for proper RUBUHA installation, practical training). Initial evaluations showed a significant increase in farmers' understanding and skills (pre-test and post-test). In this PKM activity, there was a 70% increase in knowledge/psychomotor indicators. The applied learning-by-doing method (30% theory, 70% practice) and intensive mentoring were able to strengthen the technical capacity of farmer group members in terms of making, installing, and monitoring owl houses. Socially, this activity encourages collective work, site deliberations, joint maintenance, and regular monitoring that can improve coordination between farmers and foster a sense of ownership of the implemented innovations.

Initial impacts are promising, but long-term sustainability requires additional measures. Extended monitoring of predator populations and rat dynamics is needed (the current program conducts intensive monitoring for 2–3 months in the initial phase), documentation of medium-term costs and benefits, and institutional strengthening (farmer groups acting as custodians of the Demonstration Plots). Future replication efforts will require adaptation of the RUBUHA design to micro-conditions and site specifications, training of local trainers (trainers of trainers), and a small-scale funding mechanism to enable farmers to afford standard owl houses. If implemented, this model has the potential to be scaled up from a localized effect to a community-based integrated pest management policy that supports food security in other regions.

CONCLUSION

The Community Service Program (PKM) activity of implementing the Owl House (RUBUHA) technology has proven to be a real solution in overcoming the main problem of farmers, namely the high number of rat pest attacks in rice fields. The results of the activity implementation show an increase in rice productivity from an average of 6.1 tons/ha to around 7.2 tons/ha, while reducing the level of crop damage caused by rats. In addition, this program has also succeeded in increasing the capacity of knowledge, skills, and attitudes of farmers by up to 70% through a learning-by-doing approach (30% theory and 70% practice). The implementation of RUBUHA has an economic impact in the form of an increase in farmer income of around IDR 5–6 million per hectare, while

creating a positive ecological impact by reducing the use of chemical rodenticides. Thus, this PKM activity has provided real benefits, both technically, economically, socially, and environmentally.

SUGGESTION

1. To maintain the sustainability of the activity results, it is necessary to establish and strengthen RUBUHA management groups at the partner farmer level so that the technology is maintained and can be expanded independently.
2. Local governments and agricultural extension workers are expected to support this program by providing facilitation, mentoring, and regulations that encourage wider adoption of biological control technologies. Furthermore, the program should be replicated in other areas experiencing similar rat infestation issues, while integrating RUBUHA with other sustainable agricultural innovations within an Integrated Pest Management (IPM) framework.
3. Disseminating the results of the activities through seminars, scientific publications, and popular media is also important to strengthen the impact and make the RUBUHA innovation a model for farmer empowerment based on environmentally friendly technology.

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