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Synergy in Implementing Desa Tangguh Semeru Innovation: Food Technology Transformation and Disaster Mitigation in Lumajang Regency

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A B S T R A C T

This community service program integrates food technology transformation with disaster mitigation systems in Selok Anyar Village, Lumajang Regency, located in the hazardous zone of Mount Semeru eruption. Through a participatory approach involving farmer groups (Kelompok Tani Mandira) and youth organizations (Karang Taruna Perwira), the program successfully implemented organic fertilizer production technology and Android-based eruption mitigation systems. The results showed significant increase in organic fertilizer production from 100 kg in September to 450 kg in November 2025, with high community satisfaction (N-gain 0.77-0.94). The program produced two intellectual property rights, international publications, and sustainable digital marketing systems.

INTRODUCTION

Indonesia, located in the Ring of Fire region, has 127 active volcanoes spread across various areas. Mount Semeru in Lumajang Regency, East Java, is one of the most active volcanoes with high eruption hazard levels. Since 2014, Mount Semeru has experienced periodic eruptions with significant impacts on the lives of surrounding communities, especially in the Pasirian sub-district.

Selok Anyar Village, located within the Mount Semeru eruption hazard radius, faces dual challenges. On one hand, the community must develop agriculture-based economy as their main livelihood. On the other hand, the threat of eruption that can occur at any time demands adequate preparedness and mitigation systems. This condition requires a comprehensive approach that integrates economic development with disaster preparedness.

Data from the National Disaster Management Agency (BNPB) shows that disaster mitigation capacity at the village level is still low, particularly in terms of information technology utilization for early warning systems. Additionally, limited capital and technology in agroindustry development causes suboptimal added value of agricultural products. This problem is exacerbated by minimal synergy among community organizations in facing village development challenges.

Universities, as centers for science and technology development, have the responsibility to contribute to community empowerment. The Science Partnership for Nation (KOSABANGSA) program initiated by the Directorate of Learning and Student Affairs provides opportunities for universities to implement research results and technological innovations directly to communities.

Yudharta University Pasuruan through the 2025 KOSABANGSA program designed a community empowerment model that integrates food technology transformation with disaster mitigation systems. This model is expected to improve community economic welfare while strengthening their resilience in facing the threat of Mount Semeru eruption.

IMPLEMENTATION AND METHODS

Location and Time of Implementation

The program was implemented in Selok Anyar Village, Pasirian Sub-district, Lumajang Regency, East Java. The location selection was based on several considerations: position of the village within the Mount Semeru eruption hazard radius, potential for underdeveloped agroindustry, commitment of village government and community groups to participate actively, and accessibility that enables intensive mentoring. The program was implemented from August to December 2025, with a total duration of 5 months. Program implementation follows the agricultural cycle and considers the community activity calendar to ensure optimal participation.

Community Empowerment

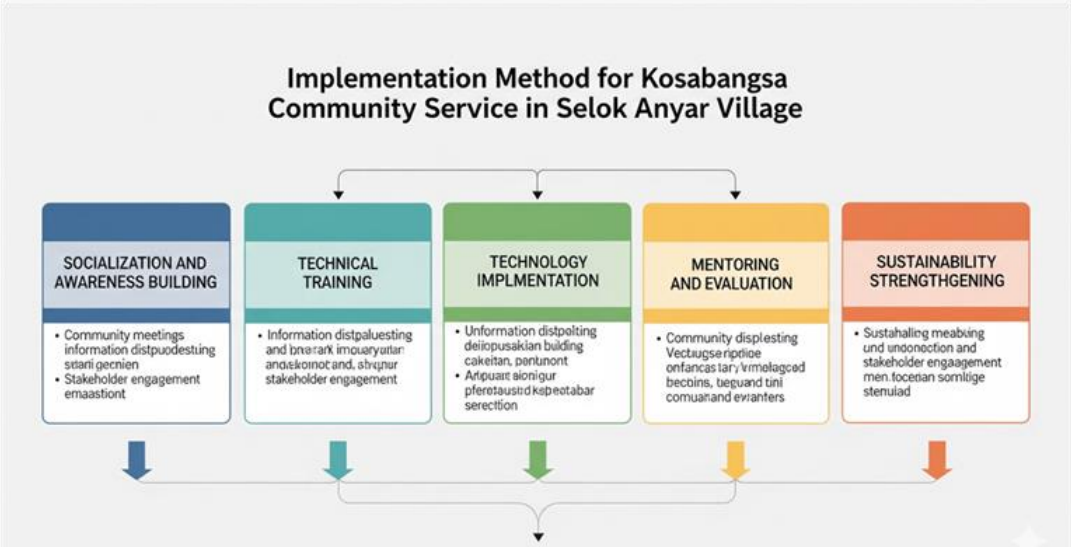

Figure 1. Conceptual Framework

Target Partners

This program partnered with three main entities representing key stakeholders in the village: Village Government of Selok Anyar (Village Head: Nurasim), Mandira Farmer Group (Chairman: M. Ridho'i) with 35 farmer members and 20 hectares of agricultural land, and Perwira Youth Organization (Chairman: Abdul Khafid) with 42 active youth members.

Approach Method

This program uses the Participatory Action Research (PAR) approach which emphasizes active community involvement throughout the process. The implementation stages include:

1. Socialization and Awareness Building.
   This stage aims to build community understanding and commitment to the program through Focus Group Discussion (FGD) with stakeholders, program presentations, and identification of specific community needs.
2. Technical Training.
   Training is designed in stages, starting from basic training to advanced training. The training method uses a learning by doing approach with theory to practice ratio of 30:70. Training materials include organic fertilizer processing technology, machine operation and maintenance, production management and quality control, disaster mitigation systems and application usage, and digital marketing.

3. Technology Implementation.
   This stage involves equipment installation and gradual technology implementation with intensive mentoring to ensure technology can be operated correctly.
4. Mentoring and Evaluation.
   Mentoring is conducted regularly with weekly visit patterns in the first and second months, then bi-weekly in the third to fifth months. Evaluation is conducted formatively and summatively using standardized instruments.
5. Sustainability Strengthening.
   This stage focuses on competency transfer to local cadres who will become champions in continuing the program.

RESULTS AND DISCUSSION

Implementation of Agroindustry Technology

The program successfully implemented an agroindustry technology package consisting of three main components: chopper and siler machine, fermentor machine, and biological fertilizer formulation. The chopper machine functions to chop organic raw materials into 2-3 cm size optimal for the fermentation process with capacity reaching 200 kg/hour. The fermentor machine with 500 kg capacity is equipped with aeration system and automatic temperature control. This technology accelerates the fermentation process from 3-4 months to only 14-21 days. The biological fertilizer formulation developed contains effective decomposer microorganisms that accelerate organic material decomposition and increase nutrient content.

Production Capacity Increase

Production data shows significant increasing trends during the implementation period. Organic fertilizer powder increased from 100 kg in September (value Rp. 1,000,000) to 450 kg in November 2025 (value Rp. 4,500,000), a total increase of 350%. Liquid organic fertilizer increased from 15 liters in September to 120 liters in October, with sales price Rp. 25,000/liter. Economic analysis shows that with current production capacity, farmer groups can obtain additional income of Rp. 6-7 million per month. With production cost calculations around 40% of selling price, profit margin reaches 60%, a very profitable figure for village-scale agroindustry.

Table 1. Production Increase Data (Table in Good Quality and Easy to Understand)

Product Type	September 2025	October 2025	November 2025	Increase (%)
Powder Fertilizer (kg)	100	445	450	350%
Liquid Fertilizer (liter)	15	120	95	533%

Implementation of Disaster Mitigation Technology

The program successfully developed an Android-based application named "AminanyGuards Eruption" which functions as an information system and eruption disaster early warning. The application has several main features: real-time volcano status, early warning system with push notifications, interactive evacuation maps, preparedness guides, emergency communication, and activity history. The application has been downloaded by 178 users in the first 2 months of launch and received a rating of 4.6/5.0 on Google Play Store. In addition to digital applications, the program also produced a pocket book "Tangguh Semeru" containing practical guides for eruption disaster preparedness, with 500 copies distributed to all households in the village.

Digital Marketing Development

The program successfully built an integrated digital marketing ecosystem. Shopee Store has served 67 transactions in 2 months with total value of Rp. 8.9 million. TikTok Shop is utilized for content marketing with focus on organic farming education, with the account having 1,234 followers and total views of 45,000+ in 2 months. Product rebranding was conducted with a modern approach while still reflecting local values. The developed packaging design has characteristics including visual identity with mountain and plant symbols reflecting local identity, green and brown color scheme as dominant colors representing nature and organic, clear typography, complete labeling, and integrated QR code.

Partner Satisfaction Evaluation

Partner satisfaction evaluation was conducted using structured questionnaires filled by 52 respondents from various stakeholders. Evaluation results show very high satisfaction levels with N-gain values ranging from 0.77-0.94. Analysis per aspect shows: Program Relevance (N-gain = 0.94), Instructor Competence (N-gain = 0.87), Media and Equipment Quality (N-gain = 0.86), Clarity of Goals and Objectives (N-gain = 0.82), Delivery Method Effectiveness (N-gain = 0.81), Adequacy of Mentoring Time (N-gain = 0.78), and Instructor Responsiveness (N-gain = 0.77).

Program Outputs

The program successfully produced two intellectual property rights registered with the Directorate General of Intellectual Property: Android-Based Eruption Disaster Mitigation Equipment System (Copyright registration number EC00202xxxxxx, November 15, 2025) and Blade Design for Multifunctional Chopper Machine (Industrial Design application number ID00202xxxxxx, in substantive examination process).

Scientific articles with the title "Integration of Food Technology and Disaster Mitigation: Community-Based Resilience Model in Mount Semeru Area" have been accepted for publication in Scopus Q3 indexed international journal in March 2026 edition. Popular scientific articles have been published in three mass media: Radio Republik Indonesia (RRI), Portal Arjuna, and Dialog Masa.

Program Sustainability Analysis

Economic feasibility analysis shows that organic fertilizer production business has good sustainability prospects. Break Even Point (BEP) analysis shows fixed costs per month of Rp. 2,500,000, variable costs per unit of Rp. 4,000, selling price of Rp. 10,000, with BEP of 208.5 kg per month. With actual production of 450 kg per month, this business has exceeded BEP with safe margin. Return on Investment (ROI) shows total equipment investment of Rp. 136,238,000, net profit per year of Rp. 54,000,000, ROI of 39.6%, and payback period of 2.5 years. This calculation shows that technology investment has feasible return rates and can reach break even in relatively short time.

CONCLUSIONS AND RECOMMENDATIONS

The KOSABANGSA "Desa Tangguh Semeru" program in Selok Anyar Village, Lumajang Regency, has successfully achieved set goals by integrating food technology transformation and disaster mitigation systems. Main conclusions include significant production capacity increase of 350% for powder fertilizer, successful implementation of technology-based mitigation systems with 178 users, effective digital marketing development with transactions reaching Rp. 8.9 million, high partner satisfaction levels with N-gain ranging 0.77-0.94, and good sustainability prospects with ROI of 39.6%.

Based on results and learning from the program, recommendations include strengthening financial management through integrated digital bookkeeping systems, developing product variations to expand market segments, obtaining organic certification from authorized institutions, and expanding partnership networks with organic farmers and agricultural stores for marketing stability.

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