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Community Empowerment Towards Proklim Based on the Implementation of a Green Economy in Petukangan Utara Village

Martini *
Accounting, Universitas Budi Luhur.
Jakarta, 12260, Indonesia
martini@budiluhur.ac.id
**Corresponding author*

Tri Endangsih
Architecture, Universitas Budi Luhur,
Jakarta, 12260, Indonesia
tri.endangsih@budiluhur.ac.id

Yousep Eka Irawan A.
Communication, Universitas Budi Luhur, Jakarta, 12260, Indonesia
yousep.ekairawan@budiluhur.ac.id

Chairunisa Nabila Putri
Accounting, Universitas Budi Luhur
Jakarta 12260, Indonesia
chnabilapitri@gmail.com

Azeeza Salsabila Nasution
Architecture, Universitas Budi Luhur,
Jakarta 12260, Indonesia
azeeza.nsaution@gmail.com

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Abstract**—**This community engagement initiative aims to accelerate the realization of a ProKlim (Program Kampung Iklim) model village in Petukangan Utara, South Jakarta, through participatory environmental empowerment. The intervention integrates four environmentally adaptive technologies: biopore infiltration holes, vertical garden systems, composting machines for organic waste management, and community-based aquaponics. The program enhances residents' environmental awareness and equips them with practical skills in waste reduction, water and soil conservation, and urban food production. The results show significant improvements in community participation, reduction of household organic waste, the establishment of productive green spaces, and the development of a sustainable environmental stewardship culture.

Keywords**—**Climate village, community empowerment, biopore, urban agriculture, composting, aquaponics, sustainability, ProKlim

I. Introduction

Rapid urban growth and fluctuating climate conditions have intensified environmental pressures within metropolitan regions of Indonesia, particularly Jakarta. Rising ambient temperatures, increasingly extreme rainfall events, shrinking green infrastructure, and escalating waste generation underscore the urgency for localized and innovative sustainability interventions. In response to these challenges, the Indonesian Ministry of Environment and Forestry initiated the *Program Kampung Iklim* (ProKlim) as a strategic framework to enhance community-level capacity in climate mitigation and adaptation. (Gw et al., 2020)

Petukangan Utara represents a highly populated urban settlement characterized by limited open land and minimal initial implementation of environmentally responsible practices, especially regarding household waste segregation, groundwater recharge mechanisms, and integrated urban farming systems. These constraints have historically contributed to insufficient waste management, reduced soil absorption capacity, and low community participation in climate-responsive initiatives.

To address these conditions, a structured community engagement and empowerment program was designed to foster environmental literacy, improve technical skills, and encourage long-term ecological behavior change. The intervention focused on the deployment of simple, scalable, and low-maintenance eco-technologies that can be independently operated and replicated by residents. Key initiatives included the installation of biopore infiltration holes, development of vertical garden systems, utilization of compost shredding machinery for organic waste processing, and establishment of aquaponics units for sustainable household-based food production (Lee & Romero, 2023).

These activities are directly aligned with ProKlim's operational indicators, emphasizing greenhouse-gas reduction, water conservation and infiltration, enhancement of urban biodiversity, and strengthening of food security at the neighborhood level. Moreover, the program reinforced collaborative participation, encouraged knowledge transfer between stakeholders, and promoted a sustainable community culture aimed at building climate-resilient urban settlements.

II. HELPFUL HINTS

A During program execution, several partnership-related challenges emerged that influenced the pace and effectiveness of community engagement. Although local community leaders displayed strong commitment, the readiness and environmental literacy levels of residents varied considerably. Some participants were unfamiliar with climate-adaptation concepts and urban eco-technology such as bio-pores, aquaponics, and organic waste processing, resulting in the need for repeated technical explanations and practical demonstrations.

In addition, household and employment schedules created participation gaps, particularly among working residents who were unable to regularly join daytime sessions. Limited open space within the dense urban environment also posed logistical constraints in allocating installation sites for vertical gardens and community composting facilities, requiring careful planning and negotiation with neighborhood leadership (Radic et al., 2019).

Coordination across various stakeholders including RT/RW authorities, community volunteers, household representatives, and academic facilitators required ongoing communication to maintain activity alignment and shared responsibility. Sustaining motivation beyond the initial activity period was another critical issue, as some residents demonstrated enthusiasm early on but required continuous encouragement to remain actively involved in maintenance routines. These challenges underscored the need for adaptable engagement approaches and consistent presence to cultivate long-term behavioral change and community ownership.

To ensure the successful implementation and long-term sustainability of the program, systematic mitigation strategies were developed in response to the partnership challenges encountered. The varying levels of environmental literacy, limited availability of residents due to work routines, and spatial constraints in a densely populated urban setting required an adaptive and community-centered approach. Additionally, maintaining consistent engagement and effective coordination among multiple stakeholders emerged as a crucial aspect in sustaining momentum throughout the project life cycle (Priyanto et al., 2021).

Mitigation efforts focused on strengthening communication channels, increasing training accessibility, and fostering community ownership through participatory decision-making and skill-transfer strategies. Capacity-building initiatives were adjusted to accommodate different learning paces, while scheduling flexibility and community task delegation were introduced to improve attendance and task continuity. Furthermore, operational sustainability was supported through technology familiarization, establishment of caretaker groups, and provision of simplified maintenance guidelines. These targeted strategies served to transform potential barriers into opportunities for enhanced collaboration, increased environmental commitment, and broader adoption of climate-adaptive practices among residents (Hudaifah, 2025). Table 1 shows to address these challenges and reinforce sustainable community participation, several strategic mitigation measures were implemented

Table 1. Mitigation Strategy

Challenge	Mitigation Strategy
Varying levels of environmental knowledge	Conduct step-by-step training, use visual demonstrations, create simple manuals and WhatsApp video tutorials
Limited resident availability	Schedule flexible sessions (weekends/evenings), designate community coordinators to relay information
Space limitations in dense urban layout	Apply modular vertical garden designs, utilize house walls and narrow alleys, encourage household-scale installation
Coordination among multiple stakeholders	Establish routine progress meetings, assign communication liaisons, use community WhatsApp group for real-time coordination
Declining participation after initial phase	Implement follow-up visits, motivational gatherings, provide seedlings and compost incentives, highlight model households as ambassadors
Sustainability and maintenance concerns	Build local caretaker teams, transfer technology knowledge, provide simple SOPs and monitoring checklists

III. THE SOLUTION OFFERED

The current climate change is causing significant changes in several regions of Indonesia. This climate change has significant negative impacts on the environment, economy, and social life. Some of these negative impacts include rising global temperatures, extreme changes in weather patterns, and ecosystem damage that impacts the survival of various species, including humans. The public needs to be aware of the importance of adapting to climate change, as it can have significant impacts, especially for those who depend on natural conditions for their livelihoods (Arifin et al., 2015).

The public must adapt and mitigate climate change to address its negative impacts. One concrete form of adaptation and mitigation in Indonesia is through ProKlim. A green city is an environmentally friendly city that synergizes the natural and built environment based on the principles of ecologically, socially, and economically sustainable development by paying attention to environmental health, utilizing water and energy resources, reducing waste production, and implementing an integrated transportation system with low emissions. To address the impacts of climate change, green city development has begun to be promoted in several countries around the world, with the goal of enabling each city to contribute to reducing carbon emissions to mitigate the impacts of global warming (Huang, 2024). In Indonesia, this effort is being initiated with various community-based programs, including the Climate Village Program.

A. Program Strategy

This initiative adopted a participatory action research (PAR) framework, prioritizing collaborative engagement between facilitators and community members. The approach emphasized structured knowledge transfer, experiential learning, active citizen participation, and long-term sustainability planning. Program strategies included awareness building, skill empowerment, technology demonstration, and ongoing community mentoring to support behavioral transformation and local ownership of environmental practices.

B. Implementation Phases

Environmental Education and Awareness Sessions The program commenced with structured workshops aimed at strengthening foundational understanding of climate change, its localized impacts, and the importance of mitigation and adaptation efforts. Training topics covered solid waste reduction, household waste segregation, urban agriculture concepts, and sustainable water management. These sessions equipped residents with essential knowledge prior to hands-on field activities (Prayogo et al., 2024), and (Purnomo & Saptaningtyas, 2024).

Biopore Installation Campaign Community members collaborated in the installation of biopore infiltration holes to enhance stormwater absorption capacity, stimulate soil biological processes, and facilitate decomposition of organic waste at the household level. This step served dual functions: reducing surface runoff during heavy rainfall and supporting natural composting cycles (Juniar et al., 2020).

Vertical Garden Development To address limited urban land availability, vertical garden structures were constructed in designated settlement zones. This method enabled the cultivation of ornamental and edible plants within confined spaces, effectively increasing vegetation density, improving air quality, and enhancing neighborhood aesthetics (Nurdiansyah et al., 2024).

Community-Scale Composting Unit Deployment A mechanical compost shredder was introduced as a centralized system for processing food waste generated by residents. The processed organic material was transformed into compost to support home gardens and communal green spaces, promoting circular waste utilization and reducing landfill dependency (Ayilara et al., 2020), and (Sayara et al., 2020).

Aquaponics Demonstration Installation Two aquaponics systems were established to illustrate integrated food production combining fish cultivation and hydroponic plant growth. This technology served as a replicable model for space-efficient urban agriculture, highlighting closed-loop nutrient recycling and water conservation benefits (Zamnuri et al., 2024) dan (K.C. et al., 2022).

Monitoring, Mentorship, and Sustainability Reinforcement Following installation activities, continuous technical guidance and monitoring were provided to ensure proper system operation and encourage long-term adoption. Community representatives were engaged as local champions to maintain facilities, promote peer learning, and stimulate expansion of environmentally resilient practices (Wang et al., 2019).

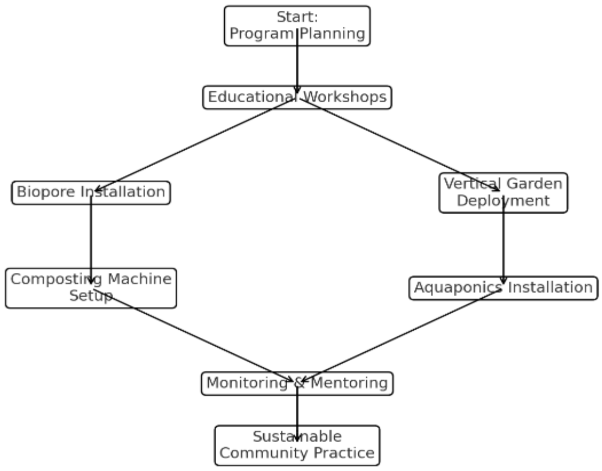

Figure 1. Environmental Program Implementation

This figure 1 shows the process flow from program planning, education, environmental technology implementation, to mentoring and sustainability.
Stoneman, R. (2017). Alexander the Great: A life in legend. Yale University Press.

IV. Implementation Results

A. Biopore System Effectiveness

The installation of biopore infiltration points demonstrated tangible environmental benefits within the settlement area. The biopores significantly improved soil infiltration capacity, thereby mitigating surface runoff during intense rainfall events. Additionally, the system facilitated in-situ decomposition of household organic waste, enriching soil fertility while reducing the volume of waste requiring municipal collection. Beyond physical outcomes, community engagement in biopore installation fostered deeper understanding of natural waste cycling processes and enhanced appreciation for soil ecosystem services.

As part of efforts to support climate change adaptation and environmental conservation programs within the Climate Village Program (ProKlim), biopore hole installation activities were carried out in densely populated areas, specifically on Jl. Haji Gaim, RT 10 and RT 11, Petukangan Utara Village, Pesanggrahan District, South Jakarta. This activity aims to increase groundwater absorption, reduce the potential for waterlogging during the rainy season, and manage household organic waste simply.

The objectives of this activity are to increase water infiltration capacity in densely populated areas, reduce the potential for local flooding due to limited water absorption, encourage community participation in organic waste management through biopore technology, and support climate change mitigation and adaptation efforts as part of the 2026 ProKlim targets.

The stages of this activity include outreach and education, mapping of construction sites, implementation of biopore hole installation, and monitoring and mentoring. This activity resulted in a total of 10 biopore holes being created, spread across neighborhood associations (RT) 10 and 11. This Figure 2 shows Resident participation was very high, particularly from housewives and neighborhood cadres. Residents expressed enthusiasm for continuing to create biopore holes independently.

Figure 2. Biopore Hole Construction

B. Vertical Garden Development Outcomes

Vertical garden structures effectively transformed previously unused vertical surfaces and corner spaces into productive micro-green areas. These installations contributed to micro-climate regulation by increasing shading, improving localized air quality, and moderating ambient temperature in densely built neighborhoods. This Figure 3 shows residents gained hands-on horticultural experience, encouraging adoption of home-based edible and ornamental plant cultivation practices despite limited urban land availability (Hamidon et al., 2020).

Figure 3 Vertical Garden

C. Operation of Community Composting Unit

The introduction of a mechanical composting unit enabled efficient conversion of organic kitchen waste into nutrient-rich fertilizer. The resulting compost was distributed to household gardens and communal planting zones, demonstrating a functioning circular resource flow at the neighborhood scale. This process not only reduced biodegradable waste but also strengthened community self-reliance in organic fertilizer production and supported continuous plant-based greening initiatives.

Organic waste remains a major challenge in waste management in densely populated residential areas. On Jl. Haji Gaim, RT 10 and RT 11, Petukangan Utara Village, the majority of household waste is dominated by organic waste, such as food and vegetable scraps. If not managed properly, this waste can produce odors, pollute the environment, and increase greenhouse gas (GHG) emissions, such as methane, from the decomposition process.

As part of the education and concrete action efforts within the Climate Village Program (ProKlim), the community service team introduced an organic waste shredder to the community. This appropriate technology aims to accelerate the composting process and encourage residents to manage their waste independently and productively.

The goal of this activity is to provide a community-based household organic waste management facility, accelerate the composting process by shredding organic materials into smaller pieces, reduce the volume of waste sent to landfills (TPS), and encourage residents to shift from a waste-recycling pattern to waste processing at the source. The series of activities consisted of socialization and education, demonstration of machine usage, composting training, collective management system coordinated by the KSM Nyiur waste bank coordinator.

Figure 4 Composting Unit

The results of the activity in figure 4 shows were in the form of 1 unit of organic waste shredding machine successfully operated collectively by residents of RT 10 and RT 11, an average of 20-30 kg of organic waste per week was successfully shredded and processed into compost, residents began to use compost to fertilize plants in the yard; vertical garden; and urban garden (Waqas et al., 2023). This activity supports the ProKlim mitigation indicators, especially in waste management and utilization of organic waste.

D. Performance of Aquaponics System

Aquaponics units successfully produced leafy vegetables alongside freshwater fish within a compact footprint, showcasing a practical model of integrated food production suitable for urban settings. This closed-loop system exemplified sustainable water and nutrient use while increasing household access to fresh produce and protein sources. The demonstration effect encouraged residents to explore small-scale urban farming technology as a means to enhance food sustainability and household nutrition.

To support household-scale food security efforts and climate change mitigation efforts within the Climate Village Program (ProKlim), an aquaponics system was built on Jl. Haji Gaim, RT 10 and RT 11, Petukangan Utara Village, Pesanggrahan District, South Jakarta. Aquaponics is an integrated agricultural technology that combines fish farming (aquaculture) and soil-less plant cultivation (hydroponics) in a single water circulation system. This technology was chosen because it is land-efficient, water-efficient, environmentally friendly, and capable of producing two types of products simultaneously: vegetables and fish for consumption.

The objectives of this activity are to increase community food security independently and sustainably, introduce environmentally friendly and efficient urban agricultural technology, provide alternative uses for limited land in densely populated areas, and encourage greenhouse gas emission mitigation practices through low-carbon agricultural systems.

The stages of this activity include technology socialization and introduction, assembly and construction of the aquaponic installation, and initial mentoring and maintenance. The results of this activity were the construction of two household-scale aquaponic systems in neighborhood units (RT) 10 and 11, each with a capacity of 1,000 liters. This increased knowledge and skills in integrated agricultural technology were also enhanced.

The community began to understand that farming can be done even with limited land. This figure 5 shows the aquaponic system not only improves family food security but also beautifies the environment and reduces dependence on imported food products. This activity supports the ProKlim mitigation action indicators and has the potential to become a model for environmental learning for local residents (Yu et al., 2023).

Figure 5. Aquaponic Technology

E. Community Engagement and Behavioral Transformation

The program produced measurable progress in social and behavioral dimensions of environmental stewardship. Key achievements included heightened resident participation in eco-volunteering, strengthened waste-segregation practices, and improved collective maintenance of shared environmental facilities. Household-level adoption of sustainable routines such as composting and small-scale planting also increased. Importantly, local community leaders emerged to champion environmental initiatives, fostering continuity and encouraging broader replication (Eliyawati et al., 2023).

Figure 6. Behavior Transformation

This Figure 6 shows enhanced neighborhood aesthetics and shared environmental pride contributed to increased social visibility, positioning the area favorably for future ProKlim recognition and certification. This training was attended by 33 residents of RT 10 and RT 11, Petukangan Utara sub-district, Jakarta

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