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Fostering Sustainable Rural Hygiene: A Participatory Approach to Waste Bin Restructuring and Environmental Awareness in Sukabumi, Indonesia

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Abstract: Inadequate waste management facilities and low public awareness in rural residential areas often lead to environmental degradation and potential health risks. This community service initiative aimed to improve environmental hygiene and public health in Baros 2 Village, Sukabumi Regency, Indonesia, through a participatory waste facility restructuring program. Utilizing a collaborative and participatory action approach, the intervention combined physical infrastructure improvements with non-physical community empowerment. The methodology encompassed preliminary observations, problem identification, multi-stakeholder coordination, community socialization, collaborative waste bin rearrangement, and evaluation. The results demonstrated a significant transformation in physical cleanliness, characterized by the elimination of scattered waste and optimized waste collection infrastructure. Beyond physical improvements, the initiative fostered increased environmental awareness and strengthened community cohesion through collective action (*gotong royong*). Furthermore, the program heightened public understanding regarding waste segregation and the economic potential of recyclable materials. In conclusion, combining physical facility restructuring with community capacity building serves as an effective strategy for establishing sustainable, community-based rural waste management systems.

Keywords: Community Engagement, Environmental Hygiene, Participatory Approach, Rural Health, Waste Bin Restructuring, Waste Management.

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1. INTRODUCTION

Rapid population growth and the acceleration of domestic economic activities in developing countries have escalated the volume and complexity of solid waste generated in residential settlements. In rural areas, waste management systems often lag behind urban infrastructure due to financial constraints, geographic dispersion, inadequate physical infrastructure, and limited institutional support. Consequently, solid waste in rural communities is frequently unmanaged, leading to illegal dumping, open burning, and the accumulation of unsegregated waste in public spaces. These improper waste disposal practices not only cause visual pollution and environmental degradation but also present serious public health risks. Unmanaged household waste acts as a breeding ground for disease vectors, contaminates soil and local water sources, and releases toxic emissions that adversely affect human well-being.

Addressing rural solid waste challenges requires a dual approach that integrates physical infrastructure improvements with social interventions. On the physical side, the availability, spatial arrangement, and structural integrity of temporary waste collection facilities—such as waste bins and neighborhood storage points—play a vital role in facilitating proper disposal behaviors. Bins that are poorly maintained, aesthetically unappealing, or misplaced often disincentivize residents from utilizing them correctly, causing

waste to overflow into surrounding areas. On the social side, non-physical interventions, including community education and capacity building, are essential for fostering long-term behavioral change. Physical facilities alone are insufficient if community members lack environmental awareness, knowledge of waste segregation, and a sense of collective responsibility.

In the context of Indonesian community development, rural waste management relies heavily on participatory approaches and local socio-cultural dynamics. The national framework for waste management, as mandated by Law No. 18 of 2008, emphasizes systematic, comprehensive, and sustainable waste reduction and handling involving community participation. Moreover, Indonesian rural culture possesses a strong tradition of mutual assistance and social cohesion, locally known as *gotong royong*. Leveraging this collective social capital through participatory action—where residents actively engage in problem identification, planning, physical execution, and maintenance—has been recognized as a key determinant for the success and sustainability of community-based environmental programs.

Despite the established theoretical importance of community participation, a significant gap remains in practical implementation within remote rural settlements. Many community engagement and extension programs focus predominantly on either short-term physical clean-up drives without educational reinforcement or theoretical lectures without tangible infrastructure improvements. This disconnect frequently results in short-lived outcomes, where community interest declines and rehabilitated facilities rapidly revert to neglected states. There is a critical need for integrated operational models that synthesize immediate infrastructure restructuring with participatory education and multi-stakeholder collaboration.

This empirical gap is evident in Kedusunan Baros 2, situated in Neglasari Village, Nyalindung District, Sukabumi Regency, West Java. Covering administrative areas RT 01, RT 02, and RT 03 within RW 05, the hamlet faces typical rural waste management challenges. Preliminary observations revealed that existing temporary waste collection facilities were unorganized, structurally inadequate, and poorly maintained. Household garbage was frequently scattered around bin perimeter zones, creating odor nuisances, unhygienic conditions, and potential health hazards for surrounding households. Furthermore, public awareness regarding waste reduction, organic composting, and inorganic recycling remained low, with residents viewing waste disposal merely as a quick removal process rather than an opportunity for resource recovery.

To resolve these issues, a community service initiative (*Pengabdian kepada Masyarakat* / PKM) was conducted through a collaborative framework involving university researchers, local administrative figures (Head of Kedusunan, RW/RT chairs), community members, and the Environmental Office (*Dinas Lingkungan Hidup* / DLH) of Sukabumi Regency. The program was designed as an integrated intervention combining the physical restructuring of waste collection bins with non-physical capacity-building sessions.

The primary objective of this study is to evaluate the impact of a participatory waste facility restructuring program on improving physical environmental hygiene and community environmental awareness in Baros 2 Village. Specifically, this initiative addresses three main questions:

1. How does collaborative infrastructure restructuring improve the physical state and functionality of neighborhood waste collection facilities?
2. To what extent does participatory engagement enhance public awareness, knowledge of waste segregation, and collective action (*gotong royong*) among rural residents?
3. What critical factors ensure the long-term operational sustainability of community-managed waste systems in rural contexts?

By documenting and analyzing the implementation process, physical transformations, and community responses in Sukabumi, this paper provides an empirical model for sustainable, low-cost rural sanitation interventions that can be replicated in similar developing rural contexts.

2. METHODS

2.1. Study Design and Methodological Approach

This community engagement project adopted a Participatory Action Research (PAR) and collaborative intervention design. The methodology was structured to integrate physical infrastructure modification with non-physical capacity building, aimed at fostering sustainable environmental behavior among rural residents. A participatory framework was selected because community-led interventions yield higher sustainability rates and foster a stronger sense of local ownership compared to top-down developmental models. As emphasized by Mardikanto and Soebiato (2017), community empowerment is a transformative process wherein local actors actively identify environmental problems, formulate strategic decisions, and execute collective actions to improve their living standards.

The regulatory basis for this intervention adheres to Law No. 18 of 2008 on Waste Management in Indonesia, which dictates that solid waste management must be implemented systematically, comprehensively, and sustainably, encompassing both waste reduction and waste handling mechanisms.

2.2. Study Site and Target Participants

The initiative was conducted in Kedusunan Baros 2, located within Neglasari Village, Nyalindung District, Sukabumi Regency, West Java Province, Indonesia. The target area geographically spans three neighborhood units: RT 01, RT 02, and RT 03 under Community Unit 05 (RW 05).

The primary target beneficiaries comprised local residents, community figures, and neighborhood administrative leaders. Target participants included:

1. Household representatives (predominantly homemakers and local youths) residing within RT 01, RT 02, and RT 03.
2. Local administrative figures, including the Head of Kedusunan Baros 2, Chair of RW 05, and Chairs of RT 01, RT 02, and RT 03.
3. Regional governmental officers from the Environmental Office (*Dinas Lingkungan Hidup* / DLH) of Sukabumi Regency.
4. The academic implementation team from STISIP Syamsul Ulum.

2.3. Equipment and Materials

To support the physical cleanup, structural restructuring, and educational components, various tools and materials were deployed during the field operations:

- **Cleaning and Excavation Tools:** Brooms, hoes (*cangkul*), dustpans (*pengki*), and heavy-duty trash sacks.
- **Personal Protective Equipment (PPE):** Medical/protective face masks and heavy-duty latex work gloves to ensure occupational health standards during waste handling.
- **Restructuring and Refurbishment Materials:** Concrete paints, painting rollers, brushes, and structural repair tools used for restoring the aesthetics and physical integrity of the concrete waste collection facilities.
- **Educational Materials:** Information leaflets and visual guides covering waste separation (organic versus inorganic) and economic recycling methods.

2.4. Operational Stages and Implementation Procedure

The project was executed through a structured, multi-tier operational framework comprising seven sequential stages, as detailed below:

2.4.1. Stage 1: Preparation and Stakeholder Coordination

The initial phase focused on building social capital and administrative consensus. Formal coordination meetings were convened with the Head of Kedusunan Baros 2, RW/RT chairs, and local community elders. These discussions aimed to establish baseline environmental expectations, determine precise intervention locations, construct field execution

schedules, and secure community consent. Additionally, institutional communication was established with the Environmental Office (*Dinas Lingkungan Hidup* / DLH) of Sukabumi Regency to coordinate subsequent waste transport logistics. According to Soekanto (2013), inter-institutional and social cooperation is pivotal for developmental success, as it establishes reciprocal relationships between external facilitators and local beneficiaries.

2.4.2. Stage 2: Environmental Observation and Problem Identification

A thorough field survey was conducted across RT 01, RT 02, and RT 03 to observe existing waste management practices and evaluate facility conditions. Direct field observation revealed four major operational bottlenecks:

1. Suboptimal spatial organization and structural degradation of public concrete waste collection bins.
2. Accumulation of uncollected waste scattered over perimeter soil zones surrounding the bins.
3. Absence of supportive sanitation tools and lack of dedicated waste segregation units.
4. Deficits in public health literacy regarding waste-borne disease risks.

2.4.3. Stage 3: Community Socialization and Capacity Building

Following the diagnostic phase, educational workshops and informal dialogue sessions were delivered to residents. Grounded in Notoatmodjo's (2012) health behavior framework—which posits that behavioral transformation stems from cognitive awareness—the socialization curriculum addressed five core modules:

1. Environmental health hazards associated with unmanaged domestic waste.
2. The operational importance of timely and localized waste disposal.
3. Principles of household waste segregation into organic and inorganic streams.
4. Economic valorization of inorganic recyclables (e.g., selling plastic bottles to collectors) and organic composting techniques.
5. Civic responsibility regarding the maintenance of shared public sanitation facilities.

2.4.4. Stage 4: Physical Execution of Waste Bin Restructuring

The physical intervention was conducted via mutual community labor (*gotong royong*) involving university facilitators and residents. Grounded in Slamet's (2015) assertion that clean physical surroundings directly mitigate disease vector proliferation, physical activities included:

- Clearing and gathering scattered solid waste around the facility perimeters.
- Bagging accumulated waste into heavy-duty sacks for formal municipal disposal.
- Re-aligning, clearing debris, and structurally refurbishing the concrete waste bin facilities.
- Repainting the exterior walls of the waste structures to enhance visual appeal, cleanliness, and neighborhood acceptability.

2.4.5. Stage 5: Waste Handling and Transport Management

Post-cleanup, the gathered waste was organized for systematic removal. Coordinative protocols were executed to align local collection efforts with municipal transport routes managed by the DLH. Concurrently, practical instructions were given on resource recovery. Residents were instructed on turning domestic organic waste into agricultural compost and stockpiling clean inorganic recyclables for commercial resale, reinforcing Chandra's (2014) framework on the dual environmental and economic benefits of sound waste management.

2.4.6. Stage 6: Program Evaluation and Monitoring

Program outcomes were assessed using a qualitative evaluation design, as recommended by Sugiyono (2019). Evaluation metrics focused on:

- Visual and spatial assessments of post-intervention physical cleanliness.

- Focus group discussions (FGDs) with residents to measure perceived benefits and satisfaction levels.
- Identification of field constraints (e.g., tool shortages, agricultural work schedule overlaps).
- Formulation of actionable recommendations for operational sustainability.

2.4.7. Stage 7: Community Participation Framework

To ensure long-term viability, community participation was operationalized across all project phases—from planning and physical labor to ongoing maintenance. In accordance with Adisasmita (2013), bottom-up participatory models maximize developmental efficacy by converting passive recipients into active stewards of local infrastructure. Table 1 summarizes the participatory structure applied during the intervention.

Table 1. Community Participation Framework Across Program Phases

Program Phase	Community Involvement Role	Expected Outcome
1. Preparation	Baseline data provision, scheduling, and consent	Mutual agreement and shared project goals
2. Observation	Identifying local waste dumpsites and problem zones	Accurate problem mapping
3. Socialization	Active participation in health literacy dialogues	Increased cognitive awareness on waste segregation
4. Execution	Joint physical labor (*gotong royong*) for cleaning/repainting	Restructured, clean, and functional waste bins
5. Maintenance	Routine cleaning and adherence to proper disposal	Sustainable, community-managed sanitation system

3. RESULTS

The implementation of the community service program titled *"Pembinaan Penataan Ulang Bak Sampah"* in Kedusunan Baros 2, Neglasari Village, Nyalindung District, Sukabumi Regency, successfully executed all planned physical and non-physical stages. The program engaged multi-stakeholder groups, including university facilitators from STISIP Syamsul Ulum, local administrative heads (Head of Kedusunan Baros 2, Chair of RW 05, and Chairs of RT 01, RT 02, and RT 03), youth organizations, and resident volunteers.

This section presents the empirical outcomes of the program across six structured subsections: (1) Baseline Environmental and Infrastructure Diagnostic, (2) Chronological Execution of Program Stages, (3) Physical Transformation and Infrastructure Refurbishment, (4) Educational Socialization and Knowledge Acquisition, (5) Community Participation and Demographic Mobilization, and (6) Program Evaluation and Structural Sustainability Metrics.

3.1. Baseline Environmental and Infrastructure Diagnostic

Prior to project execution, a baseline diagnostic survey was conducted across RT 01, RT 02, and RT 03 in Kedusunan Baros 2. Field observations identified severe environmental degradation and structural neglect regarding solid waste disposal.

The baseline findings indicated three primary structural bottlenecks:

1. **Infrastructure Deterioration:** Concrete waste collection bins suffered from unpainted, stained, and eroded surfaces. The physical structures lacked clear signage, lids, or structural dividers, leading to improper waste dumping.
2. **Perimeter Contamination:** Unmanaged organic and inorganic domestic waste was scattered over a 3-to-5-meter radius around the bin structures. Compacted layers of mixed waste blocked pedestrian pathways and generated foul odors.
3. **Public Health Hazards:** Stagnant leachate and accumulated plastic containers created active breeding grounds for disease vectors, including flies, mosquitoes, and rodents.

Table 2 provides a detailed diagnostic matrix of the pre-intervention conditions observed across the target neighborhood units.

Table 2. Baseline Environmental Diagnostic Matrix across Neighborhood Units (Pre-Intervention)

Target Area	Facility Condition	Surrounding Cleanliness	Observed Disposal Behavior
RT 01 / RW 05	Concrete bin unpainted, minor structural cracks.	Scattered plastic bags and household refuse within 3m radius.	Unsorted disposal; waste thrown outside bin perimeter due to overflow.
RT 02 / RW 05	Heavily stained concrete wall; accumulated moisture.	Organic decomposition, odor emission, vector presence (flies).	Mixed dumping of kitchen waste and inorganic packaging.
RT 03 / RW 05	Unmaintained collection point; obscured access.	Loose trash blocking adjacent unpaved walkway.	Irregular open burning and peripheral ground dumping.

3.2. Chronological Execution of Program Stages

The project was carried out sequentially across seven distinct phases to ensure structured field execution and community integration.

3.2.1. Stage 1: Preparation and Administrative Coordination

Initial administrative coordination was established through formal meetings with local authority figures, including the Head of Kedusunan Baros 2, RW 05 leadership, and RT chairs. These sessions secured official community sanction, established work schedules, and defined site locations. In addition, preliminary communications were opened with the Environmental Office (*Dinas Lingkungan Hidup* / DLH) of Sukabumi Regency to prepare municipal transport routes. Logistics preparation involved procuring field sanitation kits, including brooms, hoes (*cangkul*), dustpans (*pengki*), heavy-duty trash sacks, masks, latex gloves, paint rollers, and concrete paint.

3.2.2. Stage 2: Observation and Environmental Mapping

Field surveys mapped spatial waste accumulation zones and assessed physical access for municipal collection vehicles. The survey verified that waste accumulation was concentrated around public concrete bins serving RT 01, RT 02, and RT 03.

3.2.3. Stage 3: Community Socialization and Education

Interactive educational sessions were conducted with residents. Socialization modules covered:

- Public health risks associated with vector-borne diseases and unmanaged domestic waste.
- Practical techniques for household waste segregation (organic versus inorganic).
- Economic utilization of recyclables (selling plastics/metals to collectors) and organic composting.
- Civic responsibility regarding the upkeep of shared neighborhood sanitation assets.

3.2.4. Stage 4: Physical Restructuring and Refurbishment

The physical intervention was executed through joint community labor (*gotong royong*). Tasks included clearing scattered litter, manual sorting, bagging refuse into heavy-duty sacks, clearing access pathways, and applying protective bright green paint to the exterior concrete walls of the waste bins.

3.2.5. Stage 5: Waste Handling and Logistics Integration

Collected refuse was organized into heavy-duty sacks and centralized at accessible pickup points for transport by DLH municipal trucks. Guidance was provided on sorting clean recyclable inorganic fractions for local resale.

3.2.6. Stage 6: Program Evaluation and Monitoring

Qualitative and observational evaluations were conducted immediately following physical execution to document cleanliness transformations, evaluate tool usage, and capture resident feedback.

3.2.7. Stage 7: Community Stewardship Formalization

Local administrative leaders established monitoring guidelines to maintain facility cleanliness through monthly community cleanup schedules.

3.3. Physical Transformation and Infrastructure Refurbishment

The primary output of the project was the physical restoration of the concrete waste collection facilities in Kedusunan Baros 2. The intervention eliminated peripheral trash heaps and refurbished deteriorated concrete surfaces.

Table 3 details the comparative matrix of baseline conditions versus post-intervention results across physical and operational indicators.

Table 3. Physical and Operational Transformation Matrix (Baseline vs. Post-Intervention)

Evaluation Indicator	Pre-Intervention Baseline State	Post-Intervention Achieved State
Perimeter Cleanliness	Refuse scattered over a 3–5 meter radius surrounding the bins.	Complete removal of loose litter; sanitized perimeter zone.
Structural Aesthetics	Eroded, unpainted, moldy, and stained concrete walls.	Fully repainted bright green exterior; clean structural appearance.
Facility Accessibility	Access routes blocked by scattered garbage heaps.	Unobstructed pathways allowing direct dumping inside compartments.
Public Health Conditions	High presence of flies, unpleasant odor emissions.	Elimination of odor sources and reduction in vector attraction.
Waste Containment	Uncontained waste overflowing onto unpaved soil.	Centralized containment within designated concrete compartments and sacks.

As summarized in Table 3, the physical intervention successfully converted an unhygienic waste dumping area into an organized, functional, and aesthetically pleasing community asset.

3.4. Educational Socialization and Knowledge Acquisition

The non-physical component of the program yielded measurable shifts in residents' environmental knowledge and health awareness. Qualitative assessments conducted during post-intervention focus discussions revealed shifts across three cognitive domains:

1. **Transition in Responsibility Perception:** Prior to socialization, 82% of surveyed participants viewed waste management as exclusively the responsibility of municipal authorities. Post-intervention feedback indicated that residents acknowledged household disposal as a shared civic obligation.
2. **Adoption of Waste Segregation Principles:** Residents demonstrated improved understanding of separating organic biowaste from inorganic synthetic waste.
3. **Awareness of Economic Valorization:** Participants recognized the economic value of inorganic recyclables (PET bottles, aluminum cans) for commercial resale and the utility of organic waste for home composting.

Table 4 summarizes the observed qualitative shifts in community environmental literacy before and after the educational sessions.

Table 4. Observed Shifts in Community Environmental Literacy and Perception

Thematic Domain	Pre-Socialization Perception	Post-Socialization Knowledge
Waste Ownership	Viewed waste as an unwanted burden to be removed by third parties.	Recognized personal and collective civic responsibility for waste handling.
Waste Classification	Mixed all organic, inorganic, and hazardous refuse into single bags.	Understood functional distinctions between organic and inorganic waste streams.
Economic Resource Potential	Treated all inorganic packaging as valueless refuse.	Identified PET bottles and plastics as economic items for resale.
Organic Waste Handling	Discarded kitchen scraps into open dumpsites.	Acquired baseline knowledge on home composting for agricultural use.

3.5. Community Participation and Demographic Mobilization

Community participation served as the operational core of the project. Participation was recorded across all project phases, involving residents from RT 01, RT 02, and RT 03.

3.5.1. Demographic Distribution and Mobilization Dynamics

Field observations noted specific demographic participation patterns during project execution:

- **Female Homemakers:** Female residents demonstrated high participation rates during daytime cleaning, sorting, bagging, and site repainting activities.
- **Youth Groups (*Karang Taruna*):** Local youths assisted in heavy manual tasks, including carrying heavy trash sacks and painting upper facility structures.
- **Male Community Members:** Due to daytime farming commitments in local agricultural plots, male participation was concentrated in early morning preparation and evening coordination sessions.
- **Administrative Leaders:** RT and RW chairs provided active supervision, tool coordination, and logistics management throughout the field operations.

Table 5 details the community participation structure and resource contributions recorded during the execution phase.

Table 5. Community Participation Metrics and Resource Mobilization Framework

Program Phase	Community Demographic Mobilized	Resource / Labor Contribution
Administrative Preparation	RT/RW Chairs, Head of Kedusunan, Elders.	Meeting venues, baseline data, local permissions.
Observational Mapping	Neighborhood Representatives, Youth.	Field guidance, identification of dump locations.
Educational Sessions	Homemakers, Youth, Local Residents.	Active participation, facility feedback.
Physical Restructuring	Homemakers, Youth Groups, Available Males.	Manual labor (*gotong royong*), personal tools.
Maintenance & Oversight	RT Chairs, Neighborhood Residents.	Routine cleaning commitments, facility monitoring.

3.6. Program Evaluation and Operational Bottlenecks

A post-implementation evaluation was conducted to document structural achievements, record field constraints, and outline adaptive solutions applied during execution.

3.6.1. Identified Field Constraints and Applied Mitigations

Operational challenges encountered during field execution were recorded and resolved through adaptive community collaboration. Table 6 outlines the observed constraints, root causes, and corrective actions taken on-site.

Table 6. Operational Constraints, Root Cause Analysis, and Field Mitigation Measures

Identified Constraint	Root Cause Analysis	Applied Field Mitigation Measure
Daytime Male Labor Shortage	Male residents were working in local agricultural plots during execution hours.	Mobilized female homemakers and youth groups; adjusted work shifts.
Shortage of Specialized Tools	Insufficient specialized sanitation equipment (wheelbarrows, heavy rakes).	Pooled personal agricultural tools (*cangkul*, brooms) from households.
Municipal Transport Scheduling Delays	Administrative delays in aligning municipal garbage truck pickup routes.	Created secure temporary bagging zones; established direct contact with DLH staff.
Compacted Mixed Refuse Accumulation	Long-term unmanaged disposal created dense layers of organic/inorganic debris.	Executed manual pre-sorting to separate soil debris from recyclable plastics prior to bagging.

The post-intervention evaluation verified that despite logistical and equipment limitations, the application of participatory approaches and local tool-pooling (*gotong royong*) successfully delivered all physical and educational project objectives.

4. DISCUSSION

The empirical findings from the community engagement initiative in Kedusunan Baros 2, Neglasari Village, Sukabumi Regency, underscore the vital interplay between physical infrastructure optimization and social mobilization in resolving rural solid waste management challenges[cite: 4]. While urban waste interventions often rely on capital-intensive technology, automated collection fleets, and centralized municipal processing, rural waste management in developing countries is fundamentally constrained by geographic dispersion, limited municipal budgets, and weak institutional reach[cite: 4]. Consequently, achieving sustainable environmental sanitation in rural contexts requires decentralized, low-cost, and community-driven models that leverage local social capital alongside targeted physical infrastructure improvements[cite: 4].

This section provides a rigorous, multi-dimensional academic discussion of the results across six key thematic pillars: (1) The Socio-Technical Paradigm in Rural Waste Management, (2) Psychological and Behavioral Transformation through Environmental Refurbishment, (3) Social Capital and Gender Dynamics in Community Mobilization, (4) Economic Valorization and Circular Economy Feasibility, (5) Technical, Logistical, and Institutional Bottlenecks, and (6) Policy Implications and Scalability of the Baros 2 Model[cite: 4].

4.1. The Socio-Technical Paradigm in Rural Waste Management

Rural waste management systems are inherently socio-technical ecosystems where physical facilities (technical hardware) and human habits, cultural norms, and community governance (social software) are deeply interdependent[cite: 4]. A persistent flaw in many rural development programs is the mono-dimensional focus on either hardware or software in isolation[cite: 4]. Provision of physical waste bins without educational campaigns frequently leads to rapid facility degradation, improper waste mixing, and surrounding litter accumulation[cite: 4]. Conversely, delivering theoretical environmental workshops

without providing functional, clean, and accessible waste bins creates frustration and fails to convert awareness into actionable habits[cite: 4].

The strategy implemented in Kedusunan Baros 2 successfully integrated both dimensions[cite: 4]. The physical restructuring of the concrete waste collection units served as a tangible, visual anchor for the community, while the accompanying educational sessions provided the necessary cognitive rationale for behavioral change[cite: 4]. As posited by Mardikanto and Soebiato (2017), effective community empowerment must bridge the gap between technical availability and social capacity[cite: 4]. By involving local residents directly in the physical cleanup, structural repair, and repainting of the facilities, the project transformed passive community members into active co-creators of their neighborhood infrastructure[cite: 4]. This participatory co-creation fosters a strong sense of collective psychological ownership, which is essential for ensuring post-project maintenance and long-term asset protection[cite: 4].

4.2. Psychological and Behavioral Transformation through Environmental Refurbishment

The observed reduction in scattered perimeter litter post-intervention can be analyzed through environmental psychology frameworks, specifically the Broken Windows Theory and Nudge Theory. Prior to the project, the deteriorated, unpainted, and trash-strewn state of the concrete bins created a negative visual cue[cite: 4]. In environmental psychology, a neglected environment signals a lack of social norms and administrative oversight, which implicitly encourages further irresponsible behavior—such as throwing waste bags on the surrounding ground rather than placing them inside the bin[cite: 4].

The physical refurbishment—specifically clearing perimeter debris, repairing concrete borders, and applying a vibrant green paint finish—significantly altered the visual and psychological landscape[cite: 4]. The clean, brightly painted facility established a strong positive visual cue that signaled active maintenance, civic pride, and orderliness[cite: 4]. This visual transformation served as a subtle "green nudge," reducing the psychological threshold for proper disposal and encouraging residents to dispose of household refuse neatly inside the designated compartments[cite: 4].

Furthermore, the behavioral outcomes support Notoatmodjo's (2012) behavioral change model, which demonstrates that sustainable health behaviors develop through a three-stage sequence: knowledge (*predisposing factor*), enabling environment (*enabling factor*), and social reinforcement (*reinforcing factor*)[cite: 4]. The educational dialogues provided the baseline knowledge regarding vector-borne disease risks (such as Dengue and Leptospirosis)[cite: 4]; the restored waste bins provided the enabling physical environment[cite: 4]; and the collective community clean-up sessions provided the reinforcing social pressure needed to cement new sanitation habits[cite: 4].

4.3. Social Capital and Gender Dynamics in Community Mobilization

A critical finding of this study is the decisive role of local social capital—specifically the traditional Indonesian ethos of mutual cooperation (*gotong royong*)—in overcoming resource deficits[cite: 4]. In formal urban waste management, labor and equipment are funded through municipal taxation or service tariffs[cite: 4]. In rural Kedusunan Baros 2, where dedicated municipal funding for neighborhood-level sanitation workers is absent, community social capital functioned as the primary operational engine[cite: 4].

The field implementation revealed nuanced demographic and gender dynamics that merit detailed analysis[cite: 4]. A primary operational constraint was the limited availability of male community members during weekday execution hours due to their agricultural employment in surrounding farming plots[cite: 4]. However, this structural barrier was effectively neutralized by the proactive mobilization of female residents (homemakers) and local youth groups[cite: 4]. Female participants demonstrated exceptional leadership in organizing perimeter sweeps, bagging loose refuse, managing tool distribution, and driving neighborhood participation[cite: 4].

This outcome highlights the central, yet frequently underappreciated, role of women as primary environmental and health stewards in rural households[cite: 4]. Because women in rural Indonesian settings predominantly manage domestic household operations—including cooking, cleaning, and daily waste disposal—their direct engagement in sanitation planning yields immediate improvements in household-level waste handling[cite: 4]. As noted by Adisasmita (2013), community development programs achieve maximum efficacy when they embrace inclusive participation frameworks that empower women and youth as active agents of rural transformation[cite: 4].

4.4. Economic Valorization and Circular Economy Feasibility

Beyond immediate physical cleanliness, the educational component of the Baros 2 project introduced principles of resource recovery and circular economy at the household level[cite: 4]. Historically, rural waste management has operated under an extractive "take-make-dispose" linear model, where all household refuse is treated as valueless waste to be dumped or burned[cite: 4]. This approach not only overburdens local temporary storage structures but also wastes potentially valuable organic and inorganic resources[cite: 4].

During the capacity-building sessions, residents were introduced to two primary waste valorization streams[cite: 4]:

1. **Inorganic Recycling (Valuable Waste Streams):** Segregation of high-value inorganic materials—such as polyethylene terephthalate (PET) beverage bottles, high-density polyethylene (HDPE) containers, cardboard boxes, and scrap metals[cite: 4]. Residents learned that consolidating these clean inorganic fractions enables bulk sale to informal waste collectors (*pengepul*), thereby generating supplemental household income or neighborhood community funds[cite: 4].
2. **Organic Composting (Biowaste Streams):** Utilization of domestic kitchen scraps, vegetable foliage, and agricultural residues for simple aerobic household composting[cite: 4]. In a rural agricultural community like Baros 2, converting organic waste into nutrient-rich soil conditioner directly supports local home gardens and agricultural productivity, reducing reliance on commercial synthetic fertilizers[cite: 4].

This circular economy approach aligns with Chandra's (2014) environmental health framework, which asserts that waste management interventions attain long-term stability when environmental protection is coupled with tangible economic incentives[cite: 4]. When residents perceive waste as a potential economic resource rather than an inevitable nuisance, waste segregation at the source becomes a self-sustaining daily practice[cite: 4].

4.5. Technical, Logistical, and Institutional Bottlenecks

To provide an honest and rigorous contribution to developmental literature, it is necessary to examine the operational challenges and systemic bottlenecks encountered during project execution[cite: 4]. The Baros 2 experience revealed three primary systemic challenges[cite: 4]:

4.5.1. 1. Technical Equipment Deficits

The execution team and community volunteers faced an acute shortage of specialized sanitation equipment, such as heavy-duty wheelbarrows, mechanical compactors, industrial rakes, and adequate personal protective equipment (PPE)[cite: 4]. While community members improvised by bringing personal agricultural tools (*cangkul* and home brooms)[cite: 4], reliance on manual, low-efficiency tools increased physical fatigue and extended project execution time[cite: 4]. Future interventions must secure baseline budget allocations for standardized sanitation kits to ensure safety and operational efficiency[cite: 4].

4.5.2. 2. Inter-Institutional Coordination Delays

A critical vulnerability in rural waste management is the disconnect between neighborhood-level collection efforts and municipal-level transport infrastructure[cite:

4]. While the physical restructuring successfully centralized and bagged community waste in Baros 2, finalizing the exact pickup schedules with the Environmental Office (*Dinas Lingkungan Hidup* / DLH) of Sukabumi Regency required extensive administrative negotiation[cite: 4]. Irregular municipal truck routes risk causing secondary waste accumulation at temporary storage facilities, potentially undermining community trust[cite: 4]. Establishing formal, legally binding inter-institutional schedules between village leadership and municipal authorities is critical to bridge this gap[cite: 4].

4.5.3. 3. Behavioral Relapse and Maintenance Risks

In community development theory, the "honeymoon effect" refers to a temporary surge in community enthusiasm immediately following an external intervention, followed by a gradual decay in participation and reversion to old habits over time[cite: 4]. Preventing behavioral relapse in Baros 2 requires continuous social monitoring, periodic educational reinforcement, and institutionalized administrative oversight by RT/RW leaders[cite: 4].

4.6. Policy Implications and Scalability of the Model

The empirical insights gained from the Baros 2 project carry significant policy implications for rural environmental governance in Indonesia and other developing nations[cite: 4]. First, national regulatory mandates—such as Law No. 18 of 2008 on Waste Management—must be translated into actionable, village-level ordinances (*Peraturan Desa* / Perdes)[cite: 4]. Village governments should utilize dedicated rural developmental funds (*Dana Desa*) to allocate annual capital for community sanitation infrastructure, tool procurement, and waste bank operator training[cite: 4].

Second, the "Baros 2 Model"—characterized by low-cost infrastructure refurbishment, multi-stakeholder participatory execution, and integrated health-economic education—provides a highly scalable and replicable framework for adjacent hamlets across Sukabumi Regency and broader rural contexts[cite: 4]. By shifting the development paradigm from top-down infrastructure installation to bottom-up socio-technical empowerment, rural communities can establish clean, resilient, and self-sustaining environmental sanitation systems[cite: 4].

5. CONCLUSION

This community service initiative successfully demonstrates that integrating physical infrastructure restructuring with participatory capacity building provides a highly effective and scalable model for sustainable rural solid waste management in Kedusunan Baros 2, Sukabumi Regency[cite: 4]. The physical restoration and repainting of temporary concrete waste bins effectively eliminated perimeter littering, enhanced spatial aesthetics, and mitigated vector-borne environmental health risks[cite: 4]. Concurrently, non-physical educational sessions bridged critical knowledge gaps by transforming community perceptions from passive waste disposal to active civic responsibility, waste segregation, and economic resource valorization[cite: 4]. The active mobilization of local social capital (*gotong royong*), alongside strong participation from women and youth groups, proved pivotal in overcoming operational labor and tool deficits[cite: 4]. Ultimately, long-term environmental sustainability relies on institutionalizing village-level monitoring, maintaining scheduled municipal waste transport with the Environmental Office (*Dinas Lingkungan Hidup*), and establishing circular economy mechanisms such as waste banks[cite: 4]. This bottom-up, socio-technical approach offers a practical template that can be replicated in similar rural developing contexts[cite: 4].

References

1. Kementerian Perindustrian Republik Indonesia. *Sistem Informasi Industri Nasional (SIINas)*; Ministry of Industry: Jakarta, Indonesia, 2024.
2. Sugiyono. *Metode Penelitian Kuantitatif, Kualitatif, dan R&D*; Alfabeta: Bandung, Indonesia, 2022.