

FOSTERING COMMUNITY-BASED SOLID WASTE MANAGEMENT THROUGH PARTICIPATORY ACTION RESEARCH: EVIDENCE FROM RURAL INDONESIA

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Abstract: Rural solid waste management remains a persistent governance and public-health challenge in Indonesia, particularly in communities where disposal infrastructure is limited and open dumping has become normalised. This article examines how Participatory Action Research (PAR) fostered community-based solid waste management in Pandansari Hamlet, Tigasan Wetan Village, Probolinggo Regency. Using a qualitative-dominant design, the study integrated participatory observation, social mapping, focus group discussions, visual documentation, and community reflection conducted from December 2024 to January 2025. The PAR cycle comprised trust-building, problem diagnosis, deliberative planning, collective action, and reflective evaluation. The intervention identified three interrelated barriers: the transition from organic to mixed household waste, dependence on external infrastructure, and the normalisation of unsanitary disposal practices. By mobilising religious networks, neighbourhood leadership, and gotong royong, residents implemented clean-ups in three critical zones and established a small communal disposal facility. The findings show that PAR strengthened environmental awareness, enabled local consensus, and converted community concern into practical action. The article contributes to community-based waste-management literature by demonstrating that rural sustainability initiatives depend not only on technical facilities but also on the activation of social capital, locally legitimate leadership, and culturally embedded collective learning. The study recommends institutional follow-up through RT/RW rules, village-supported waste facilities, and circular-economy mechanisms such as waste banks linked to local governance.

Keywords: Community-Based Solid Waste Management; Participatory Action Research; Social Capital; Rural Sanitation

Introduction

Solid waste management has become a global environmental crisis, intensified by population growth, urbanisation, and changing consumption patterns. Global solid waste generation is already above two billion tonnes annually and is projected to

increase substantially by 2050 if prevailing systems remain unchanged.¹ Recent global assessments also frame waste not merely as a local sanitation problem but as a governance challenge that requires integrated, resource-oriented solutions.²

Beyond aesthetic degradation, ineffective waste governance produces direct risks for public health and ecosystems. Open dumping and unregulated burning are associated with soil and water contamination, greenhouse gas emissions, air-quality deterioration, and the spread of vector-borne diseases.³ Sustainable waste management therefore requires more than the installation of physical facilities; it also depends on household-level behavioural change, collective responsibility, and locally trusted mechanisms of enforcement.

In Indonesia, structural constraints are particularly visible in rural and peri-urban settlements, where collection services, temporary storage facilities, and formal recycling pathways remain limited. Pandansari Hamlet in Tigasan Wetan Village, Probolinggo Regency, reflects this challenge: initial observation and social mapping found that the absence of an organised waste system had normalised open disposal in unused spaces and along community access points.⁴ The resulting accumulation threatened sanitation conditions and weakened the environmental quality of the settlement.

Existing scholarship consistently shows that environmental programmes are more effective when local residents participate as decision makers rather than as

¹ Cody Ellis, "World Bank: Global Waste Generation Could Increase 70% by 2050," WasteDive, 2018, <https://www.wastedive.com/news/world-bank-global-waste-generation-2050/533031/>.

² The United Nations Environment Programme, *Global Waste Management Outlook 2024 - Beyond an Age of Waste: Turning Rubbish Into a Resource* (Nairobi: United Nations Environment Programme, 2024) February 2024, <https://doi.org/10.59117/20.500.11822/44939>.

³ Zhechen Zhang et al., "Municipal Solid Waste Management Challenges in Developing Regions: A Comprehensive Review and Future Perspectives for Asia and Africa," *Science of The Total Environment* 930 (June 2024): 172794, <https://doi.org/10.1016/j.scitotenv.2024.172794>; Aminatuz Zahroh et al., "Upaya Peningkatan Pemahaman UMKM Terhadap Pelaporan Keuangan Berbasis SAK EMKM Di Desa Tirtomoyo," *Khidmatuna: Jurnal Pengabdian Masyarakat* 3, no. 2 (May 15, 2023): 128–40, <https://doi.org/10.54471/khidmatuna.v3i2.2212>; Waringin Margi Yushman et al., "Bahaya Lingkungan Pada Open Dumping Sampah Organik Perkotaan," *Jurnal Bengawan Solo: Pusat Kajian Riset Dan Inovasi Daerah Kota Surakarta* 2, no. 2 (2023): 85–101; Mela Yuliyanti, Dini Anggraeni, and Ika Feni Setyaningrum, "Kajian Analisis Pengelolaan Sampah Tempat Pembuangan Akhir (TPA) Di Indonesia Dan Dampaknya Terhadap Kesehatan," in *Prosiding Seminar Nasional UNIMUS*, vol. 7.

⁴ Asep Hendra, Irfan Setiawan, and Nur Handayani, *Collaborative Governance: Suatu Studi Pengelolaan Sampah Dalam Menuju Zero Waste Zero Emission Di Kota Malang Provinsi Jawa Timur* (Bandung: CV. Rtujuh Media Printing, 2024) 2024.

passive beneficiaries.⁵ Community-based solid waste management (CBSWM) operationalises this insight by placing residents at the centre of problem identification, planning, implementation, and monitoring.⁶ In this model, waste management is treated as a socio-institutional process as well as a technical service.

Participatory practice in environmental management is commonly implemented through social mapping, focus group discussions, public deliberation, communal clean-ups, and locally negotiated rules for managing shared resources.⁷ These activities are important not only because they solve immediate operational problems, but also because they function as collective learning spaces in which communities reinterpret cleanliness, health, and responsibility.

However, many community-based waste initiatives remain fragile. Programmes often succeed during the intervention period but fail to sustain behavioural change once external facilitators leave. This gap is usually caused by weak institutionalisation, unclear post-programme management mechanisms, limited local ownership, and the persistence of old disposal habits.

Responding to this practical and theoretical gap, this article examines how a Participatory Action Research (PAR) framework was used to strengthen environmental awareness and collective participation in Pandansari Hamlet. The article argues that PAR can bridge infrastructural limitations and behavioural inertia when it is embedded in existing socio-cultural networks, especially religious gatherings, gotong royong traditions, and locally respected leadership. The study contributes to rural waste-management discourse by demonstrating how a community can move from problem recognition to collective action through a context-sensitive PAR cycle.

⁵ Eva Lesna Nainggolan, Karol Teovani Lodan, and Lubna Salsabila, "Menuju Keberlanjutan Lingkungan: Keterlibatan Masyarakat Dalam Pengelolaan Sampah Kota Batam," *PUBLIKA: Jurnal Ilmu Administrasi Publik* 9, no. 2 (2023): 179–88; Lolom Evalita Hutabarat and Agnes Sri Mulyani, "Analisis Korelasi Tingkat Pemahaman Masyarakat Terhadap Perilaku Pemilahan Dan Pengolahan Sampah Di Dusun Pade Mare Lombok Utara," *Jurnal Ilmu Lingkungan* 20, no. 3 (2022): 646–53.

⁶ Bambang Munas Dwiyanto, "Model Peningkatan Partisipasi Masyarakat Dan Penguatan Sinergi Dalam Pengelolaan Sampah Perkotaan," *Jurnal Ekonomi Pembangunan: Kajian Masalah Ekonomi Dan Pembangunan* 12, no. 2 (December 1, 2011): 239, <https://doi.org/10.23917/jep.v12i2.196>.

⁷ Rido Argo Mukti and David Efendi, *Kampung Hijau Gambiran: Praktik Tata Kelola Lingkungan Hidup Berbasis Collaborative Governance* (Yogyakarta: Samudra Biru, 2020)2020.

Method

This community-engagement study employed Participatory Action Research (PAR) as its primary methodological framework. PAR was selected because it combines inquiry, reflection, action, and evaluation in a collaborative cycle, allowing residents to become co-producers of both practical solutions and local knowledge.⁸ In this study, the approach was not limited to consultation; residents were involved in identifying waste hotspots, formulating priorities, implementing collective action, and reflecting on follow-up mechanisms.

The programme was conducted in Pandansari Hamlet, Tigasan Wetan Village, Probolinggo Regency, from December 2024 to January 2025. Operationally, the PAR process was organised into four connected phases: (1) participatory identification and resource mapping to locate waste accumulation points; (2) collaborative planning through focus group discussions (FGDs) to establish action priorities; (3) collective action through community clean-ups around Masjid Nurus Syafi'i, the railway-track area, and RT 002/003, accompanied by the establishment of a communal disposal site and the placement of basic waste facilities; and (4) a reflection forum to consolidate lessons learned and discuss continuation strategies.⁹

Data were collected through participatory observation, social mapping, FGD notes, visual documentation, and semi-structured interviews with village officers, neighbourhood leaders, religious figures, and community members. The analysis followed a qualitative-dominant design. Thematic analysis was used to code and interpret patterns related to awareness, participation, social capital, perceived constraints, and emerging local initiatives. Physical outputs and attendance patterns were interpreted descriptively as supporting evidence rather than as statistically generalisable indicators.

⁸ Flora Cornish et al., "Participatory Action Research," *Nature Reviews Methods Primers* 3, no. 1 (April 27, 2023): 34, <https://doi.org/10.1038/s43586-023-00214-1>.

⁹ Fithawee Tzeggai, "Handbook on Participatory Action Research and Community Development," *Contemporary Sociology: A Journal of Reviews* 53, no. 1 (January 22, 2024): 82–84, <https://doi.org/10.1177/00943061231214609ii>.

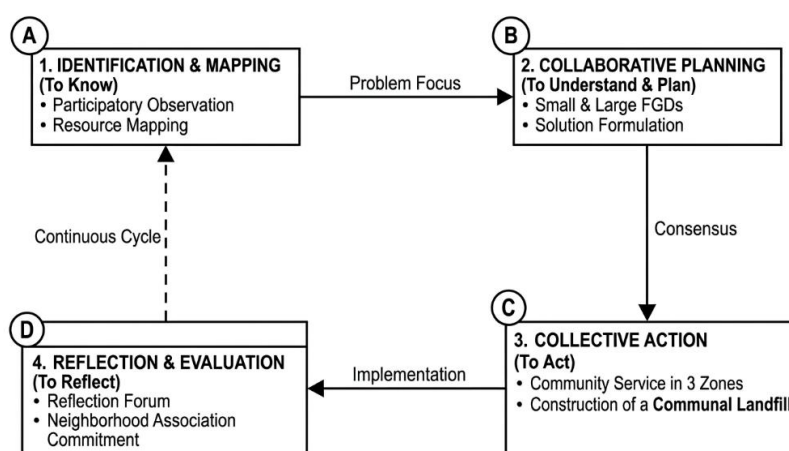


Figure 1. The Cyclical PAR Framework Implemented in Pandansari Hamlet

Programme sustainability was assessed through a community-based monitoring and evaluation orientation. The evaluation focused on four indicators: the mobilisation of residents across the intervention sites, the creation of basic waste-disposal infrastructure, the emergence of shared rules and collective responsibility, and the willingness of local authorities to continue the practice after the facilitation period. Data credibility was strengthened through methodological and source triangulation as well as member checking during the reflection forum, thereby reducing the risk of facilitator-centred interpretation.

Results and Discussion

Socio-Cultural Dynamics and Community Ecological Profile

Pandansari Hamlet is located in a lowland area of Tigasan Wetan Village, approximately 48-75 metres above sea level. Its tropical climate, combined with periods of heavy rainfall, increases the risk of waste mobilisation when drainage and disposal systems are inadequate. In this setting, waste accumulation around railway access points, worship facilities, and residential paths is not a peripheral problem; it directly shapes sanitation risk and everyday environmental quality.

From an environmental-risk perspective, rural settlements that rely on open dumping are highly vulnerable when exposed to seasonal rainfall and unmanaged surface runoff. Waste that remains in open areas may spread into public access routes,

contaminate soil, and intensify public-health risks.¹⁰ The geographical profile of Pandansari therefore functions as a determinant that amplifies the consequences of weak infrastructure and normalised disposal practices.

Socio-economically, Tigasan Wetan represents an agrarian community that is gradually diversifying into household-scale production, including traditional snacks such as getas, chips, and crackers. Although agriculture remains central to livelihoods, these emerging home industries have changed the composition of household waste. Organic residues are now accompanied by increasing volumes of packaging materials, especially plastics, which require a different management logic from agricultural residues.

This transition has produced a management gap. Many residents continued to treat waste as if it were biodegradable material that could be discarded around household space, while the actual waste stream increasingly included non-biodegradable plastic polymers.¹¹ The mismatch between changing waste composition and inherited disposal habits became a key driver of environmental deterioration in Pandansari.

Culturally, Pandansari is characterised by strong communal ties associated with Madurese social identity, religious practice, and neighbourhood-based solidarity. Local institutions such as mosques, musholla, Tahlilan, Muslimatan, and TPQ activities function not only as worship and learning spaces but also as trusted channels for communication and mobilisation. The community's basic literacy foundation made environmental education possible, yet the intervention needed to use visual, practical, and dialogic methods rather than abstract instruction.

Within the CBSWM framework, social capital especially gotong royong, trust in religious figures, and routine communal gatherings became the main enabling

¹⁰ H. M. T. C. Herath et al., "Sustainable Solid Waste Management in Developing Countries: Converting Urban Wood, Garden, Food, and Cardboard Waste Into Biochar Using Pyrolysis," *Journal of Desk Research Review and Analysis* 2, no. 1 (December 30, 2024): 92–109, <https://doi.org/10.4038/jdrra.v2i1.28>.

¹¹ Zilfani Fuadiyah Haq, "The Role of Social Capital in Household Waste Management: A Case Study in Blunyahrejo Village," in *The 12th UGM Public Health Symposium*.

mechanism for PAR.¹² The intervention's effectiveness depended less on external infrastructure provision and more on the activation of collective agency through locally legitimate networks.¹³ In this sense, environmental management in Pandansari was also a process of strengthening community governance.

Cultural Immersion and Participatory Problem Mapping

The PAR cycle began with to know and to understand phases. Because PAR positions residents as co-producers of knowledge, facilitators did not rely on distant observation. Instead, they built trust by joining everyday activities, including agricultural work, home-industry routines, and religious gatherings.¹⁴ This immersion allowed the team to understand how residents interpreted waste, cleanliness, responsibility, and the perceived absence of government-supported infrastructure.



Figure 2. Trust-Building Through Participation in Residents' Daily Activities

Observation and social-mapping data were then interpreted using thematic analysis. Inductive and deductive coding of educational, economic, socio-cultural, religious, and environmental conditions generated three diagnostic themes: socio-economic transition and ecological-awareness gaps; the strength of social capital and communal religious networks; and the normalisation of sanitation degradation under weak infrastructure. These themes provided the analytical basis for designing the action phase.

¹² Zhang et al., "Municipal Solid Waste Management Challenges in Developing Regions: A Comprehensive Review and Future Perspectives for Asia and Africa."

¹³ Cornish et al., "Participatory Action Research."

¹⁴ Cornish et al.

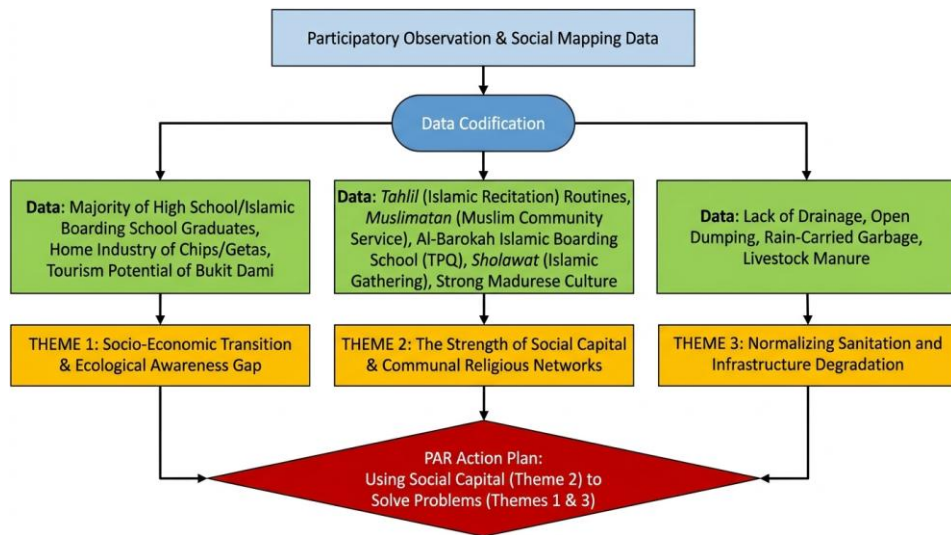


Figure 3. Thematic Analysis Framework of Socio-Cultural and Environmental Conditions in Pandansari

Based on this framework, the problem-mapping stage produced three key findings that explain why waste accumulation persisted and why a participatory strategy was necessary.

1. Socio-Economic Transition and the Ecological Awareness Gap

Pandansari is undergoing significant demographic and economic transition. Older residents who generally completed primary education are being followed by younger cohorts with secondary-school, pesantren, and some higher-education experience. Formal and non-formal learning institutions, including SDN Tigrasan Wetan 03 and TPQ Al-Barokah, operate actively. At the same time, agriculture remains dominant while household industries and the natural-tourism potential of Bukit Dami are beginning to expand.

This positive economic transition has an ecological consequence. Growth in home-based production and local tourism activity has increased the volume of waste, particularly plastic packaging.¹⁵ Yet the shift in waste composition has not been accompanied by a comparable shift in community

¹⁵ Navarro Ferronato and Vincenzo Torretta, "Waste Mismanagement in Developing Countries: A Review of Global Issues," *International Journal of Environmental Research and Public Health* 16, no. 6 (March 24, 2019): 1060, <https://doi.org/10.3390/ijerph16061060>.

disposal practices. As a result, modern waste streams are managed through traditional and often unsystematic habits.

2. Social Capital and Communal Religious Networks

Although the settlement pattern in Pandansari is spatially dispersed, the community is held together by dense social and religious networks. Regular prayer gatherings, weekly Yasin and Tahlil recitations at Musholla Al-Barokah, Friday Muslimatan, and religiously framed arisan activities function as deliberative spaces where community messages circulate effectively. In participatory environmental governance, this type of social capital can be mobilised to replace purely top-down interventions that often fail to generate local ownership.¹⁶

3. Normalised Sanitation Degradation and Weak Infrastructure

The study found that residents' perception of cleanliness had been shaped by long-term normalisation of domestic-waste piles and livestock manure around residential areas. The absence of basic drainage and disposal infrastructure worsened the situation during the rainy season, when dumped waste was carried onto access roads. Several residents expressed discomfort with odour and visual degradation, but the absence of a clear facility and collective mechanism prevented individual concern from becoming organised action.¹⁷

The thematic diagnosis therefore shaped the strategy for the next stage. The problem could not be resolved simply by adding bins or creating a disposal point. A durable intervention had to use the community's religious and social networks to challenge the normalisation of careless disposal and to transform concern into shared responsibility.

¹⁶ Eko Handoyo, Lailasari - Ekaningsih, and Islakhul Grace Saadah, "The Contribution of Social Capital to Waste Management for Street Vendors in Semarang City, Indonesia," *Komunitas* 15, no. 1 (March 30, 2023): 53–66, <https://doi.org/10.15294/komunitas.v15i1.38530>.

¹⁷ Zhang et al., "Municipal Solid Waste Management Challenges in Developing Regions: A Comprehensive Review and Future Perspectives for Asia and Africa."

Deliberative Planning and Collective Action

In the to plan phase, the facilitation team initiated small-scale FGDs with grassroots representatives. The discussions revealed a fundamental structural barrier: dependency syndrome. Residents recognised the waste problem but believed they lacked spatial capacity and institutional authority to create a disposal site. They therefore tended to delegate responsibility to the village government. Such dependency is a recurring challenge in rural environmental governance, where the absence of formal infrastructure can weaken local initiative.¹⁸



Figure 4. Small-Scale FGD to Identify Environmental Structural Barriers

To address this barrier, a larger FGD was held on 19 January 2025 involving the hamlet head, RT/RW leaders, and religious figures. The forum produced a paradigm shift from waiting for top-down intervention to formulating a bottom-up solution based on available local capacity. The deliberation generated three strategic agreements: determining a communal disposal point through self-help, revitalising communal clean-up activities, and strengthening environmental education through trusted community channels.

¹⁸ Zhang et al.



Figure 5. Large-Scale FGD as a Consensus Forum for the CBSWM Model

The agreements were implemented in the to act phase through three participatory physical interventions. The first focused on the area surrounding Masjid Nurussyafi'i, a public space near TK Perintis. Residents interpreted the clean-up not only as an ecological activity but also as preparation for a communal religious event. This finding shows that CBSWM becomes more persuasive when ecological action is connected to the community's existing socio-cultural and religious calendar.¹⁹



Figure 6. Community Service Around the Mosque: Integrating Ecological Action with a Socio-Cultural Agenda

¹⁹ Ai Juliani, Anna Permanasari, and Yuyun Elizabeth Patras, "Enhancing Creative Thinking and Global Diversity Through Culturally Responsive Teaching in Primary Schools," *Al-Ishlah: Jurnal Pendidikan* 16, no. 3 (2024): 3248–62, <https://doi.org/10.35445/alishlah.v16i3.5352>.

The second intervention took place east of the railway track, identified as the most critical hotspot for domestic waste and livestock manure. The clean-up exposed the cumulative consequences of long-term open dumping. Residents undertook sorting and emergency waste removal, including limited burning to enable land clearing. This practice should be understood as a transitional response under technological constraints rather than a recommended long-term solution, because uncontrolled burning and open dumping carry serious environmental and health risks.²⁰



Figure 7. Railway-Track Clean-Up: Addressing a Critical Open-Dumping Zone

The third intervention was conducted in RT 002/003, where waste was lighter and consisted mainly of leaves and plastic packaging. At this site, the PAR cycle produced a tangible output: a small communal disposal facility locally referred to as *bruk-brukan*. The facility's construction demonstrates that residents were able to transform the initial obstacle--the absence of a government-provided disposal site--into collective infrastructure through their own agency.²¹

²⁰ Ferronato and Torretta, "Waste Mismanagement in Developing Countries: A Review of Global Issues."

²¹ Cornish et al., "Participatory Action Research."



Figure 8. Construction of a Communal Disposal Site (Bruk-Brukan) in RT 003 as a form of Infrastructure Independence

Overall, the collective actions show that PAR can convert ecological apathy into practical participation when the process is grounded in local social capital. The intervention did not merely clean three waste hotspots; it also created an initial institutional foundation for community-managed waste governance. The most important outcome was the emergence of shared ownership: residents began to view waste management not as an external government duty alone, but as a communal responsibility linked to health, religious space, and neighbourhood dignity.

Conclusion

This study demonstrates that rural waste crises are rooted not only in infrastructural deficits but also in the socio-cultural normalisation of disposal habits. Through the PAR cycle--to know, to understand, to plan, and to act--the Pandansari intervention repositioned residents from policy objects into active subjects of environmental governance. Trust-building, participatory diagnosis, deliberative planning, and gotong royong-based action enabled the community to address sanitation problems through locally available capacities.

Theoretically, the article contributes to CBSWM literature in developing-country contexts by showing that the activation of social capital and religiously embedded networks can bridge the gap between structural limitations and behavioural

change. The findings indicate that the strongest driver of rural environmental transformation is not necessarily sophisticated technology, but the conversion of existing communal cohesion into organised environmental responsibility.

Practically, the study recommends that future programmes move beyond short-term clean-up activities toward institutionalised waste governance. Follow-up interventions should develop a village-level circular-economy model, such as a waste bank integrated with BUMDes, clear RT/RW-based waste rules, routine monitoring, and education through religious and community forums. Because this study was limited by a short facilitation period and relied primarily on qualitative evidence, longitudinal research is needed to assess whether the observed behavioural shift can endure and produce measurable improvements in environmental health

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