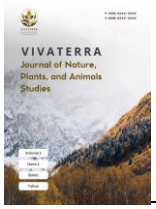

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# Plastic Waste Management in Cilacap From an Ecological Awareness Perspective: An Epistemological Analysis in Environmental Science

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***Abstract***

*This study analyzes the role of community-based plastic waste banks in reducing plastic waste generation in Cilacap, Indonesia, a region experiencing significant daily waste accumulation. Using a descriptive qualitative approach supported by literature review, field insights, and contextual environmental data, the research explores how waste bank operations, community participation, and institutional support shape the effectiveness of plastic waste management. The findings reveal that plastic waste banks serve as an accessible and socially driven mechanism that encourages household-level sorting, strengthens recycling practices, and provides economic incentives for local residents. Despite their potential, the system faces several challenges, including inconsistent community engagement, limited financial and managerial capacity, and inadequate coordination between local government and waste bank operators. This study concludes that improving institutional support, enhancing operational capacities, and expanding public education efforts are essential to strengthen the sustainability and impact of plastic waste banks. The results offer valuable insights for policymakers, local governments, and environmental practitioners seeking to optimize waste reduction strategies in urban and semi-urban Indonesian contexts.*

***Keywords:*** *plastic waste bank, community-based waste management, recycling behavior, environmental policy, Cilacap.*



## INTRODUCTION

Plastic waste has become a rapidly escalating environmental concern in Indonesia due to increased consumption patterns, demographic expansion, and insufficient waste-processing capacity, creating significant pressure on ecological systems at the regional level (Nurhaliza & Adnan, 2023). National datasets consistently show that plastic waste occupies a large share of municipal solid waste streams, reinforcing the urgency of interventions grounded in environmental science and ecological behavior studies (Supriatna & Lenz, 2022). Composition data from several districts reveal that plastic waste commonly accounts for roughly one-fifth of daily waste generation, surpassing the capacity of local recycling systems and exposing fundamental gaps in public environmental understanding (Resolute, 2024). These conditions highlight the relevance of epistemological inquiries into how individuals and institutions acquire, interpret, and apply environmental knowledge in shaping daily habits and policy decisions (Pratama & Sarjan, 2024).

In Cilacap Regency, the scale of waste generation has become a defining environmental challenge, with daily municipal waste output recorded at approximately 954–955 tons per day, illustrating the severity of the ecological burden faced by the region's infrastructure. Reports identify households as the largest contributors to total waste volume, pointing to the critical role of public ecological awareness and scientific literacy in influencing disposal practices and decision-making behaviors (Rahmawati et al., 2022). Research on community-level environmental initiatives in Indonesia shows that weak internalization of ecological values often results in persistent mismanagement of waste, including plastics that accumulate in waterways and coastal zones (Primayanti & Puspita, 2022). These trends align with earlier findings that environmental governance reforms often struggle to operate effectively without strong societal engagement and culturally embedded behavioral change (Purnaweni, 2004).

Recent municipal records from the 2024 SIPSN dataset indicate that Cilacap generates approximately 954 to 955 tons of waste per day, a figure that underscores the heavy environmental

burden faced by the district's solid-waste infrastructure, while also demonstrating how daily waste output consistently surpasses local processing capabilities. Plastic waste constitutes about 19.74 percent of this total volume, revealing the disproportionate presence of plastics within the municipal waste stream and highlighting the urgent need for interventions grounded in behavioral and ecological research (radarbanyumas.disway.id). The substantial share of plastic waste, when viewed against the limitations of existing facilities, illustrates the structural imbalance between generation and treatment that persists despite technological upgrades and policy adjustments (Resolute, 2024). These data reinforce the argument that technical solutions alone cannot resolve the waste problem, making it necessary to examine ecological awareness and environmental epistemology to understand how knowledge, habits, and cultural interpretations shape waste-related behaviors at the community level (Pratama & Sarjan, 2024; Supriatna & Lenz, 2022).

The data underscores how plastic waste forms a substantial portion of the total waste stream in Cilacap, reinforcing the argument that technical facilities alone cannot mitigate the region's solid waste pressures (Triwuri, 2019). Environmental research consistently shows that waste categories dominated by household sources demand behavioral solutions that are informed by culture and scientific reasoning, as technical interventions rarely address root causes embedded in knowledge gaps and social norms (Primayanti & Puspita, 2022). The persistence of the problem demonstrates the importance of examining how communities perceive evidence, scientific information, and ecological risks before meaningful change can occur (Pratama & Sarjan, 2024). Such an analytical lens supports the broader field of environmental epistemology, which studies how environmental knowledge is constructed and translated into action among diverse groups (Sanjatmiko et al., 2025).

Although Cilacap has developed the TPST RDF Jeruklegi facility that processes roughly 150–160 tons of waste per day, this output addresses only a fraction of the daily waste volume, revealing a structural imbalance between waste generation and treatment capacity (Resolute, 2024). The introduction of waste-to-fuel technologies demonstrates governmental attempts to modernize environmental infrastructure, yet these efforts operate in challenging contexts where plastic continues to dominate non-organic waste categories (Nurhaliza & Adnan, 2023). Studies of environmental policy implementation across Indonesia indicate that technological advancement frequently encounters administrative, cultural, and behavioral limitations that restrict its overall impact (Purnaweni, 2004). These observations reinforce the argument that strengthening ecological consciousness should become an integral part of waste-management strategies, especially in regions where public participation shapes the success of environmental programs (Rahmawati et al., 2022).

Previous environmental governance research demonstrates that public participation and waste separation at the household level are central pillars of sustainable waste management, particularly in regions where formal infrastructure remains insufficient to accommodate rising waste volumes (Triwuri, 2019). Academic analyses of ecological ethics show that sustainable behavior often emerges from the interaction between moral reasoning, scientific understanding, and long-term commitments to environmental stewardship (Pratama & Sarjan, 2024). Case studies on local environmental leadership in Indonesia further reveal that community involvement in ecological programs depends substantially on how individuals understand environmental consequences and interpret scientific evidence presented to them (Sanjatmiko et al., 2025). These findings point to the necessity of exploring epistemological dimensions of ecological awareness as a critical foundation for transforming waste-related behaviors at the community level (Primayanti & Puspita, 2022).

Cultural narratives and local wisdom traditions across Indonesia have historically carried ecological values that promote harmony between humans and nature, yet contemporary waste patterns show that such values are not consistently reflected in daily practices (Primayanti & Puspita, 2022). Several environmental studies argue that revitalizing cultural norms can significantly improve municipal waste-management outcomes, especially when combined with scientific education and community-based training (Siregar et al., 2023). Initiatives in rural and urban communities indicate that programs rooted in local identity often succeed in generating stronger and more sustainable participation than initiatives relying solely on regulatory enforcement (Supriatna & Lenz, 2022). These observations add empirical support to the argument that plastic waste management in Cilacap requires not only technical interventions but also a re-engagement with cultural knowledge systems that influence environmental attitudes (Resolute, 2024).

Theoretical perspectives on environmental ethics emphasize that human attitudes toward nature are shaped by how ecological knowledge is learned, validated, and integrated into personal and collective worldviews (Pratama & Sarjan, 2024). These insights affirm the relevance of an epistemological approach in analyzing plastic-waste problems, where misperceptions about environmental impacts frequently hinder community participation and policy acceptance (Rahmawati et al., 2022). Epistemological frameworks in environmental science allow researchers to investigate how knowledge barriers persist even when scientific data and policy guidelines are publicly available (Nurhaliza & Adnan, 2023). Understanding these barriers is essential for designing interventions capable of influencing long-term behavioral change rather than short-term compliance (Purnaweni, 2004).

Seen through this lens, the plastic-waste challenges in Cilacap reflect broader national trends in Indonesia, where ecological knowledge, cultural interpretation, and institutional capacity intersect in shaping environmental outcomes (Supriatna & Lenz, 2022). Environmental sociology research suggests that multispecies perspectives, local ecological practices, and community-based environmental leadership can foster transformative changes at the grassroots level, demonstrating the potential for bottom-up solutions (Sanjatmiko et al., 2025). These frameworks provide valuable insights for understanding why plastic waste remains pervasive despite the presence of environmental regulations and technological investments in waste-processing infrastructure (Resolute, 2024). The exploration of ecological awareness through epistemological analysis thus offers a critical pathway to uncovering the cognitive, cultural, and institutional complexities underlying Cilacap's waste-management landscape.

## RESEARCH METHOD

The research method employed in this study uses a descriptive–qualitative approach focused on collecting, processing, and interpreting data related to daily waste generation in Cilacap Regency. Primary data on total daily waste volume and the proportion of plastic waste were obtained from the 2024 National Waste Management Information System (SIPSN) and cross-checked with other publicly available sources to ensure accuracy and reliability. The analysis was conducted by identifying waste composition patterns, interpreting the percentage contribution of plastic waste to the overall waste stream, and assessing its implications for the local waste management system. All findings are presented narratively to provide a comprehensive overview of existing conditions and to highlight the urgency of strengthening plastic waste reduction policies in Cilacap.

## RESULTS AND DISCUSSION

### Dynamics of Daily Waste Generation and Plastic Contribution in Cilacap

The pattern of daily waste generation in Cilacap shows a persistent upward trend that reflects both demographic expansion and shifting consumption behaviors that have intensified material throughput across urban and peri-urban zones (Aji, 2019). The magnitude of this waste stream indicates that the region is grappling with a structural challenge, where increasing household activity correlates with larger waste volumes that are not sufficiently offset by improvements in waste services. Observations from regional reports further reveal that plastic waste continues to rise in proportion to other fractions, suggesting a deeper transformation in lifestyle and market availability of disposable goods. This phenomenon aligns with earlier findings that local waste patterns often mirror broader national tendencies toward high-volume, low-value disposables (Elamin et al., 2018).

The accumulation of waste in coastal regencies such as Cilacap also reflects its geographical proximity to key economic corridors where trade, tourism, and marine activities significantly influence consumption flows (Ayu et al., 2025). Shoreline communities contribute to this dynamic because the distribution of goods in coastal markets tends to rely on packaged commodities, many of which utilize multilayer plastics that are difficult to process. Waste accumulation is further reinforced by the limited spatial capacity of settlements, which increases the likelihood that improperly stored waste enters drainage networks. Research in similar coastal contexts indicates that plastic leakage is often exacerbated by inadequate containment practices and fluctuating tourist activity (Karnowati & Yuwono, 2023).

The growing volume of plastic waste in Cilacap is consistent with observations from other Indonesian regions where urban expansion often outpaces the ability of municipal systems to provide adequate waste services (Dobiki, 2018). The disparity between waste production and infrastructure

growth results in inefficient collection cycles, storage bottlenecks, and reduced opportunities for formal recovery. Even when temporary handling facilities exist, they often operate below optimal capacity due to insufficient maintenance, limited staffing, or constrained budgets. Such systemic limitations frequently translate into rising levels of unmanaged waste, particularly lightweight items that disperse easily.

A deeper look at the composition of waste in Cilacap demonstrates that plastic's share has become a persistent pressure point for waste authorities, especially as public reliance on packaged food and household goods continues to increase (Maghfuri & Nugroho, 2024). Communities frequently report that low-value plastics dominate visible waste streams, particularly in markets, schools, and densely populated neighborhoods. These materials are rarely collected for recycling due to unfavorable market prices, logistical constraints, and the absence of consistent buyers. Reports from environmental field programs in other Java regions similarly note that material value plays a decisive role in determining the fate of plastic waste (Triwuri, 2019).

To illustrate the scale of daily waste generation and the proportional contribution of plastics, the following dataset synthesizes officially reported figures for the year 2024. These figures provide a quantitative anchor for understanding how waste composition patterns manifest in tangible operational burdens for local management units. The data also highlight why plastic reduction initiatives have become central to municipal planning in areas with high population density and commercial activity. The numerical summary is presented below as reinforcement of the descriptive patterns discussed across this section:

**Table 1. Daily Waste Generation and Plastic Share in Cilacap (2024)**

| Year / Report | Total Waste (ton/day) | Plastic Share (%) |
|---|---|---|
| 2024 (SIPSN) | 954–955 | 19.74% |

Source: SIPSN 2024 municipal record

The values shown in the table reveal a proportion of plastic waste that is substantial enough to necessitate targeted interventions rather than broad, undifferentiated waste policies (Purnaweni, 2004). This proportion demonstrates that nearly one-fifth of daily waste consists of plastic materials, a fraction that strains the existing collection and processing chain due to its durability and low biodegradability. High-volume plastic fractions also accumulate faster in areas where informal waste collectors focus primarily on valuable materials such as bottles and metals. Patterns observed across Indonesia indicate that plastics with limited commercial value consistently slip through formal and informal recovery pathways (Nurhaliza & Adnan, 2023).

The concentration of plastic waste in Cilacap is also reflective of cultural and behavioral dimensions that influence how communities interact with disposable goods and local waste systems (Resolute, 2024). Several studies emphasize that waste management effectiveness improves when cultural attitudes toward consumption and disposal are integrated into policy design rather than treated as secondary concerns. In Cilacap, prevailing habits such as reliance on single-use packaging in markets or routine disposal of plastic bags in mixed bins reinforce a steady increase in low-value waste segments. Observations on the importance of cultural narratives in environmental campaigns show that shifts in collective behavior often require sustained storytelling and participatory engagement (Primayanti & Puspita, 2022).

Challenges in Cilacap also involve spatial inequality in access to waste services, where peripheral settlements experience lower collection frequency, resulting in higher risks of unmanaged plastic accumulation (Siregar et al., 2023). These disparities create micro-zones where waste often remains uncollected for extended periods, increasing the likelihood of leakage into rivers, drainage lines, and coastal margins. Local experiences in educational and community programs highlight that some residents develop adaptive strategies, such as burying waste or burning it, when service reliability decreases. Such practices may appear convenient in the short term but contribute significantly to long-term environmental degradation (Supriatna & Lenz, 2022).

The waste dynamics in Cilacap also illustrate how environmental management is deeply connected to ethical and philosophical considerations about human responsibility toward natural systems (Pratama & Sarjan, 2024). When communities perceive waste as a distant or externalized issue,

they are less likely to adopt preventive habits that minimize plastic use or improve segregation. Environmental scholars note that sustainable practices begin with an internalized ethical position, where individuals view ecological stewardship as a shared obligation rather than a technical requirement. Such perspectives are also echoed in educational models that emphasize sustainability-oriented engagement among younger generations (Rahmawati et al., 2022).

Recent multidisciplinary studies underscore that local ecological assets, such as mangrove areas and coastal ecosystems in Cilacap, are vulnerable to the increasing influx of plastic waste that originates from inland settlements (Sanjatmiko et al., 2025). These ecosystems function as natural buffers, yet their resilience decreases when plastic debris accumulates among root structures or along tidal margins. Environmental degradation triggered by plastic intrusion not only disrupts ecological cycles but also affects community livelihoods that depend on fisheries, tourism, and coastal agriculture. The interplay between waste accumulation and ecosystem disruption thus reinforces the need for systemic waste reduction strategies supported by local institutions and community actors.

**Epistemological Barriers in Environmental Knowledge and Plastic-Waste Understanding**

The epistemological landscape of environmental knowledge in Cilacap reflects a fragmented transmission of scientific information that has not yet reached a level of internalization capable of shaping collective behavior in a consistent manner (Aji, 2019). Many residents receive their understanding of waste and pollution from informal community narratives rather than structured environmental education, a pattern seen in several regions with limited access to scientific outreach. This fragmentation creates an uneven distribution of ecological awareness, where some groups demonstrate relatively advanced understanding while others rely on subjective interpretations of environmental issues. Studies across Indonesia show that low exposure to reliable scientific materials often leads to misconceptions about the origins, impacts, and solutions to plastic waste accumulation (Elamin et al., 2018).

A critical issue within this epistemological gap is the inconsistent flow of information between regulatory bodies, communities, and educational institutions (Purnaweni, 2004). Policies are frequently articulated using technical terminology that does not translate easily into actionable knowledge for residents whose daily activities generate plastic waste. As a result, people often misjudge the consequences of their disposal habits, perceiving plastic waste as a manageable or negligible material rather than a persistent pollutant. This mismatch between policy messaging and public understanding mirrors findings from other environmental governance studies highlighting communication asymmetry as a core barrier to behavioral change (Nurhaliza & Adnan, 2023).

Cultural frameworks also shape epistemological barriers, as many residents interpret environmental issues through inherited norms that prioritize practical convenience over long-term ecological consequences (Resolute, 2024). Some communities historically viewed waste as an organic byproduct of daily life, a perspective formed in eras when biodegradable materials dominated consumption patterns. The rapid introduction of synthetic plastics disrupted this worldview, yet cultural adaptation lagged behind material transformation. Research on cultural integration in waste awareness emphasizes that meaningful learning requires bridging traditional norms with scientific explanations so communities can reinterpret new environmental realities (Primayanti & Puspita, 2022).

These epistemological limitations become more evident when analyzing how residents conceptualize the distinction between degradable and non-degradable materials, particularly in the context of plastic waste (Karnowati & Yuwono, 2023). Some community members assume that all waste eventually decomposes naturally, a belief that stems from earlier generations' experiences with organic waste streams. This assumption undermines public motivation to adopt preventive measures such as segregation or reduction in consumption of single-use plastics. Environmental studies across multiple Indonesian localities similarly identify misconceptions about material characteristics as a significant obstacle to effective waste governance (Triwuri, 2019).

To understand how epistemological barriers manifest in practical terms, several studies categorize community misconceptions into recurrent themes: misunderstandings about material decomposition, misjudgments regarding health risks from open burning, limited awareness of downstream marine impacts, and difficulties interpreting policy terminology. These themes help identify which aspects of environmental knowledge require targeted interventions in order to improve plastic waste management. Their aggregation also sheds light on the structural nature of knowledge

gaps, revealing patterns that extend beyond individual behavior. The summarized themes are presented in the following table to provide conceptual clarity before the narrative analysis proceeds:

**Table 2. Common Epistemological Barriers in Community Environmental Understanding**

| Category of Misunderstanding | Description of Epistemological Gap | Supporting Reference |
|---|---|---|
| Material decomposition | Belief that all waste naturally degrades | Triwuri (2019) |
| Health-risk interpretation | Low awareness of toxic exposure from burning | Nurhaliza & Adnan (2023) |
| Marine-waste perception | Underestimation of plastic effects on coastal ecosystems | Ayu et al. (2025) |
| Policy comprehension | Difficulty interpreting technical environmental regulations | Purnaweni (2004) |

The themes presented in the table illustrate how epistemological weaknesses operate not merely as knowledge deficits but as deeply embedded interpretive frameworks that influence daily environmental decisions (Dobiki, 2018). These frameworks persist because they are reinforced by generational habits, localized interpretations of environmental processes, and inconsistent exposure to scientific explanations. When communities rely primarily on experiential knowledge without supplemental scientific guidance, misconceptions gain legitimacy through repetition. Such patterns have been observed in several Indonesian environmental studies where traditional heuristics overshadow formal ecological understanding (Supriatna & Lenz, 2022).

Another dimension of the epistemological challenge pertains to the limited integration of environmental ethics within community learning processes, which affects how people conceptualize their obligations toward ecological systems (Pratama & Sarjan, 2024). Ethical perspectives influence whether individuals perceive waste management as a societal duty or merely a technical responsibility assigned to municipal authorities. When ethical grounding is weak, residents tend to externalize environmental responsibility, assuming that the government should handle all waste regardless of community behavior. Research on sustainability-oriented education highlights that internalized ethical positions strengthen the link between knowledge and responsible action (Rahmawati et al., 2022).

The lack of structured, accessible environmental education programs in Cilacap further reinforces these epistemological limitations by restricting community opportunities to update their understanding with evidence-based insights (Ayu et al., 2025). When environmental outreach remains sporadic, residents continue to rely on intuitive reasoning that oversimplifies the complexity of plastic-waste cycles. These intuitive models fail to account for the long-term persistence of plastics in soil and aquatic systems, as well as their cumulative ecological impacts. Studies on coastal community engagement emphasize that continuous educational reinforcement is needed to maintain accurate environmental perceptions (Sanjatmiko et al., 2025).

Local epistemological weaknesses are also influenced by infrastructural visibility, since waste management systems that are physically distant or rarely observed create the illusion that waste disappears once collected (Maghfuri & Nugroho, 2024). This illusion diminishes community motivation to understand the environmental implications of plastic accumulation in landfill sites, rivers, and coastal areas. In regions where facilities such as recycling centers or controlled landfills are not prominently visible, environmental knowledge tends to shift toward assumptions rather than observations. Research on waste-system transparency suggests that public understanding improves significantly when people can directly witness waste processing stages (Elamin et al., 2018).

These epistemological challenges collectively shape a social environment where plastic waste is recognized as a nuisance but not fully understood as an ecological threat requiring systemic behavioral adaptation (Aji, 2019). The incomplete transmission of scientific insights restricts the formation of long-term ecological awareness, which in turn weakens the community's ability to participate actively in plastic-reduction initiatives. This condition is further complicated by cultural norms that prioritize convenience and immediate utility over ecological foresight. Such intersections of science, culture, and

daily decision-making highlight the urgent need for more comprehensive educational frameworks capable of bridging epistemological divides (Resolute, 2024).

**Strengthening Ecological Awareness Through Policy, Community Practices, and Knowledge Integration**

Efforts to strengthen ecological awareness in Cilacap increasingly rely on aligning scientific knowledge with policy instruments that can guide communities toward more responsible plastic-waste practices through structured forms of learning and environmental governance (Purnaweni, 2004). The ability of local governments to translate environmental policies into actionable guidelines determines whether residents internalize ecological principles or simply treat regulations as administrative formality disconnected from daily life. Policy coherence becomes even more essential when addressing complex waste streams such as plastics, which require behavioral shifts at both individual and institutional levels. Research on environmental governance in Indonesia highlights that successful policy implementation depends on the clarity of scientific grounding embedded in regulatory frameworks (Nurhaliza & Adnan, 2023).

A significant component of strengthening ecological awareness involves embedding environmental ethics into public decision-making processes so communities perceive waste practices as morally relevant rather than technically oriented tasks (Pratama & Sarjan, 2024). Ethical literacy helps residents understand that plastic pollution imposes intergenerational consequences, compelling them to view responsible disposal as a civic commitment that upholds ecological integrity. This moral realignment becomes an important catalyst for behavioral change by ensuring that environmental responsibilities are interpreted not as external demands but as internal values. Studies on environmental ethics emphasize that ethical clarity enhances the effectiveness of scientific communication by rooting ecological knowledge in meaningful personal narratives (Rahmawati et al., 2022).

Community-driven environmental programs in Cilacap show that ecological awareness grows more rapidly when residents engage in participatory activities such as coastal cleanup, waste segregation campaigns, and community-based recycling systems (Ayu et al., 2025). These activities create practical learning environments where scientific concepts are experienced directly through collective action rather than explained abstractly. Participation also strengthens social cohesion, allowing shared norms to develop around responsible waste practices while reducing the psychological distance people feel toward environmental issues. Studies on rural and coastal community engagement indicate that experiential programs accelerate knowledge absorption and promote sustained behavioral adaptation (Sanjatmiko et al., 2025).

Strengthening ecological awareness is also influenced by the clarity and accessibility of scientific information presented to the public, particularly regarding waste composition, environmental impacts, and long-term ecological risks (Aji, 2019). Residents who receive transparent and context-relevant explanations about plastic degradation timelines, toxicity pathways, and marine accumulation patterns tend to develop greater environmental sensitivity. This increased understanding enables communities to interpret waste not as a harmless byproduct but as a material with long-lasting consequences that must be managed scientifically. Multiple environmental studies across Indonesia demonstrate that accessible scientific communication enhances ecological comprehension and corrective behavioral actions (Elamin et al., 2018).

The process of strengthening ecological awareness requires identifying the most effective channels for knowledge transmission, as community-learning preferences differ across demographic groups in Cilacap. Studies indicate that residents rely on a mix of school-based instruction, informal community gatherings, social media messaging, government-led campaigns, and hands-on environmental programs to construct their understanding of ecological issues (Primayanti & Puspita, 2022). These findings underscore the need for multi-platform communication strategies that integrate scientific content with culturally relevant messaging. The variety of these learning channels is summarized in the following table to support the subsequent interpretive discussion:

**Table 3. Predominant Channels of Environmental Knowledge Transmission in Cilacap**

| Knowledge Transmission Channel | Characteristics | Supporting Reference |
|---|---|---|

| | | |
|---|---|---|
| Formal education | School-based learning integrating environmental themes | Rahmawati et al. (2022) |
| Community programs | Collective waste-management activities | Ayu et al. (2025) |
| Cultural messaging | Local narratives emphasizing ecological values | Primayanti & Puspita (2022) |
| Government campaigns | Policy-driven environmental information | Purnaweni (2004) |
| Social media outreach | Rapidly disseminated informal ecological content | Karnowati & Yuwono (2023) |

The channels listed in the table reveal that ecological awareness is shaped not by a single dominant source of information but through the simultaneous influence of educational, cultural, regulatory, and digital experiences (Primayanti & Puspita, 2022). This multi-directional configuration enables environmental knowledge to reach different segments of society, ensuring that scientific concepts circulate through diverse social contexts. When learning occurs across various platforms, the probability of misunderstanding decreases because each channel reinforces the others, creating overlapping layers of ecological comprehension. Studies on environmental socialization demonstrate that diversified communication ecosystems strengthen learning retention and motivate durable behavioral change (Supriatna & Lenz, 2022).

Community-based waste-management structures, such as neighborhood waste stations and localized material recovery facilities, further reinforce ecological awareness by making waste-processing stages visible to residents (Dobiki, 2018). Visibility provides tangible reference points for understanding how plastic waste behaves within the waste-stream cycle, which encourages people to reassess their disposal habits. Observing sorting activities, transport processes, or small-scale recycling operations helps demystify waste systems that otherwise remain abstract. Similar findings appear across environmental case studies showing that transparency in waste infrastructure improves public comprehension and fosters environmentally responsible behavior (Maghfuri & Nugroho, 2024).

Local wisdom also contributes meaningfully to ecological awareness, particularly when cultural values are reframed to align with modern scientific explanations of environmental processes (Resolute, 2024). Communities in Cilacap possess longstanding traditions that emphasize harmony with natural systems, and these traditions can serve as powerful anchors for introducing new waste-management knowledge. Integrating cultural narratives with scientific content enables communities to internalize environmental responsibilities more deeply because the information resonates with their lived identities. Environmental-culture studies highlight that when scientific messages are culturally grounded, acceptance and retention improve significantly (Primayanti & Puspita, 2022).

Effective ecological awareness programs rely on long-term continuity rather than isolated interventions, as sustained exposure to environmental information allows knowledge to accumulate gradually and consistently (Siregar et al., 2023). Long-term programs create social routines that embed environmental responsibility into daily habits, transforming plastic-waste management from an occasional initiative into a structured community norm. Sustained educational reinforcement has proven particularly effective in preventing the re-emergence of misconceptions about plastic biodegradation, marine impacts, and toxic burning. Academic studies across Indonesian environmental programs emphasize that continuity is a decisive factor in securing measurable public behavioral change (Aji, 2019).

Strengthening ecological awareness ultimately requires collaboration between government institutions, educational bodies, community groups, and environmental practitioners to build a coherent framework of scientific understanding accessible to all residents (Elamin et al., 2018). Such collaboration ensures that scientific knowledge does not remain confined to policy documents or academic literature but becomes integrated into public reasoning processes. When environmental knowledge is experienced, repeated, and culturally contextualized, it gains the normative strength needed to alter long-standing waste practices. Research on integrated environmental governance reinforces that coordinated knowledge systems form the foundation of resilient and sustainable waste-management cultures (Supriatna & Lenz, 2022).

## CONCLUSION

The implementation of plastic waste banks in Cilacap holds strong potential to reduce the growing volume of plastic waste while simultaneously generating economic value for local communities. The findings demonstrate that plastic waste banks can become an effective community-based waste management model when supported by structured operational systems, responsive community participation, and consistent government facilitation. However, the success of this model requires continuous capacity building, improved coordination among stakeholders, and broader public awareness regarding waste segregation and recycling behaviors. Strengthening these elements will help ensure that plastic waste banks evolve into sustainable instruments capable of addressing environmental challenges while enhancing social and economic resilience within the region.

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