

Collaborative Communication of Environmental Activists in Addressing Waste Management Issues in South Tangerang

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Abstract

This study analyzes the effective collaborative communication model among environmental activists addressing waste management issues in Ciputat Subdistrict, South Tangerang. Using a qualitative case study approach, data were collected through in-depth interviews, participatory observation, and document analysis, supplemented by Participatory Action Research (PAR) techniques. Social network analysis was conducted to map interactions among 42 stakeholders. Key findings reveal that actors with low Constraint and high EgoBet, such as the Head of the Environmental Office, Subdistrict Heads, and key community leaders, hold significant influence and control within the social network, facilitating communication and coordination. However, challenges include uneven group involvement, imbalanced role distribution, limited access to information, and insufficient consultation. Recommendations include increasing the engagement of less active groups, redistributing roles more equitably, enhancing transparency and information access, and strengthening expert consultation. These strategies are essential for improving collaborative communication and achieving a more integrated and sustainable waste management system.

Keywords: Collaborative Communication, Waste Management, Environmental Activists, Social Network Analysis, Participatory Action Research

INTRODUCTION

South Tangerang faces significant environmental issues, particularly in waste management. Currently, the daily waste volume generated by the residents reaches approximately 1,500 tons, but the Cipeucang landfill, the only one available, has a capacity of only 880 tons per day. Consequently, the landfill has exceeded its capacity, leading to waste being improperly managed and disposed of in unsuitable locations (Shahreza et al., 2022). The city has implemented various waste management initiatives, including the 3R (Reuse, Reduce, and Recycle) approach with the establishment of Temporary Disposal Sites (TPS) as part of strategic government programs fully funded by the city budget (Samin, 2022).

Additionally, community initiatives have emerged, such as the establishment of waste banks, composting, eco-enzyme utilization, and maggot cultivation for waste management. These efforts aim to empower the community through innovative waste management techniques like Black Soldier Fly bioconversion (Asropi et al., 2023). Efforts have also been made to develop information systems like the SampahQu mobile app, which engages waste collectors, waste bank managers, and individuals in the process (Rahayu et al., 2023).

Waste management remains a major environmental challenge in urban areas, including Ciputat Subdistrict, South Tangerang City (Jaswita & Maharani, 2023). With rapid population growth and increasing consumption patterns, waste volume continues to rise (Voukkali et al., 2023). Inefficient waste management often results in negative environmental impacts, such as pollution, increased health risks, and ecosystem damage. Community-based waste bank movements have encouraged community participation and empowerment by educating and habituating waste segregation at the household level (Fatmawati et al., 2022). Since 2013, the waste bank community in South Tangerang has grown, with 230 waste banks established as of April 21, 2019, according to the South Tangerang Environmental Agency (DLH), but only 115 (50%) are actively reporting and saving waste monthly. In the midst of these complexities, a community of environmental activists

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emerged in 2020 in Ciputat Subdistrict, playing a crucial role in building collaboration among stakeholders in waste management.

Collaborative communication among environmental activists is key to achieving sustainable solutions for waste management in Ciputat. Effective coordination among individuals, groups, and organizations concerned with the environment opens up opportunities to identify holistic, community-based solutions (R. Sharma, 2023). Active participation from various parties is also foundational in raising awareness about the importance of environmentally friendly waste management practices and formulating policies that support the transformation towards a more sustainable society (N. Nmere et al., 2020).

Environmental activists play a vital role in addressing complex environmental issues faced by modern society. They advocate for the protection of biodiversity, clean water and air, healthy food, and the well-being of communities (Dimitriou & Christidou, 2011). Working with governments, NGOs, and judicial bodies, environmental activists combat pollution and other environmental diseases (Wenger & Yang, 2011). They are also involved in research initiatives and partnerships with universities and research institutions to better understand environmental health issues and identify solutions (Aldeia & Alves, 2019).

One of the activities in commemoration of Water, Earth, and Environment Day 2024 in Pondok Ranji Village, East Ciputat Subdistrict, South Tangerang, held on Saturday, June 8, 2024, exemplifies the synergy between environmental activists and the South Tangerang City Government, particularly the East Ciputat Subdistrict, Pondok Ranji Village, involving various community components such as neighborhood and community leaders, Family Welfare Empowerment, Women's Farmer Groups, Youth Organizations, Village Security, and Community Guidance Officers, Community Policing Advisor, Community of Fitness for Indonesian Elderly and Pre-Elderly, Educators and Managers of Reuse, Reduce, and Recycle Waste Management Sites, Educators and Managers of Waste Banks, Eco Enzyme, Ecobrick, Composters, Hydroponics, Recycling, Collection Points, Maggot Depots, Purnahayati Funeral Management Institution, Young Environmental Warriors, Sanitation Workers of the Environmental Service, Cemetery Managers and Grave Diggers, Community Self-Help Groups for Clean Water and other Community Members.

Environmental activist actions have been held in three subdistricts of South Tangerang City—Ciputat, Pamulang, and Serpong—starting from April to May 2024, focusing on neighborhood and community levels with activities such as communal work, tree planting, biopore creation, fish pond construction, and cleaning floating waste in rivers. The climax of the 2024 ABL Day celebration activities took place on June 8, 2024, in Pondok Ranji Village, East Ciputat.

Collaborative communication is considered essential in effectively addressing environmental issues as it facilitates information sharing, solution negotiation, and coordination among resource users and stakeholders (Andriollo et al., 2021). It helps build shared motivation and collective action, crucial for achieving agreements and resolving conflicts in natural resource management (Hossu et al., 2019). Through collaborative communication, stakeholders can overcome complex challenges in waste, cleanliness, and environmental management, leading to improved performance of individual and group environmental activists (Bodin, 2017).

Studies on environmental activists indicate that collaborative communication can facilitate cooperation among activists and other stakeholders by developing environmental communication strategies that involve all target groups and stakeholders (Biezina et al., 2019). This can be achieved through networking and collaboration, as demonstrated by the experience of Latvia's Environmental School (Gupta et al., 2017). Additionally, the use of environmental report cards can support adaptive management and encourage collaboration among stakeholders (Kung, 2017). Regular monitoring data and routine agendas related to national environmental days allow activists to continuously campaign on waste, cleanliness, and environmental issues to the public and engage stakeholders (Chygryn et al., 2020). Collaborative approaches that involve all stakeholders can lead to better community engagement, social learning, and improved decision-making in integrated environmental management (Grushina, 2017). Based on the background presented, this research aims to:

- 1) Analyze the effective collaborative communication models among environmental activists in waste management efforts.
- 2) Identify and analyze the barriers and challenges faced by environmental activists in collaborative communication for waste management.

LITERATURE REVIEW

Collaborative Communication

Collaborative communication is an interactive process where individuals or groups work together to achieve common goals through effective exchange of information, ideas, and resources (McClellan, 2023). The basic concept of collaborative communication includes active participation, transparency, and openness in sharing information (Akbar, 2021). It also encompasses aspects such as mutual trust, respect, and a commitment to consistently working together (AbouAssi et al., 2024). Fair and inclusive participation is crucial to ensure all voices are heard and valued in the decision-making process (Carrick et al., 2023). Advanced communication technologies, such as digital collaboration platforms, play a significant role in supporting effective communication in the digital era (Haleem et al., 2022).

Key elements of effective collaborative communication include trust, mutual respect, and a commitment to working together to achieve shared goals (Meredith et al., 2023). Characteristics of effective collaborative communication include clear and open communication channels, active listening skills, and the ability to resolve conflicts and find solutions beneficial to all parties involved (Schoon et al., 2021). Trust is built through consistency and reliability in communication, while mutual respect is gained through recognizing each member's contributions (Lansing et al., 2023). The ability to manage conflict constructively is also crucial for maintaining productive collaboration (Adham, 2023). Utilizing communication technologies such as email, video conferencing, and online collaboration platforms also helps facilitate communication and coordination among group members (Lal et al., 2023).

Waste Management

Waste management theories and concepts focus on a systematic and integrated approach to managing waste from its source to its disposal (Nguyen et al., 2023). According to the waste management hierarchy, the first step is source reduction, followed by recycling, energy recovery, and finally, safe disposal (El-Saadony et al., 2023). This hierarchy emphasizes the importance of reducing waste generation and maximizing the reuse of recyclable materials before considering other options (Singh & Hussain, 2021). Another relevant concept is the circular economy approach, which aims to maintain the value of products, materials, and resources in the economy for as long as possible by minimizing waste and continuously reusing materials (Velenturf & Purnell, 2021).

Sustainable waste management strategies and practices involve various methods designed to minimize the environmental impact of waste (Zhang et al., 2022). One key strategy is enhancing recycling infrastructure and waste separation at the source, which enables efficient processing of recyclable materials (Kurniawan et al., 2023). Additionally, practices such as organic composting can reduce the volume of waste sent to landfills and produce beneficial products for agriculture (Farhidi et al., 2022). According to the Global Waste Management Outlook (2022), the adoption of advanced technologies such as thermal treatment for energy recovery and biogas production from organic waste is becoming increasingly popular as a sustainable waste management solution (UNEP, 2024). Collaboration among government, the private sector, and communities is crucial to support these initiatives and ensure long-term sustainability in waste management (Leal Filho et al., 2024).

Environmental Activists

Environmental activists play a crucial role in society by advocating for and implementing practices aimed at protecting and improving environmental conditions (Kefeli et al., 2023). They act as agents of change, educating the public about environmental issues, encouraging public participation in environmental activities, and collaborating with governments and other organizations to develop sustainable policies and programs (N.

Sharma et al., 2023). Environmental activists are often the primary initiators of recycling campaigns, waste reduction programs, and other green initiatives that focus on raising awareness and promoting community action towards environmental stewardship (Meng et al., 2023). Moreover, they are involved in researching and developing innovative solutions to address complex environmental problems, such as eco-friendly waste management technologies and nature conservation projects (Schwartz et al., 2023).

A case study of environmental activists addressing waste management issues can be seen in the initiatives undertaken by the "Bank Sampah" community in Indonesia (van Leeuwen & Surya, 2024). Bank Sampah is a non-profit organization founded by a group of environmental activists with the aim of reducing the volume of waste ending up in landfills through participatory recycling programs (Ismiraj et al., 2023). The community has successfully engaged thousands of households in waste separation at the source and educated the public on the importance of recycling (Budiyarto et al., 2024). As a result, the volume of waste sent to landfills has significantly decreased, and recyclable materials can be sold to generate income for the community (Anshassi & Townsend, 2023). The success of Bank Sampah demonstrates how environmental activists can significantly contribute to waste management solutions through innovative and participatory approaches (Yandri et al., 2023).

METHODOLOGY

This research employs a qualitative approach with a case study as its primary method. The case study method was chosen because it allows for an in-depth exploration of the phenomenon of collaborative communication among environmental activists in a specific context, namely Ciputat District, South Tangerang (Priya, 2021). Case studies provide flexibility in collecting data from various sources and offer a comprehensive picture of the dynamics and complexities of the issue being studied (Paparini et al., 2021). The qualitative approach enables researchers to deeply understand the experiences, perceptions, and practices of environmental activists, which cannot be captured through quantitative methods (Natali, 2024).

The research is conducted in Ciputat District, South Tangerang, chosen due to its significant waste management issues and various initiatives by local environmental activists. The subjects of the study include environmental activists, community members, and related organizations involved in addressing waste management problems in this area. Focusing on these subjects allows the researcher to identify the various roles and contributions of environmental activists, as well as their interactions in collaborative efforts to tackle waste issues. According to Dada et al. (2023), selecting an appropriate location and subjects is crucial to ensuring the relevance and depth of the collected data.

The data collection techniques in this research include in-depth interviews, participatory observation, and analysis of relevant documents and archives. Additionally, the research employs Participatory Action Research (PAR), a research approach that involves the active participation of the subjects in all stages of the research, from planning to evaluation (Feekery, 2024). Data collection techniques involve participatory observation, individual and group in-depth interviews, and document studies (Wallwey & Kajfez, 2023). Key and supporting informants include local government officials, community leaders, environmental activist communities, local recycling entrepreneurs, and local residents involved in collaborative waste management activities in Ciputat District, South Tangerang. The PAR approach enables the researcher to obtain rich data and triangulate various information sources to enhance the validity of the findings (Ritter et al., 2023).

In addition to these techniques, the researcher also observes the relationships and interactions among 42 stakeholders (nodes), including individuals, groups, organizations, companies, and institutions (Table 1). Communication network analysis is conducted using Ucinet 6 for Windows and developed with Social Network Visualizer to model the collaborative communication carried out by the environmental activist community with all stakeholders in waste management (Majeed et al., 2020). The data analysis is performed in two stages: 1) Structural Gap Analysis: This concept describes the unique position of an ego actor relative to alters (Duygan et al., 2021). Actors positioned in structural gaps are characterized by the absence of constraints and minimal redundancy in relationships among alters. Consequently, these actors can control and create dependencies among alters. Actors in structural gaps can connect with all other actors in the network; 2) Brokerage Analysis: This analysis aims to identify which ego actors act as brokers among alters and what

types of brokerage roles they play (Becker & Bodin, 2022). The brokerage analysis used by UCINET calculates five types of brokers: coordinator, consultant, representative, gatekeeper, and liaison.

Table 1: The Role of Actors in Waste Management Collaboration and Strategy in South Tangerang

| Code | Actor | Role in Waste Management | Flow Category | Node |
|------|--|--|---------------|------------|
| 1 | Mayor | Formulates policies and regulations related to city waste management. | Top-down | Individual |
| 2 | Head of the Environmental Service | Oversees the implementation of environmental policies and waste management. | Top-down | Individual |
| 3 | Head of the Sanitation and Waste Management Department | Manages the cleaning and waste processing system. | Top-down | Individual |
| 4 | Head of the Housing, Spatial Planning, and Settlement Department | Integrates waste management into spatial planning and housing. | Top-down | Individual |
| 5 | Head of the Cooperative, Micro, Small, and Medium Enterprises Department | Supports small and medium enterprises in waste processing and recycling. | Top-down | Individual |
| 6 | Sub-District Head | Coordinates cleanliness and waste management programs at the sub-district level. | Top-down | Individual |
| 7 | Chief of Police (Sector Level) | Ensures security and order related to the implementation of waste management programs. | Top-down | Individual |
| 8 | Military District Commander | Supports logistics and resources in waste management if needed. | Top-down | Individual |
| 9 | Chairman of the Community Association | Mobilizes the community in community-based waste management activities. | Bottom-up | Individual |
| 10 | Village Head | Oversees and encourages village residents' participation in cleanliness and waste management programs. | Top-down | Individual |
| 11 | Head of Cleanliness Division, Environmental Service | Manages city cleanliness operations. | Top-down | Individual |
| 12 | Head of Community Partnership Division, Environmental Service | Coordinates partnerships with the community in waste management. | Top-down | Individual |
| 13 | Head of Cemetery and Land Affairs Division | Manages waste in cemetery and city land areas. | Top-down | Individual |
| 14 | Sub-District Staff | Implements cleanliness programs at the sub-district level. | Top-down | Individual |
| 15 | Village Staff | Implements cleanliness programs at the village level. | Top-down | Individual |
| 16 | Waste Bank Educator | Provides education on waste management and waste bank operations. | Bottom-up | Individual |

| | | | | |
|----|---|---|-----------|-------------|
| 17 | 3R (Reduce, Reuse, Recycle) Facility Educator | Educates the community on the importance of 3R in waste management. | Bottom-up | Individual |
| 18 | Neighborhood Association Leader | Leads waste management activities at the neighborhood level. | Bottom-up | Individual |
| 19 | Community Unit Leader | Coordinates waste management activities at the community unit level. | Bottom-up | Individual |
| 20 | Waste Bank Community | Manages and operates waste banks to recycle and reduce waste. | Bottom-up | Group |
| 21 | National Waste Bank Association | Supports and coordinates waste banks at the national level. | Bottom-up | Group |
| 22 | South Tangerang Waste Bank Association | Supports and coordinates waste banks at the city level in South Tangerang. | Bottom-up | Group |
| 23 | Urban Farming Group | Uses organic waste for compost in urban farming. | Bottom-up | Group |
| 24 | Women Farmers Group | Manages organic waste and recycles for agricultural activities. | Bottom-up | Group |
| 25 | Youth Organization | Mobilizes youth in waste management campaigns and actions. | Bottom-up | Group |
| 26 | Maggot Compost Facility | Processes organic waste using maggots to produce compost. | Bottom-up | Group |
| 27 | Street Sweepers, Environmental Service, South Tangerang City | Performs city cleaning and waste collection duties. | Top-down | Group |
| 28 | Cemetery/Tomb Area Management | Manages waste in cemetery areas. | Top-down | Group |
| 29 | Eco-Enzyme Activist | Uses organic waste to make eco-enzyme beneficial for the environment. | Bottom-up | Individual |
| 30 | Community Empowerment Institution | Mobilizes the community in various empowerment programs including waste management. | Top-down | Institution |
| 31 | Elderly and Pre-Elderly Fitness Group of Indonesia | Educates and involves the elderly in waste management activities. | Bottom-up | Group |
| 32 | Indonesian Waste Entrepreneurs Association | Supports entrepreneurs in the waste management industry. | Bottom-up | Corporation |
| 33 | Waste Collectors | Collects and recycles waste from the community. | Bottom-up | Corporation |
| 34 | Environmental Activist Community | Campaigns for the importance of waste management and environmental cleanliness. | Bottom-up | Group |
| 35 | Clean Water Community Group Communication Forum, South Tangerang City | Campaigns for proper waste management to maintain clean water quality. | Bottom-up | Group |
| 36 | Family Welfare Empowerment | Mobilizes families in household waste management activities. | Top-down | Institution |
| 37 | Military Village Supervisory Non-Commissioned Officer | Assists in implementing cleanliness programs in villages. | Top-down | Individual |

| | | | | |
|----|--|--|-----------|-------------|
| 38 | Community Police Officer | Oversees and ensures the implementation of waste management programs in the community. | Top-down | Individual |
| 39 | Funeral Service Management, Purnahayati | Manages waste generated from funeral activities. | Bottom-up | Institution |
| 40 | Young Environmental Warriors, South Tangerang City | Mobilizes youth in various environmental activities including waste management. | Top-down | Group |
| 41 | Environmental Experts and Academicians | Provides advice and solutions based on scientific research in waste management. | Top-down | Group |
| 42 | Key Community Movers | Inspires and leads the community in waste management activities. | Bottom-up | Individual |

The data analysis technique used is thematic analysis, which aims to identify patterns and key themes in the collected data (Naeem et al., 2023). Thematic analysis involves coding and grouping data based on emerging themes, facilitating the researcher's understanding of the structure and dynamics of collaborative communication among environmental activists (Wang & Ran, 2023). Additionally, data triangulation is conducted to ensure the validity and reliability of the findings. Triangulation involves using various data sources and collection methods to confirm research findings and reduce bias (Ahmed, 2024). This technique helps enhance the credibility of the research results and provides a more accurate depiction of the studied phenomenon (Younas et al., 2023).

RESULTS AND DISCUSSION

Collaborative Communication Model for Environmental Activists in Waste Management

Through network communication analysis using Ucinet 6 for Windows and Social Network Visualizer, this study identifies the collaborative communication model among 42 actors, including individuals, groups, organizations, companies, and institutions. Two stages of network analysis were conducted: structural gap analysis, which reveals the unique positions of actors who control and create dependencies among others, and broker analysis, which identifies the roles of actors as intermediaries in five types of brokers—coordinator, consultant, representative, gatekeeper, and liaison. The results demonstrate how these roles influence the effectiveness of collaboration in waste management in the region.

Table 2: The Results of Communication Network Analysis using Ucinet 6 for Windows

| Actor | Degree | EffSize | Efficiency | Constraint | Hierarchy | EgoBet | Ln(Constraint) | Indirects | Density | AvgDegree | Open Pairs |
|-------|--------|---------|------------|------------|-----------|---------|----------------|-----------|---------|-----------|------------|
| 1 | 8 | 2.25 | 0.281 | 0.433 | 0.017 | 2.333 | -0.836 | 0.844 | 0.821 | 5.75 | 10 |
| 2 | 25 | 19 | 0.76 | 0.19 | 0.257 | 148.233 | -1.66 | 0.8 | 0.25 | 6 | 450 |
| 3 | 7 | 1.286 | 0.184 | 0.49 | 0.002 | 0.333 | -0.713 | 0.85 | 0.952 | 5.714 | 2 |
| 4 | 7 | 1.286 | 0.184 | 0.49 | 0.002 | 0.333 | -0.713 | 0.85 | 0.952 | 5.714 | 2 |
| 5 | 6 | 1 | 0.167 | 0.56 | 0 | 0 | -0.579 | 0.833 | 1 | 5 | 0 |
| 6 | 28 | 21.929 | 0.783 | 0.165 | 0.238 | 214.5 | -1.8 | 0.802 | 0.225 | 6.071 | 586 |
| 7 | 8 | 2.75 | 0.344 | 0.43 | 0.024 | 3.533 | -0.844 | 0.831 | 0.75 | 5.25 | 14 |
| 8 | 8 | 2.75 | 0.344 | 0.43 | 0.024 | 3.533 | -0.844 | 0.831 | 0.75 | 5.25 | 14 |
| 9 | 3 | 1 | 0.333 | 0.926 | 0 | 0 | -0.077 | 0.667 | 1 | 2 | 0 |
| 10 | 10 | 6 | 0.6 | 0.35 | 0.113 | 20 | -1.05 | 0.757 | 0.444 | 4 | 50 |
| 11 | 4 | 1 | 0.25 | 0.766 | 0 | 0 | -0.267 | 0.75 | 1 | 3 | 0 |
| 12 | 6 | 1.333 | 0.222 | 0.555 | 0.004 | 0.4 | -0.588 | 0.822 | 0.933 | 4.667 | 2 |
| 13 | 4 | 1 | 0.25 | 0.766 | 0 | 0 | -0.267 | 0.75 | 1 | 3 | 0 |
| 14 | 3 | 1 | 0.333 | 0.926 | 0 | 0 | -0.077 | 0.667 | 1 | 2 | 0 |

| | | | | | | | | | | | |
|----|----|--------|-------|-------|-------|---------|--------|-------|-------|-------|------|
| 15 | 2 | 1 | 0.5 | 1.125 | 0 | 0 | 0.118 | 0.5 | 1 | 1 | 0 |
| 16 | 8 | 4.75 | 0.594 | 0.418 | 0.134 | 13.5 | -0.872 | 0.709 | 0.464 | 3.25 | 30 |
| 17 | 5 | 1.4 | 0.28 | 0.638 | 0.008 | 0.5 | -0.449 | 0.78 | 0.9 | 3.6 | 2 |
| 18 | 4 | 1 | 0.25 | 0.766 | 0 | 0 | -0.267 | 0.75 | 1 | 3 | 0 |
| 19 | 4 | 1 | 0.25 | 0.766 | 0 | 0 | -0.267 | 0.75 | 1 | 3 | 0 |
| 20 | 9 | 4.556 | 0.506 | 0.384 | 0.084 | 12.233 | -0.957 | 0.775 | 0.556 | 4.444 | 32 |
| 21 | 6 | 1.333 | 0.222 | 0.555 | 0.004 | 0.4 | -0.588 | 0.822 | 0.933 | 4.667 | 2 |
| 22 | 6 | 1.333 | 0.222 | 0.555 | 0.004 | 0.4 | -0.588 | 0.822 | 0.933 | 4.667 | 2 |
| 23 | 2 | 1 | 0.5 | 1.125 | 0 | 0 | 0.118 | 0.5 | 1 | 1 | 0 |
| 24 | 5 | 1.8 | 0.36 | 0.627 | 0.024 | 1.333 | -0.467 | 0.753 | 0.8 | 3.2 | 4 |
| 25 | 4 | 1 | 0.25 | 0.766 | 0 | 0 | -0.267 | 0.75 | 1 | 3 | 0 |
| 26 | 3 | 1 | 0.333 | 0.926 | 0 | 0 | -0.077 | 0.667 | 1 | 2 | 0 |
| 27 | 3 | 1 | 0.333 | 0.926 | 0 | 0 | -0.077 | 0.667 | 1 | 2 | 0 |
| 28 | 4 | 1.5 | 0.375 | 0.74 | 0.021 | 0.667 | -0.3 | 0.708 | 0.833 | 2.5 | 2 |
| 29 | 5 | 1.8 | 0.36 | 0.627 | 0.024 | 1.333 | -0.467 | 0.753 | 0.8 | 3.2 | 4 |
| 30 | 3 | 1 | 0.333 | 0.926 | 0 | 0 | -0.077 | 0.667 | 1 | 2 | 0 |
| 31 | 1 | 1 | 1 | | 1 | 0 | | 0 | | 0 | 0 |
| 32 | 5 | 2.6 | 0.52 | 0.599 | 0.078 | 3.667 | -0.513 | 0.677 | 0.6 | 2.4 | 8 |
| 33 | 3 | 1.667 | 0.556 | 0.84 | 0.074 | 1 | -0.175 | 0.556 | 0.667 | 1.333 | 2 |
| 34 | 31 | 35.488 | 0.866 | 0.121 | 0.281 | 725.467 | -2.116 | 0.753 | 0.138 | 5.512 | 1414 |
| 35 | 3 | 1 | 0.333 | 0.926 | 0 | 0 | -0.077 | 0.667 | 1 | 2 | 0 |
| 36 | 6 | 2.333 | 0.389 | 0.542 | 0.039 | 2.5 | -0.612 | 0.772 | 0.733 | 3.667 | 8 |
| 37 | 5 | 1 | 0.2 | 0.648 | 0 | 0 | -0.434 | 0.8 | 1 | 4 | 0 |
| 38 | 5 | 1 | 0.2 | 0.648 | 0 | 0 | -0.434 | 0.8 | 1 | 4 | 0 |
| 39 | 2 | 1 | 0.5 | 1.125 | 0 | 0 | 0.118 | 0.5 | 1 | 1 | 0 |
| 40 | 3 | 1 | 0.333 | 0.926 | 0 | 0 | -0.077 | 0.667 | 1 | 2 | 0 |
| 41 | 3 | 1 | 0.333 | 0.926 | 0 | 0 | -0.077 | 0.667 | 1 | 2 | 0 |
| 42 | 31 | 25.323 | 0.817 | 0.169 | 0.317 | 271 | -1.777 | 0.781 | 0.189 | 5.677 | 754 |

In the network analysis (Table 2), the concept of structural holes describes the unique position of an ego actor within the network relative to other actors (alters). This is characterized by minimal constraints and a low level of redundancy in relationships among the alters. Several actors stand out in this network, demonstrating the ability to control and create dependencies among other actors, as well as having significant influence within the network.

First, the Mayor has a high Degree value of 8, indicating a large number of connections with other actors in the network. Although the Constraint value of 0.433 suggests some obstacles in these relationships, the significant EgoBet value of 2.333 indicates that the Mayor still has substantial influence within the network. However, compared to other actors, the Mayor's position is not entirely free from constraints.

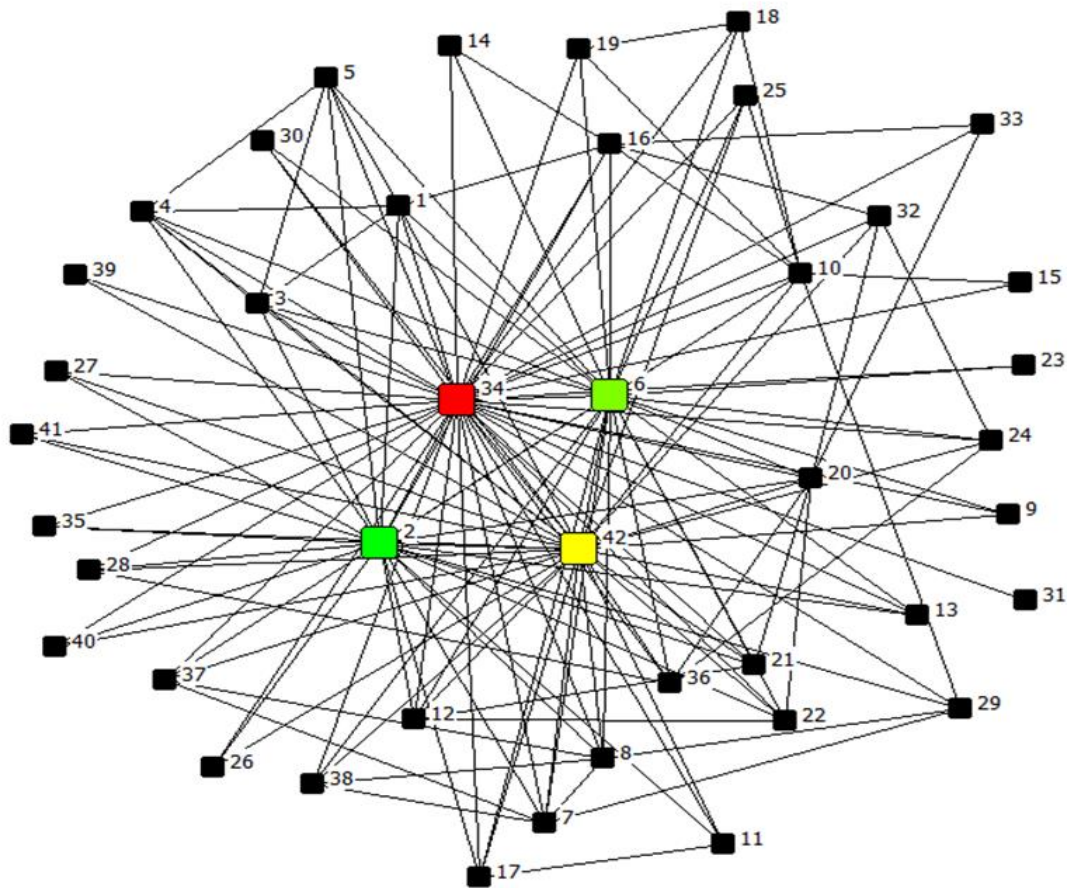


Figure 1: The Results of Communication Network Analysis of Actors in Waste Management (Proceed using Ucinet 6 for Windows)

Finally, the Key Community Movers also demonstrate a highly strategic position with a Degree value of 31 and a low Constraint value of 0.169. With an EgoBet value of 271, they have significant capacity to control the network and direct various other actors, creating dependencies among them and facilitating effective coordination.

Overall, actors such as the Head of the Environmental Agency, the Sub-district Head, Environmental Activist Communities, and Key Community Movers occupy strategically important structural holes. They face few obstacles in their relationships and can control and create dependencies among other actors in the network, giving them considerable influence in coordinating and mobilizing the network effectively.

Based on the brokerage analysis in Table 3, several actors play crucial intermediary or broker roles in the communication network among the various groups. These broker roles are classified into five types: coordinator, consultant, representative, gatekeeper, and liaison.

Coordinators are actors who connect members within the same group. In this context, some actors serving as coordinators are the Village Head, Sub-District Head, Waste Bank Community, Eco-Enzyme Activists, Head of the Environmental Agency, and Environmental Activist Community. They play a key role in maintaining cohesion and coordination within their groups, ensuring smooth information flow and activities without obstacles.

Table 3: The Results of Brokerage Analysis using Ucinet 6 for windows

| Actor | Coordinat | Gatekeeper | Represent | Consultan | Liaison | Total |
|-------|-----------|------------|-----------|-----------|---------|-------|
| 1 | 0 | 0 | 0 | 10 | 0 | 10 |
| 2 | 10 | 76 | 76 | 288 | 0 | 450 |
| 3 | 2 | 0 | 0 | 0 | 0 | 2 |
| 4 | 2 | 0 | 0 | 0 | 0 | 2 |
| 5 | 0 | 0 | 0 | 0 | 0 | 0 |
| 6 | 10 | 93 | 93 | 390 | 0 | 586 |
| 7 | 6 | 4 | 4 | 0 | 0 | 14 |
| 8 | 6 | 4 | 4 | 0 | 0 | 14 |
| 9 | 0 | 0 | 0 | 0 | 0 | 0 |
| 10 | 18 | 15 | 15 | 2 | 0 | 50 |
| 11 | 0 | 0 | 0 | 0 | 0 | 0 |
| 12 | 2 | 0 | 0 | 0 | 0 | 2 |
| 13 | 0 | 0 | 0 | 0 | 0 | 0 |
| 14 | 0 | 0 | 0 | 0 | 0 | 0 |
| 15 | 0 | 0 | 0 | 0 | 0 | 0 |
| 16 | 0 | 5 | 5 | 20 | 0 | 30 |
| 17 | 0 | 1 | 1 | 0 | 0 | 2 |
| 18 | 0 | 0 | 0 | 0 | 0 | 0 |
| 19 | 0 | 0 | 0 | 0 | 0 | 0 |
| 20 | 20 | 6 | 6 | 0 | 0 | 32 |
| 21 | 2 | 0 | 0 | 0 | 0 | 2 |
| 22 | 2 | 0 | 0 | 0 | 0 | 2 |
| 23 | 0 | 0 | 0 | 0 | 0 | 0 |
| 24 | 2 | 1 | 1 | 0 | 0 | 4 |
| 25 | 0 | 0 | 0 | 0 | 0 | 0 |
| 26 | 0 | 0 | 0 | 0 | 0 | 0 |
| 27 | 0 | 0 | 0 | 0 | 0 | 0 |
| 28 | 0 | 1 | 1 | 0 | 0 | 2 |
| 29 | 4 | 0 | 0 | 0 | 0 | 4 |
| 30 | 0 | 0 | 0 | 0 | 0 | 0 |
| 31 | 0 | 0 | 0 | 0 | 0 | 0 |
| 32 | 2 | 2 | 2 | 2 | 0 | 8 |
| 33 | 0 | 1 | 1 | 0 | 0 | 2 |
| 34 | 10 | 165 | 165 | 1074 | 0 | 1414 |
| 35 | 0 | 0 | 0 | 0 | 0 | 0 |
| 36 | 6 | 1 | 1 | 0 | 0 | 8 |
| 37 | 0 | 0 | 0 | 0 | 0 | 0 |
| 38 | 0 | 0 | 0 | 0 | 0 | 0 |
| 39 | 0 | 0 | 0 | 0 | 0 | 0 |
| 40 | 0 | 0 | 0 | 0 | 0 | 0 |
| 41 | 0 | 0 | 0 | 0 | 0 | 0 |

| | | | | | | |
|----|---|----|----|-----|---|-----|
| 42 | 0 | 68 | 68 | 618 | 0 | 754 |
|----|---|----|----|-----|---|-----|

Gatekeepers control the flow of information from outside the group to within the group. Actors in this role include Women's Farmer Group, Head of the Police Sector, District Military Commander, Village Head, Environmental Association Leader, Waste Collectors, Family Welfare Empowerment, Indonesian Waste Entrepreneurs Association, Cemetery Area Management, 3R Facility Educators, Sub-District Head, Waste Bank Educators, Head of the Environmental Agency, Environmental Activist Community, and Key Community Movers. They act as gatekeepers of incoming information, ensuring that only relevant and beneficial information is received by their group.

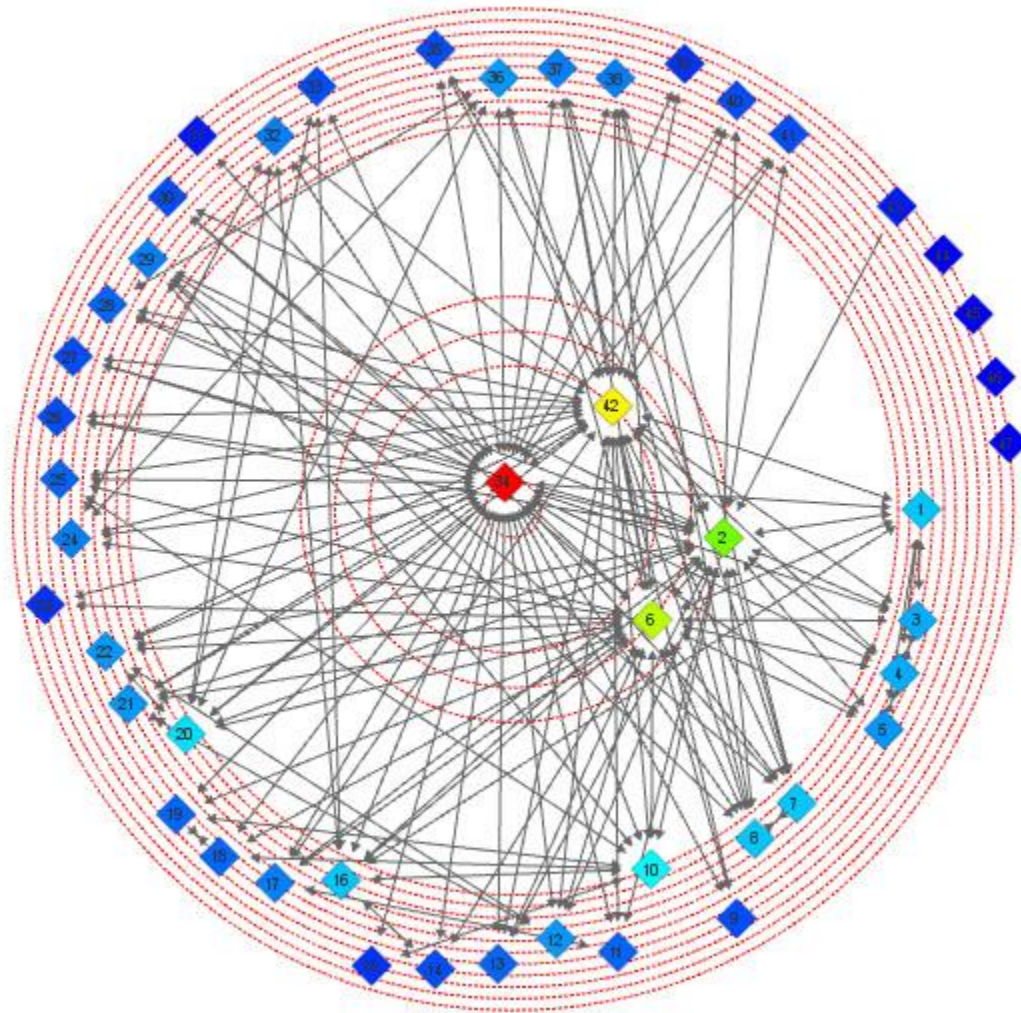


Figure 2: Four Key Brokerage Roles Across Various Actor Categories

(Proceed using Social Network Visualizer)

Representatives connect group members with external parties. Actors serving as representatives include Women's Farmer Group, Head of the Police Sector, District Military Commander, Village Head, Environmental Association Leader, Waste Collectors, Family Welfare Empowerment, Indonesian Waste Entrepreneurs Association, Cemetery Area Management, 3R Facility Educators, Sub-District Head, Waste Bank Educators, Head of the Environmental Agency, Environmental Activist Community, and Key Community Movers. They function as bridges linking their group with the outside world, introducing new ideas, and facilitating cooperation with other groups or institutions.

Consultants provide information to other groups without controlling the flow of that information. Some actors in this role include the Mayor, Sub-District Head, Head of the Environmental Agency, Environmental Activist Community, and Key Community Movers. They serve as sources of knowledge and advice, offering valuable guidance and recommendations to other groups.

Liaisons connect members of different groups. Actors in this role include the Sub-District Head, Head of the Environmental Agency, Environmental Activist Community, and Key Community Movers. They act as intermediaries between groups, ensuring effective communication and collaboration among different groups.

Overall, actors such as the Sub-District Head, Head of the Environmental Agency, Environmental Activist Community, and Key Community Movers play very important broker roles in various categories. They ensure good information flow, maintain intergroup relationships, and support coordination and collaboration among the involved parties. Additionally, the Village also plays significant roles as coordinator, gatekeeper, and representative in this communication network. This analysis helps identify key actors who facilitate communication and coordination both within and between groups.

Barriers and Challenges Faced by Environmental Activists

In the analysis of structural holes in the waste management network, several barriers and challenges affecting the effectiveness of collaborative communication have emerged. Although the Mayor has a high Degree value, indicating numerous connections with other actors in the network, their significant Constraint value suggests that there are obstacles in these relationships. This may limit the effectiveness of communication, as some connections might not be optimal or could be overly dependent on certain individuals or groups. Despite the Mayor's substantial influence, these challenges need to be addressed to ensure better coordination.

On the other hand, the Head of the Environmental Agency demonstrates a strategic position with a very high Degree and low Constraint, indicating minimal obstacles in relationships. However, the complexity of relationships involving many parties may present challenges in aligning goals and communication among actors with different interests. The significant influence of the Head of the Environmental Agency needs to be managed well to facilitate effective coordination without causing resistance.

The Environmental Activist Community, with very low Degree and Constraint values, occupies the most strategic position in the network. Although they have significant influence due to a high EgoBet value, they may face challenges related to dependency on key individuals or groups. This substantial influence could create tension or resistance if not managed carefully. Active involvement of the Environmental Activist Community needs to be maintained to ensure their impact remains constructive for the entire network.

Key Community Movers, with high Degree and low Constraint, are also in a strategic position. However, challenges may arise in the form of resistance to their direction or decisions, as well as limited support from various parties. To address this, it is important to ensure that decisions and policies are supported by all involved actors to minimize resistance and enhance collaborative effectiveness.

Overall, environmental activists face various barriers in collaborative communication, including issues related to coordination, integration, and support from all parties. Improving communication among actors with high Degree values, managing dependencies on key individuals, and ensuring equitable participation are crucial steps to overcoming these challenges. Developing effective integration systems will aid in guiding collaboration and ensuring that all parties are productively involved in waste management efforts.

Collaborative communication in waste management faces several obstacles and challenges that need to be addressed to improve its effectiveness and efficiency. One major barrier is the lack of involvement from some key groups. For example, groups such as "Urban Farming Group", "Youth Organization", "Maggot Compost Facility", and "Neighborhood Association Leader" do not show active roles in coordination, consultation, representation, gatekeeping, or liaison. This reflects their low engagement in the collaborative communication process, which can hinder comprehensive waste management efforts. To address this issue, it

is essential to conduct training and empowerment programs to encourage broader and more active participation from these groups.

Role and responsibility imbalances also pose a significant challenge. There is an imbalance where some actors, such as the “Environmental Activist Community”, “Head of the Environmental Service”, and “Key Community Movers”, play dominant roles in various types of brokerage. Conversely, other actors have minimal or no roles at all. This imbalance can lead to uneven workloads and potential communication bottlenecks if key actors cannot perform their functions effectively. To address this imbalance, task and responsibility redistribution should be more equitable, and broader collaboration among various parties should be encouraged.

Limited access and control over information also represent a significant barrier. Actors such as the “Chief of Police (Sector Level)”, “Military District Commander”, and “Head of Cemetery and Land Affairs Division” serve as gatekeepers controlling the flow of information. This can hinder the accessibility of important information for those who need it. Therefore, it is crucial to enhance transparency and develop an open and easily accessible information system for all actors to ensure timely receipt of necessary information.

Additionally, the lack of consultation and support from important actors such as the “Mayor” and the “Head of the Sanitation and Waste Management Department” highlights the need for increased expert support and consultation. Conducting regular consultation sessions and providing access to knowledge resources can help key actors make better decisions regarding waste management.

Limited coordination is also a major challenge. Although there are some actors serving as coordinators, their numbers are still limited, and weak coordination can impede synergy among the various involved parties. To improve coordination, more effective mechanisms such as regular meetings, joint communication platforms, and good feedback systems are needed.

By understanding and addressing these barriers, and implementing appropriate recommendations, collaborative communication in waste management can become more effective and efficient. Efforts to involve more groups, improve role distribution, enhance information access, and strengthen coordination are expected to create better synergy and support more integrated and sustainable waste management programs.

CONCLUSION

From the structural gap analysis, it can be concluded that actors with low Constraint values and high EgoBet, such as the Head of the Environmental Agency, District Heads, Environmental Activist Communities, and Key Community Mobilizers, occupy highly strategic positions within the social network. These actors have high Degrees and low Constraints, indicating they face few relational barriers and exert significant control within the network. This strategic positioning allows them to wield considerable influence, manipulate decisions, and create dependencies among other actors in the social network.

Environmental Activist Communities, in particular, exhibit the most dominant position with the highest Degree and EgoBet values and the lowest Constraint. This suggests they hold a unique and influential role in the network, effectively impacting various social aspects. Key Community Mobilizers also demonstrate similar potential, reinforcing their role in coordinating and driving the network. Overall, these actors have significant potential to influence network dynamics and play crucial roles in directing and organizing interactions within their social networks.

Collaborative communication in waste management faces several significant obstacles, including lack of involvement from certain groups, inequalities in role distribution, limited access to information, and insufficient consultation and support from key actors. These barriers result in uneven workloads, a lack of synergy, and impediments in decision-making.

To address these challenges, strategic steps are necessary, including increasing the involvement of less active groups, redistributing roles more equitably, enhancing transparency and access to information, and strengthening consultation and expert support. Additionally, more effective coordination mechanisms must

be established to bolster synergy among various parties. By implementing these recommendations, collaborative communication is expected to become more effective and efficient, thereby facilitating a more integrated and sustainable approach to waste management.

REFERENCES

- AbouAssi, K., Prince, W., & Johnston, J. M. (2024). A recipe for success? The importance of perceptions of goal agreement in cross-sector collaboration. *Public Administration*, 102(2), 370–387. <https://doi.org/10.1111/padm.12925>
- Adham, T. K. I. (2023). Conflict Resolution in Team: Analyzing the of Conflicts and Best Skills for Resolution. *Scholars Journal of Engineering and Technology*, 11(08), 152–162. <https://doi.org/10.36347/sjet.2023.v11i08.001>
- Ahmed, S. K. (2024). The pillars of trustworthiness in qualitative research. *Journal of Medicine, Surgery, and Public Health*, 2(January), 100051. <https://doi.org/10.1016/j.gjmedi.2024.100051>
- Akbar, A. (2021). Collaborative spatial learning for improving public participation practice in Indonesia [University of Twente]. <https://doi.org/10.3990/1.9789036552226>
- Aldeia, J., & Alves, F. (2019). Against the Environment. *Problems in Society/Nature Relations. Frontiers in Sociology*, 4. <https://doi.org/10.3389/fsoc.2019.00029>
- Andriollo, E., Caimo, A., Secco, L., & Pisani, E. (2021). Collaborations in Environmental Initiatives for an Effective “Adaptive Governance” of Social–Ecological Systems: What Existing Literature Suggests. *Sustainability*, 13(15), 8276. <https://doi.org/10.3390/su13158276>
- Anshassi, M., & Townsend, T. G. (2023). The hidden economic and environmental costs of eliminating kerb-side recycling. *Nature Sustainability*, 6(8), 919–928. <https://doi.org/10.1038/s41893-023-01122-8>
- Asropi, A., Erfanti, M., & Timur, A. (2023). Community Empowerment Effectiveness in Waste Management with Maggot BSF Bioconversion In Tangerang City. *Dia*, 21(01), 25–37. <https://doi.org/10.30996/dia.v21i01.7563>
- Becker, P., & Bodin, Ö. (2022). Brokerage activity, exclusivity and role diversity: A three-dimensional approach to brokerage in networks. *Social Networks*, 70(March), 267–283. <https://doi.org/10.1016/j.socnet.2022.02.014>
- Biezina, L., Truksans, D., & Ernsteins, R. (2019). Municipal environmental communication development: collaboration communication model, networking nodes and instruments. 45–52. <https://doi.org/10.22616/ESRD.2019.056>
- Bodin, Ö. (2017). Collaborative environmental governance: Achieving collective action in social-ecological systems. *Science*, 357(6352). <https://doi.org/10.1126/science.aan1114>
- Budiyarto, A., Clarke, B., & Ross, K. (2024). Overview of waste bank application in Indonesian regencies. *Waste Management & Research: The Journal for a Sustainable Circular Economy*. <https://doi.org/10.1177/0734242X241242697>
- Carrick, J., Bell, D., Fitzsimmons, C., Gray, T., & Stewart, G. (2023). Principles and practical criteria for effective participatory environmental planning and decision-making. *Journal of Environmental Planning and Management*, 66(14), 2854–2877. <https://doi.org/10.1080/09640568.2022.2086857>
- Chygryn, O., Bilan, Y., & Kwilinski, A. (2020). Stakeholders of Green Competitiveness: Innovative Approaches for Creating Communicative System. *Marketing and Management of Innovations*, 3, 356–368. <https://doi.org/10.21272/mmi.2020.3-26>
- Dada, S., Dalkin, S., Gilmore, B., Hunter, R., & Mukumbang, F. C. (2023). Applying and reporting relevance, richness and rigour in realist evidence appraisals: Advancing key concepts in realist reviews. *Research Synthesis Methods*, 14(3), 504–514. <https://doi.org/10.1002/jrsm.1630>
- Dimitriou, A., & Christidou, V. (2011). Causes and Consequences of Air Pollution and Environmental Injustice as Critical Issues for Science and Environmental Education. In *The Impact of Air Pollution on Health, Economy, Environment and Agricultural Sources*. InTech. <https://doi.org/10.5772/17654>
- Duygan, M., Stauffacher, M., & Meylan, G. (2021). What constitutes agency? Determinants of actors’ influence on formal institutions in Swiss waste management. *Technological Forecasting and Social Change*, 162(September 2019). <https://doi.org/10.1016/j.techfore.2020.120413>
- El-Saadony, M. T., Saad, A. M., El-Wafai, N. A., Abou-Aly, H. E., Salem, H. M., Soliman, S. M., Abd El-Mageed, T. A., Elrys, A. S., Selim, S., Abd El-Hack, M. E., Kappachery, S., El-Tarabily, K. A., & AbuQamar, S. F. (2023). Hazardous wastes and management strategies of landfill leachates: A comprehensive review. *Environmental Technology and Innovation*, 31, 103150. <https://doi.org/10.1016/j.eti.2023.103150>
- Farhidi, F., Madani, K., & Crichton, R. (2022). How the US Economy and Environment can Both Benefit From Composting Management. *Environmental Health Insights*, 16, 117863022211284. <https://doi.org/10.1177/11786302221128454>
- Fatmawati, F., Mustari, N., Haerana, H., Niswaty, R., & Abdillah, A. (2022). Waste Bank Policy Implementation through Collaborative Approach: Comparative Study—Makassar and Bantaeng, Indonesia. *Sustainability (Switzerland)*, 14(13). <https://doi.org/10.3390/su14137974>
- Feekey, A. (2024). The 7 C’s framework for participatory action research: inducting novice participant-researchers. *Educational Action Research*, 32(3), 332–347. <https://doi.org/10.1080/09650792.2023.2234417>
- Grushina, S. V. (2017). Collaboration by Design: Stakeholder Engagement in GRI Sustainability Reporting Guidelines. *Organization & Environment*, 30(4), 366–385. <https://doi.org/10.1177/1086026616681612>

- Gupta, R., Ardalan, N., & Fraser, J. (2017). The Intergroup Context of Environmental Education and Approaches to Facilitate Collaboration. *Small Group Research*, 48(4), 420–454. <https://doi.org/10.1177/1046496417706416>
- Haleem, A., Javaid, M., Qadri, M. A., & Suman, R. (2022). Understanding the role of digital technologies in education: A review. *Sustainable Operations and Computers*, 3, 275–285. <https://doi.org/10.1016/j.susoc.2022.05.004>
- Hossu, C. A., Iojă, I. C., Pătroescu, M., Dușa, A., & Hersperger, A. M. (2019). Dispute Resolution and Collaborative Decision-Making: What Accounts for Their Effectiveness? The Case of Romania. *Sustainability*, 11(24), 7072. <https://doi.org/10.3390/su11247072>
- Ismiraj, M. R., Wulansari, A., Setiadi, Y., Pratama, A., & Mayasari, N. (2023). Perceptions of Community-Based Waste Bank Operators and Customers on Its Establishment and Operationalization: Cases in Pangandaran, Indonesia. *Sustainability*, 15(14), 11052. <https://doi.org/10.3390/su151411052>
- Jaswita, D. I., & Maharani, H. (2023). Peluang Untuk Berwirausaha Dengan Pemanfaatan Limbah Sampah Menjadi Pasif Income Pada Petugas Kebersihan Di Perumahan Angrek Loka Sektor 2-2 Bsd *Comserva ...*, 3(5), 1942–1949. <https://doi.org/10.59141/comserva.v3i5.938>
- Kefeli, D., Siegel, K. M., Pittaluga, L., & Dietz, T. (2023). Environmental policy integration in a newly established natural resource-based sector: the role of advocacy coalitions and contrasting conceptions of sustainability. *Policy Sciences*, 56(1), 69–93. <https://doi.org/10.1007/s11077-022-09485-z>
- Kung, A. (2017). Using environmental report cards to encourage constructive stakeholder relationships in natural resource management: developing a participatory report carding process [The University of Queensland]. <https://doi.org/10.14264/uql.2017.403>
- Kurniawan, T. A., Meidiana, C., Dzarfan Othman, M. H., Goh, H. H., & Chew, K. W. (2023). Strengthening waste recycling industry in Malang (Indonesia): Lessons from waste management in the era of Industry 4.0. *Journal of Cleaner Production*, 382, 135296. <https://doi.org/10.1016/j.jclepro.2022.135296>
- Lal, B., Dwivedi, Y. K., & Haag, M. (2023). Working from Home During Covid-19: Doing and Managing Technology-enabled Social Interaction With Colleagues at a Distance. *Information Systems Frontiers*, 25(4), 1333–1350. <https://doi.org/10.1007/s10796-021-10182-0>
- Lansing, A. E., Romero, N. J., Siantz, E., Silva, V., Center, K., Casteel, D., & Gilmer, T. (2023). Building trust: Leadership reflections on community empowerment and engagement in a large urban initiative. *BMC Public Health*, 23(1), 1252. <https://doi.org/10.1186/s12889-023-15860-z>
- Leal Filho, W., Dibbern, T., Pimenta Dinis, M. A., Coggo Cristofolletti, E., Mbah, M. F., Mishra, A., Clarke, A., Samuel, N., Castillo Apraiz, J., Rimi Abubakar, I., & Aina, Y. A. (2024). The added value of partnerships in implementing the UN sustainable development goals. *Journal of Cleaner Production*, 438, 140794. <https://doi.org/10.1016/j.jclepro.2024.140794>
- Majeed, S., Uzair, M., Qamar, U., & Farooq, A. (2020). Social Network Analysis Visualization Tools: A Comparative Review. *Proceedings - 2020 23rd IEEE International Multi-Topic Conference, INMIC 2020*. <https://doi.org/10.1109/INMIC50486.2020.9318162>
- McClellan, J. G. (2023). Collaboration in Organizations. In *Oxford Research Encyclopedia of Communication*. Oxford University Press. <https://doi.org/10.1093/acrefore/9780190228613.013.1276>
- Meng, J., Lin, Y.-P., & Tsai, H.-J. (2023). Environmental activism in the platform society: Spatial agency in digital maps. *New Media & Society*, 146144482311625. <https://doi.org/10.1177/14614448231162581>
- Meredith, C., Moolenaar, N., Struyve, C., Vandecandelaere, M., Gielen, S., & Kyndt, E. (2023). The importance of a collaborative culture for teachers' job satisfaction and affective commitment. *European Journal of Psychology of Education*, 38(1), 43–62. <https://doi.org/10.1007/s10212-022-00598-w>
- N. Nmere, O., O. Okolo, V., O. Abugu, J., Chukwubuzo Alio, F., & C. Anetoh, J. (2020). Influence of public relations' media public enlightenment campaign and community participation strategies on waste management. *Problems and Perspectives in Management*, 18(1), 82–96. [https://doi.org/10.21511/ppm.18\(1\).2020.08](https://doi.org/10.21511/ppm.18(1).2020.08)
- Naeem, M., Ozuem, W., Howell, K., & Ranfagni, S. (2023). A Step-by-Step Process of Thematic Analysis to Develop a Conceptual Model in Qualitative Research. *International Journal of Qualitative Methods*, 22, 1–18. <https://doi.org/10.1177/16094069231205789>
- Natali, L. (2024). The social perception of environmental victimization. A visual and sensory methodological proposal. *Crime, Law and Social Change*, 81(5), 561–580. <https://doi.org/10.1007/s10611-023-10099-6>
- Nguyen, A. T., Nguyen, N., Phung, P., & YẾN-Khanh, N. (2023). Residents' waste management practices in a developing country: A social practice theory analysis. *Environmental Challenges*, 13, 100770. <https://doi.org/10.1016/j.envc.2023.100770>
- Paparini, S., Papoutsi, C., Murdoch, J., Green, J., Petticrew, M., Greenhalgh, T., & Shaw, S. E. (2021). Evaluating complex interventions in context: systematic, meta-narrative review of case study approaches. *BMC Medical Research Methodology*, 21(1), 1–22. <https://doi.org/10.1186/s12874-021-01418-3>
- Priya, A. (2021). Case Study Methodology of Qualitative Research: Key Attributes and Navigating the Conundrums in Its Application. *Sociological Bulletin*, 70(1), 94–110. <https://doi.org/10.1177/0038022920970318>
- Rahayu, P. C., Simatupang, V. S. U., & Christiani, A. (2023). Pengembangan Sistem Informasi Berbasis Web Bagi Bank Sampah Di Tangerang Selatan [Development of A Web-Based Information System For Waste Banks In South Tangerang].

- FaST - Jurnal Sains Dan Teknologi (Journal of Science and Technology), 7(1), 65. <https://doi.org/10.19166/jstfast.v7i1.6711>
- Ritter, C., Koralesky, K. E., Saraceni, J., Roche, S., Vaarst, M., & Kelton, D. (2023). Invited review: Qualitative research in dairy science—A narrative review. *Journal of Dairy Science*, 106(9), 5880–5895. <https://doi.org/10.3168/jds.2022-23125>
- Samin. (2022). Pendampingan Program Pengelolaan Sampah di Tempat Penampungan Sementara Taman Rekreasi Sengkaling Universitas Muhammadiyah Malang. *Jurnal Inovasi Pengabdian Dan Pemberdayaan Masyarakat*, 4(1), 107–114. <https://doi.org/10.54082/jippm.423>
- Schoon, M., Chapman, M., Loos, J., Ifejika Speranza, C., Carr Kelman, C., Aburto, J., Alexander, S., Baggio, J., Brady, U., Cockburn, J., Cundill, G., Garcia Lopez, G., Hill, R., Robinson, C., Thondhlana, G., Trimble, M., & Whittaker, D. (2021). On the frontiers of collaboration and conflict: how context influences the success of collaboration. *Ecosystems and People*, 17(1), 383–399. <https://doi.org/10.1080/26395916.2021.1946593>
- Schwartz, S. E. O., Benoit, L., Clayton, S., Parnes, M. F., Swenson, L., & Lowe, S. R. (2023). Climate change anxiety and mental health: Environmental activism as buffer. *Current Psychology*, 42(20), 16708–16721. <https://doi.org/10.1007/s12144-022-02735-6>
- Shahreza, M., Sarwoprasodjo, S., Arifin, H. S., & Hapsari, D. R. (2022). Strategi Komunikasi Lingkungan yang Mendukung Keberlanjutan Komunitas Pengelolaan Sampah di Kota Tangerang Selatan [Institut Pertanian Bogor]. <https://repository.ipb.ac.id/handle/123456789/111456>
- Sharma, N., Paço, A., & Upadhyay, D. (2023). Action or necessity: Role of environmental education as transformative change agent. *Evaluation and Program Planning*, 97, 102244. <https://doi.org/10.1016/j.evalprogplan.2023.102244>
- Sharma, R. (2023). Civil society organizations' institutional climate capacity for community-based conservation projects: Characteristics, factors, and issues. *Current Research in Environmental Sustainability*, 5, 100218. <https://doi.org/10.1016/j.crsust.2023.100218>
- Singh, S., & Hussain, C. M. (2021). Zero waste hierarchy for sustainable development. In *Concepts of Advanced Zero Waste Tools* (pp. 123–142). Elsevier. <https://doi.org/10.1016/B978-0-12-822183-9.00006-4>
- UNEP. (2024). *Global Waste Management Outlook 2024 - Beyond an age of waste: Turning rubbish into a resource*. United Nations Environment Programme. <https://doi.org/10.59117/20.500.11822/44939>
- van Leeuwen, J., & Surya, I. R. F. (2024). Network power and exclusion of informal waste pickers when plastic flows change: A case study of community waste banks in Klaten Municipality in Indonesia. *Marine Policy*, 167, 106285. <https://doi.org/10.1016/j.marpol.2024.106285>
- Velenturf, A. P. M., & Purnell, P. (2021). Principles for a sustainable circular economy. *Sustainable Production and Consumption*, 27, 1437–1457. <https://doi.org/10.1016/j.spc.2021.02.018>
- Voukkali, I., Papamichael, I., Loizia, P., & Zorpas, A. A. (2023). Urbanization and solid waste production: prospects and challenges. *Environmental Science and Pollution Research*, 31(12), 17678–17689. <https://doi.org/10.1007/s11356-023-27670-2>
- Wallwey, C., & Kajfez, R. L. (2023). Quantitative research artifacts as qualitative data collection techniques in a mixed methods research study. *Methods in Psychology*, 8(February), 100115. <https://doi.org/10.1016/j.metip.2023.100115>
- Wang, H., & Ran, B. (2023). Network governance and collaborative governance: a thematic analysis on their similarities, differences, and entanglements. *Public Management Review*, 25(6), 1187–1211. <https://doi.org/10.1080/14719037.2021.2011389>
- Wenger, R., & Yang, Z. (2011). *Environmental and Water Resources Management: Problems and Solutions*. *Frontiers of Earth Science*, 5(4), 331–333. <https://doi.org/10.1007/s11707-011-0210-1>
- Yandri, P., Budi, S., & Putri, I. A. P. (2023). Waste sadaqah : a new community-based waste-management practice in Java, Indonesia. *Sustainability: Science, Practice and Policy*, 19(1). <https://doi.org/10.1080/15487733.2023.2212510>
- Younas, A., Fábregues, S., Durante, A., Escalante, E. L., Inayat, S., & Ali, P. (2023). Proposing the “MIRACLE” Narrative Framework for Providing Thick Description in Qualitative Research. *International Journal of Qualitative Methods*, 22, 1–13. <https://doi.org/10.1177/16094069221147162>
- Zhang, Z., Malik, M. Z., Khan, A., Ali, N., Malik, S., & Bilal, M. (2022). Environmental impacts of hazardous waste, and management strategies to reconcile circular economy and eco-sustainability. *Science of The Total Environment*, 807, 150856. <https://doi.org/10.1016/j.scitotenv.2021.150856>