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Original Research

Gender Empowerment Model in Environmental Management to Control Climate Change

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Abstract
Background: Climate change is an inevitable consequence of inadequate environmental protection. Strengthening gender roles and functions offers a strategic approach to mitigating its impacts.
Objective: This study aims to explore environmental management practices at the micro level through a gender-based perspective. Enhancing the role of gender in addressing climate change can be achieved by improving knowledge and awareness of environmental issues and their associated impacts. The consequences of climate change on public health are frequently observed, particularly through drought, reduced food availability, and limited access to clean water.
Methods: This study employs a qualitative research design to gain a holistic understanding of the phenomena experienced by the research subjects. The participants in this study, referred to as informants, were selected to represent diverse perspectives within the community.
Results: The primary informants in this study consisted of women and community leaders, while supporting informants included members of the Banyumas Regency community. The community's actions extend beyond environmental protection, encompassing both individual and collective efforts in environmental management. Strengthening gender roles within families demonstrates the shared responsibilities of parents, children, and other community members in fostering environmental stewardship. Effective climate change mitigation is supported by the availability of adequate facilities and infrastructure, as well as systematic models and processes for environmental management and control. Addressing public and environmental health issues remains a critical priority to prevent the widespread impacts of climate-related challenges.
Conclusion: Family engagement plays a pivotal role in enhancing knowledge, attitudes, and practices that contribute to climate change mitigation, emphasizing the importance of collaborative efforts at the household and community levels.

Keywords: climate; environment; health; community; management

Background

Population growth significantly influences waste generation and has the potential to increase greenhouse gas (GHG) emissions, which contribute to global warming and, consequently, to climate change (Allysa & Pini, 2023). Inadequate waste management practices exacerbate this issue, as the decomposition of wasteparticularly in unmanaged or open dumping systems produces leachate from rainwater infiltration. This leachate often contains hazardous compounds, including heavy metals such as lead (Pb), which is carcinogenic and capable of contaminating air, water, soil,

plants, and animals (Wahid & Ayu, 2023; Afifah & Endah, 2023). Globally, waste is recognized as a significant contributor to GHG emissions, accounting for approximately 3.2% of total emissions.

Indonesia faces urgent challenges in managing solid waste. Rapid urbanization has resulted in the generation of up to 8 million tons of waste daily in major urban centers, positioning the country as the third-largest waste producer globally. Greenhouse gas emissions from landfills further exacerbate Indonesia's environmental footprint. Addressing this issue requires a dual approach that emphasizes reducing waste generation at the source, particularly among households and other primary waste generators, while simultaneously implementing advanced solid waste management (SWM) systems and technologies as comprehensive end-of-pipe solutions.

Government intervention plays a pivotal role in optimizing waste management solutions by enforcing strict source segregation policies, strengthening waste-related regulations, allocating sufficient regional budgets to support management processes, improving waste collection systems, and investing in advanced solid waste management (SWM) technologies. At the community level, active participation is equally important, as individuals can contribute by segregating recyclable and organic waste, engaging in composting activities, and participating in waste bank programs (Aprilia, 2021). In the industrial sector, adopting environmentally friendly and cost-effective waste management practices is essential to minimizing potential environmental risks (Pratibha et al., 2022). From a gender perspective, organizational practices continue to demonstrate disparities in task allocation, where female managers are frequently assigned to domestic or internal organizational roles, while male managers are typically entrusted with inter-organizational activities, including those that require rapid and high-level emergency responses (Kambarwati & Putri, 2023; Handayani et al., 2025). This persistent gendered division of responsibilities underscores the need for more inclusive and balanced participation in environmental management initiatives. Currently, such initiatives are largely driven by women, highlighting the urgency of fostering more gender-equitable collaboration.

Environmental management activities also influence broader aspects such as time efficiency and urban traffic flow (Mohanty et al., 2023). Furthermore, public health is intrinsically linked to environmental conditions, with community health playing a crucial role in preventing and controlling environment-related diseases (Kaseya et al., 2023). To enhance resilience against such health risks, it is essential for health workers to be well-informed and for governments to strengthen disease prevention and health promotion programs (Olukemi et al., 2023).

Plastic waste, in particular, presents an escalating environmental challenge. Population growth intensifies plastic waste production, which, when improperly managed or incinerated, significantly contributes to GHG emissions and global warming (Allysa & Pini, 2023). Therefore, effective plastic waste management strategies are urgently needed to mitigate environmental and health risks. Liquid waste management represents another critical area of concern. Implementing wastewater treatment facilities (IPAL) provides a viable approach to reducing environmental contamination from hazardous leachate and industrial effluents (Wahid & Ayu, 2023). This study, therefore, seeks to examine the dynamics of gender roles in the context of environmental management and climate change adaptation, emphasizing the importance of equitable participation across all sectors to achieve sustainable outcomes.

Methods

Study Design

This study uses a qualitative method. The main informants in this study are women and community leaders and the supporting informants are residents of Banyumas Regency. Data collection is complete when the data is saturated (redundancy). This study was conducted on 4 main informants and 2 supporting informants. The main informants were carried out in the waste activist group and supporting informants were collected from sources who knew about activities and policies related to waste management. Data collection techniques were carried out through in-depth interviews and observations. Researchers will observe environmental management activities in climate change in Banyumas Regency. This study uses interview guidelines, checklists and recording devices. Data analysis is open by using an inductive thinking process using an interactive analysis model. This model consists of data collection, data reduction, data presentation, and drawing conclusions. Data validity uses source triangulation techniques which are carried out by cross-checking answers between informants. This study uses a case study design to find out an in-depth analysis of one phenomenon about the Gender Empowerment Model in Environmental Management for Climate Change Control.

Setting

This study was conducted in Banyumas Regency. The research location was chosen because it has a unique phenomenon in waste management.

Sample and instrument

The participants in this study were 4 people as the main informants and 2 people as supporting informants. The instruments in this study include in-depth interview guidelines, observation, and documentation studies.

Data Collection
Data collection in journals refers to the process of collecting relevant information about the Gender Empowerment Model in Environmental Management for Climate Change Control. Some common methods used are observation, interviews, and document studies.

Data Analysis
Data analysis in journals involves the process of processing and interpreting data to gain insights and conclusions.

Ethical Considerations
Ethical considerations in journals include principles such as informed consent, confidentiality, anonymity, and minimizing risks to research participants. In addition, respecting the rights of participants, including their rights to privacy and dignity.

Results

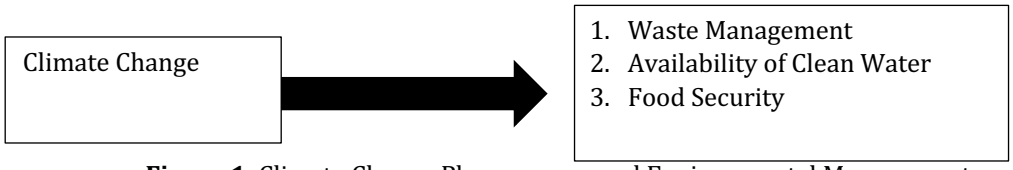


Figure 1. Climate Change Phenomenon and Environmental Management

The phenomenon of climate change from the results of the study concerns three aspects in terms of waste management activities, the availability of clean water and food security in the community. Climate change can have an impact on irregular weather, for example, the arrival of the rainy and dry seasons cannot be predicted, thus having an impact on the amount of food and food security around us.

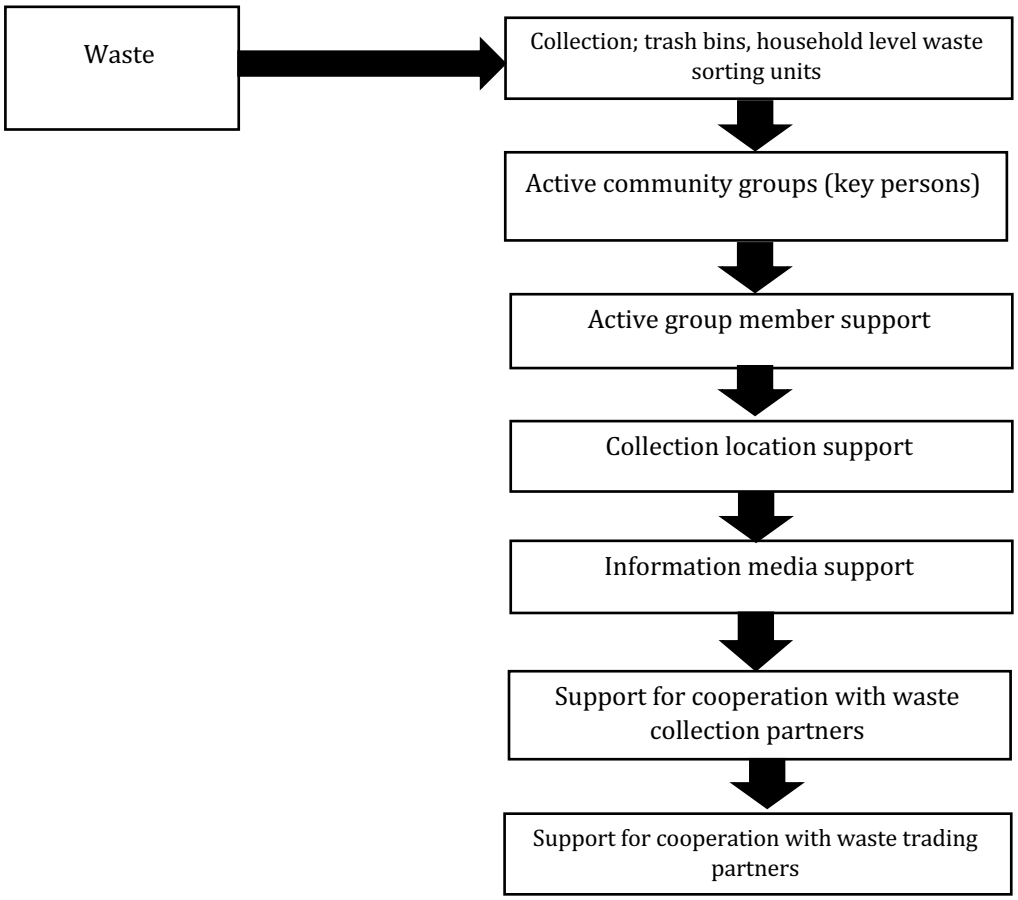


Figure 2. Gender Aspects in Environmental Management

Other significant contributors to climate change problems include improper waste management within communities. The success of waste management initiatives largely depends on their ability to emerge naturally from the needs and collective aspirations of the community. When the planning process, operational mechanisms, and designated locations are developed through mutual agreement, the sense of ownership and participation among residents tends to increase. Shared facilities, such as transportation equipment for waste collection including garbage carts and small transport vehicles (tosas) further enhance operational efficiency and sustainability.

However, several challenges persist in waste management practices. In certain areas, the proximity of rivers often facilitates direct waste disposal into water bodies, exacerbating pollution and environmental degradation. Similarly, the presence of large yards and unused open spaces in residential areas frequently leads to informal dumping practices. These behavioral and spatial challenges highlight the need for integrated interventions that combine community education, regulatory enforcement, and the provision of adequate infrastructure.

Findings from the study indicate several key observations. First, overall, the clean water sources in the study area exhibit good physical quality, as the water is colorless, tasteless, and odorless. Second, villages such as Beji, Cikidang, Dermaji, Wlahar Wetan, and Banteran are able to meet their clean water needs from local sources. Conversely, villages including Banjar Penapen, Binangun, Cilangkap, and Sibalung still face difficulties in accessing adequate clean water from nearby sources. This limitation is primarily attributed to the lack of proper facilities at each water source. Additionally, the suboptimal utilization of clean water is influenced by the difficult accessibility of water sources, as well as topographical conditions where the elevation of the water source is below the residential areas, making gravity-based distribution through hoses or pipes unfeasible.

In Banyumas Regency, there exists considerable potential for the production of non-rice carbohydrate food sources such as corn, cassava, and sweet potatoes. The suitability of land characteristics and climate conditions strongly influences farmers' decisions to cultivate these crops. Marginal or dry lands in the region can be optimized for the cultivation of one or a combination of these crops. Nevertheless, the impacts of climate change, including unpredictable rainfall and increased temperature variability, pose significant risks to agricultural productivity and food security in the region.

Waste collection and processing activities in Banyumas Regency are predominantly carried out by women, highlighting their central role in local environmental management. Conversely, men generally take on responsibilities related to the provision of communal facilities and supporting infrastructure. Knowledge-enhancement activities, often facilitated through community-based programs, are primarily attended and implemented by women, reflecting gendered participation patterns in environmental initiatives. These activities, however, require stronger support and collaboration from all family members to ensure their sustainability and broader impact in mitigating the effects of climate change.

Waste management initiatives in the Purwokerto area have been actively carried out as a community-driven environmental effort aimed at promoting sustainability and improving local living conditions. Findings from the discussion reveal that these activities are not merely operational measures to manage household and community waste but also serve as a platform for social interaction, fostering mutual support, collective sincerity, and effective communication among residents. The origin of these initiatives can be traced to the collective efforts of members of the Dasa Wisma association, who share a common understanding that waste, often perceived as valueless, still holds potential economic and environmental benefits. Locally, this idea is framed as “blessed waste,” reflecting a cultural perspective that encourages reusing and repurposing materials for community welfare.

Leadership within the group plays a pivotal role in ensuring the program’s success. By establishing a well-integrated communication network, they facilitate coordination between local traders and Dasa Wisma members, ensuring smooth operations and program sustainability. Broad community support, including participation from various neighborhood groups, further strengthens mobilization and collective engagement. Additionally, the availability of communal funds, jointly managed by members, ensures the continuity of waste management operations by providing consistent financial backing for necessary expenses.

In the initial stages of implementation, the community faced several challenges, particularly in determining appropriate waste collection points. Safety and accessibility were key considerations, as the locations needed to accommodate different types of waste while remaining secure and easy to reach for regular collection. These issues were gradually resolved through collaborative decision-making, resulting in the selection of safe, less-trafficked areas that remain easily accessible for waste retrieval. The Purwokerto waste management program highlights how strong community leadership, collective participation, and adaptive problem-solving can drive sustainable and socially inclusive environmental initiatives.

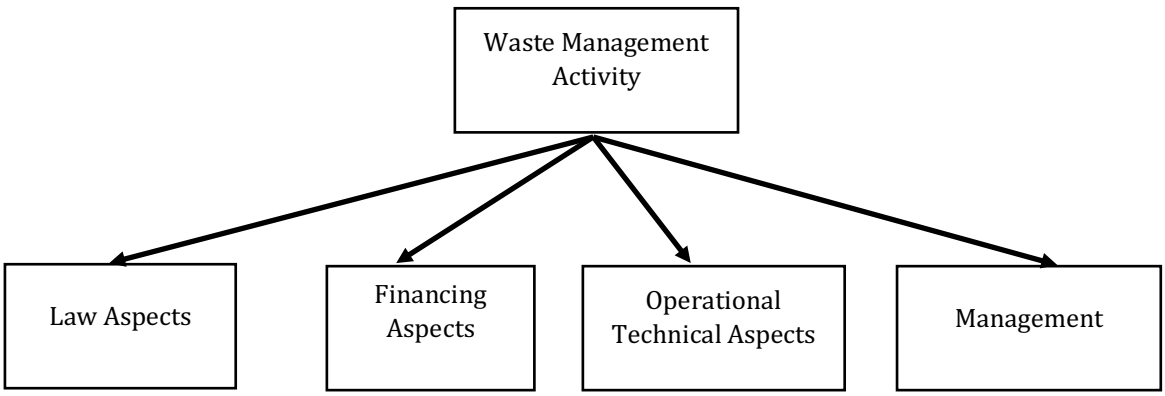
Figure 3. Final Disposal Site

Figure 4. Map of Banyumas District

Figure 5. Household waste

Figure 6. Waste manajemen activities

The tools and infrastructure used in these activities are the result of collective self-help efforts, reflecting a high level of community solidarity and participation. As a result of the program's visibility and effectiveness, several external parties have conducted visits to observe and learn from the ongoing initiatives. Moving forward, there is a collective expectation that these activities will continue to be implemented routinely and will serve as a motivational model for other residents, inspiring broader participation in sustainable waste management practices



Factors that affect waste recycling centers include institutional factors, laws, financing, operational techniques and community participation. Each factor interacts with each other to support waste management activities.

Discussion

Environmental conditions significantly influence public health outcomes. The carrying capacity of the environment plays a crucial role in supporting fundamental needs across physical, chemical, microbiological, and psychosocial dimensions (Fikri et al., 2023). Effective environmental management directly impacts microbial presence; areas with higher concentrations of pathogens tend to exhibit increased disease transmission. Such conditions can lead to notable shifts in disease patterns within communities, posing substantial challenges for public health surveillance and disease prevention programs. Furthermore, the interaction between environmental degradation and urban population density often accelerates the spread of vector-borne and waterborne diseases, highlighting the urgency of integrated interventions.

Unpredictable variations in temperature, humidity, and rainfall often hinder the implementation of effective environmental and public health interventions. These climate irregularities also disrupt ecological balance, leading to increased vulnerability of communities to infectious disease outbreaks and other health risks associated with environmental stressors. Optimizing environmental carrying capacity, therefore, requires integrated cross-sectoral collaboration and active community engagement to ensure sustainable outcomes (Lagiono et al., 2023; Asfian et al., 2025). Such collaboration fosters innovation in policy design and encourages the adoption of context-specific technologies for environmental health management.

Climate change mitigation should begin at the micro level by enhancing individual knowledge, education, and skills. Empowering individuals with the capacity to understand, adapt to, and mitigate environmental risks enables broader social advocacy and the promotion of collective action to protect and restore ecosystems. Indicators of a healthy and sustainable environment include the absence of air pollution, balanced ecological cycles, and the preservation of natural resources, as reflected in clean air, uncontaminated water, and healthy soil ecosystems (Hamsa & Rizkariani, 2021). Strengthening education and awareness programs within communities can further cultivate behavioral changes that support environmental conservation and climate resilience.

Strengthening family involvement based on gender roles empowering both men and women serves as a critical entry point for fostering environmental stewardship (Wang & Man, 2024; Jannah & Ela, 2021; Nurmaladewi & La, 2023). Family-level initiatives collectively contribute to achieving global commitments, such as reducing greenhouse gas (GHG) emissions and improving community-level climate adaptation strategies. Methane emissions from improper waste management remain a major contributor to air pollution, emphasizing the importance of modernizing waste processing facilities and promoting circular economy principles. Without immediate action, the cumulative effects of these emissions will exacerbate climate change and associated health problems. Thus, mitigating the impacts of climate change requires not only local initiatives but also international cooperation, policy alignment, and sustainable financing mechanisms to support long-term environmental and health goals (Abbas et al., 2022).

Comprehensive environmental management involves sanitation-related efforts, including the provision of clean water, effective wastewater treatment, and proper solid waste management (Evitasari, Dinan, & Firda, 2023; Yustati, 2020; Jatmoko et al., 2021; Ulfah et al., 2023). These interventions not only improve environmental quality but also reduce the incidence of communicable diseases linked to inadequate sanitation and poor hygiene practices. Additionally, community-based training programs focused on economic empowerment can enhance livelihoods while building resilience against environmental and health-related shocks. When communities are economically empowered, they are more likely to invest in sustainable practices and actively participate in local health and environmental initiatives (Rahayu et al., 2021).

The complex interplay between climate change, environmental quality, and public health underscores the need for sustained, collaborative, and adaptive management strategies (Merdekawati & Aziz, 2023; Fathurachmi & Wafiq, 2022; Evitasari, Dinan, & Firda, 2023). Policy frameworks should be evidence-based, incorporating real-time data and local knowledge to create contextually relevant and scalable solutions. Strengthening institutional capacities, fostering multi-stakeholder partnerships, and integrating environmental health considerations into broader development agendas are essential to ensuring that both ecosystems and human populations can thrive in a changing climate.

Conclusion

The role of the family is pivotal in maintaining and preserving the environment, as it serves as the primary unit of socialization where knowledge, values, and practices related to environmental stewardship are developed and reinforced. A comprehensive understanding of the family's functions, including its capacity to shape behavioral patterns and foster environmentally responsible attitudes, is essential in addressing current ecological challenges. Detailed examinations of

these roles provide valuable insights into how micro-level dynamics contribute to broader environmental outcomes. Such findings emphasize the need to integrate family-based approaches into the formulation and implementation of environmental policies. Policymakers should consider the unique contributions of family units in promoting sustainable practices, from waste reduction and resource conservation to active participation in community-based environmental programs. Future research is warranted to explore strategies for strengthening family engagement in climate adaptation and mitigation efforts, particularly in the context of rapid urbanization and environmental degradation. By recognizing and optimizing the family's role within environmental governance frameworks, it becomes possible to achieve more inclusive, participatory, and sustainable environmental management systems.

Declaration of conflicting interest
The authors declare no potential conflict of interest.

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Author contributions
Authors are responsible for ensuring that the entire research and publication process is conducted ethically and properly, including avoiding plagiarism and conflicts of interest.

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