

# Advancing eco-friendly tourism through integrated zero-waste management strategies

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## ABSTRACT

This study examines the implementation of zero-waste management as a strategic approach to promoting eco-friendly tourism in Wirokerten Tourism Village, Yogyakarta. The rapid growth of tourism activities often results in increased volumes of waste that are inadequately managed, thereby posing serious threats to environmental sustainability and reducing the overall quality and attractiveness of tourism destinations. The primary aim of this study is to explore the application of plastic waste management concepts within community-based tourism practices in Wirokerten Tourism Village. Through the adoption of a zero-waste approach, the village seeks to integrate the core principles of reduction, reuse, and recycling into its tourism planning, management, and daily operational practices. This research employs a qualitative case study methodology, incorporating field observations, in-depth interviews with key local stakeholders, and document analysis to examine how zero-waste initiatives are incorporated into tourism development processes in Wirokerten. The findings reveal that active community participation, consistent support from local government institutions, and collaborative environmental governance mechanisms are critical factors contributing to the effectiveness and sustainability of the zero-waste programs. Specific initiatives, including waste segregation at the household and tourism facility levels, composting of organic waste, and eco-education activities targeting visitors, significantly enhance the village's image as an environmentally responsible and sustainability-oriented tourism destination. Nevertheless, several challenges persist, particularly in relation to limited funding availability, capacity building constraints, and the need to foster long-term behavioral change among both residents and tourists (Rachmawati et al., 2024). This study contributes to the broader discourse on sustainable tourism by illustrating how zero-waste practices can be systematically integrated into tourism governance at the village level. The findings provide practical insights for policymakers, local communities, and tourism managers seeking to advance eco-friendly and sustainable tourism models in Indonesia and comparable contexts worldwide.

**Keywords:** *Community-based tourism, eco-friendly tourism, environmental governance, sustainable tourism, zero-waste management*

## INTRODUCTION

The growth of the global tourism industry has had a significant impact on Indonesia's economy, particularly through increased foreign exchange earnings, job creation, and the promotion of national economic growth (Yakup, 2019; Febriani & Firmansyah, 2024). According to data released by Badan Pusat Statistik (BPS, 2024), the number of foreign tourists reached 11.68 million visits in 2023-2024. However, behind the growth in the number of tourists and tourism activities each year, there are increasingly complex environmental issues, especially related to the increasing volume of waste and its management (Aritonang et al., 2024). The issue of waste management in the tourism sector has become a global issue that requires serious attention (Hilman et al., 2023; Tutiliana et al., 2023). According to United Nations Environment Programme (UNEP, 2023), Approximately 35% of waste generated in tourist destinations is single-use plastic waste, such as mineral water bottles, plastic bags, and food packaging (Prayogo et al., 2023). Indonesia currently ranks second as the

country that produces the most plastic waste dumped into the sea in the world, with a total of 187.2 million tons, after China, which reaches 262.9 million tons (Astor et al., 2022).

Environmental health risks due to the accumulation of plastic waste and poorly managed food waste can reduce the quality of the ecosystem and threaten the attractiveness of tourist destinations (Rahman et al., 2024). Indonesia faces major challenges in waste management, including waste generated by tourism activities (Hafifi & Murdiana, 2024; Sugiyono et al., 2025). Based on data from the Ministry of Kementerian Lingkungan Hidup dan Kehutanan (KLHK, 2024) through National Waste Management Information System/Sistem Informasi Pengelolaan Sampah Nasional (SIPSN), Waste generation in Indonesia reaches 68.5 million tons per year, with 18% of that being plastic waste, or more than 12 million tons annually. However, only about 64% of that amount is managed properly, while the rest ends up in landfills (TPA), burned, or pollute the environment. This phenomenon emphasizes the need for local environmental policies based on

collaboration between the community and local government to achieve sustainable tourism waste management (Darmawi, 2017; Maimun & Priyadi, 2025; Zahra et al., 2025). The government has set a target of 70% by 2025 through Presidential Regulation No. 83 of 2018 concerning Marine Waste Management and the reduction of plastic waste by banning the use of single-use plastic bags (Nasython, 2025; Yunaz et al., 2021). Achieving this target remains challenging, especially in tourist areas that experience a surge in waste volume as the number of tourists increases (Nasir, 2024; Pratama & Astuti, 2025; Putra et al., 2025).

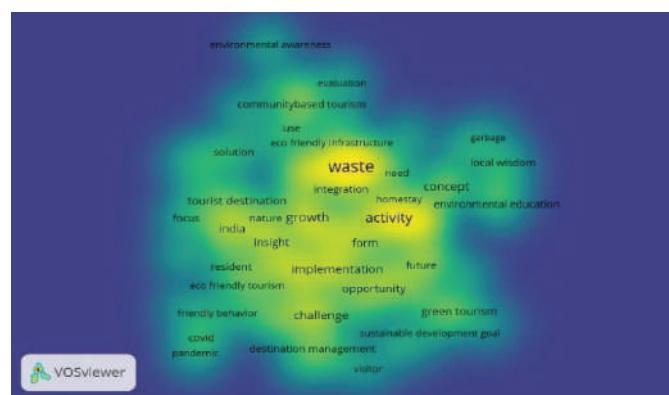
The implementation of zero-waste management principles is considered a strategic step in realizing sustainable tourism (Sari et al., 2024; Satriawati et al., 2024). However, studies on the application of zero-waste principles in community-based tourism management are still very limited (Widyastuti, 2025). The concept of Zero-waste Management is an innovative approach that emphasizes the principle of *reduce, reuse, dan recycle* (Adifa & Wibero, 2024; Fitriani et al., 2024; Widiatmoko et al., 2024). This approach not only focuses on the technical aspects of waste management, but also fosters awareness and behavioral change among the community (Sanjayanti & Fauzi, 2024; Valentino et al., 2025). Zero-waste also optimizes the circular economy by processing waste into value-added products (Darmawan et al., 2023; Sanjayanti & Fauzi, 2024). Tourism operators should also behave in an environmentally friendly manner. In the context of sustainable tourism, the implementation of zero-waste is an important strategy for realizing eco-friendly tourism that balances economic, social, and ecological aspects (Suryawan et al., 2024).

Daerah Istimewa Yogyakarta (DIY) as one of the leading national tourist destinations, it also faces the problem of accumulating waste (Ananda et al., 2023; Astuti & Prasetyoningsih, 2024). Based on the data of Badan Pusat Statistik (BPS DIY, 2024), the number of tourist visits to DIY reached more than 27 million people in 2023, a significant increase compared to the previous year (Dzaky & Nugroho, 2024). The surge in visitors has had a direct impact on the increase in waste volume in various tourist destinations, including in tourist village areas (Rustiana et al., 2024; Satriawati et al., 2024).

Wirokerten is one of eight village in Kapanewon Banguntapan Subdistrict, Regency of Bantul (Sakir et al., 2025). Wirokerten Tourism Village is a destination that has begun implementing sustainability principles through the application of zero-waste program (Nursetiawan et al., 2024). This effort demonstrates the village's commitment to creating a clean, healthy, and competitive tourist environment (Sakir et al., 2025). However, the success of this program's implementation is greatly influenced by environmental governance which is effective, where collaboration between the village

government, the community, and tourism stakeholders is key to establishing a participatory and sustainable waste management system. (Daud et al., 2025; Putri & Setiawan, 2024). Through the Community-Based Tourism (CBT) approach, the community not only benefits economically, but also plays a key role in maintaining environmental cleanliness and sustainability (Anarta & Darwis, 2025; Aulia et al., 2024; Wicaksono et al., 2023). The CBT approach serves as a means of implementing the zero-waste principle through collaboration between the community, tourism operators, and village governments to achieve integrated and sustainable waste management (Alimi & Darwis, 2023).

This study combines environmental governance and community-based tourism to explain the internalization of zero-waste in village tourism governance, an approach that is still rarely studied in Indonesia. With this basis, this study examines the process of implementing zero-waste in Wirokerten Tourism Village, identifies supporting and hindering factors, and assesses its contribution to the development of environmentally friendly and sustainable tourism.



**Figure 1.** The VOS viewer density map shows that columns with bright colors are topics that are frequently discussed, while columns with faded colors are topics that are rarely discussed.

Although many studies discuss waste management in tourist destinations, most still focus on technical aspects such as sorting, composting, and education, while studies that integrate zero-waste with community-based tourism village management are still very limited (Figure 1). Furthermore, most literature highlights zero-waste practices at the city or regional level, but few have evaluated how the institutional capacity of villages, the role of tourism working groups, and community participation actually influence the success of its implementation (Hadi et al., 2024). Previous studies have also failed to provide an in-depth explanation of governance challenges, such as coordination between actors, consistency in village regulations, and the long-term sustainability of zero-waste programs. Thus, this study fills the gap by analyzing the mechanisms for

implementing zero-waste at the tourist village level, including supporting factors, obstacles, and the dynamics of the community's role in developing sustainable, environmentally friendly tourism.

## METHODS

### Research Location

The research was conducted in Wirokerten Tourism Village, Banguntapan Subdistrict, Bantul Regency, Province of Daerah Istimewa Yogyakarta (DIY). The research location is more precisely in Blumbang Market, and the research was conducted between October–November 2025.

### Research Design

This study uses a descriptive qualitative method that aims to deeply understand the implementation of the zero-waste management program. According to John W. Creswell Qualitative research is an inquiry process of understanding based on distinct methodological traditions of inquiry that explore a social or human problem. The researcher builds a complex, holistic picture, analyzes words, reports views of informants, and conducts the study in a natural setting (Nugroho & Murhayati, 2024). The object of study focuses on zero-waste management. This approach is used because it is considered most relevant for comprehensively understanding social and environmental phenomena through in-depth exploration of the experiences, perceptions, and participation of tourism stakeholders and local communities.

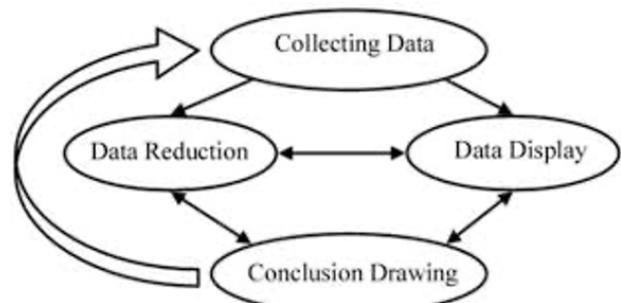
### Data Collection Techniques

The data collection technique was carried out in three steps. First, a literature review was conducted by examining various articles and references relevant to the implementation of zero-waste in the Tourism Village. Second, interviews were conducted with six informants who had the relevant capacity and knowledge related to the research theme, namely three representatives of the Wirokerten Tourism Village Management and three business actors who were also local residents. The informants themselves had a direct role in zero-waste management, including the head of Pokdarwis (*Kelompok Sadar Wisata* or Tourism Aware Group), the head of the Wirokerten Tourism Village Management, and the head of the Tourism Innovation Division. In addition to interviewing village managers, business actors also served as sources for research data. From the information provided by the sources during the interviews, information was gathered regarding policies, planning, and implementation. Based on the interview findings, the zero-waste program has its strengths and weaknesses. This program is still merely a campaign that has been

well implemented in the community. The third observation was conducted by directly observing zero-waste implementation activities to obtain data and documentation. Interviews and observations were conducted to collect data.

### Data Analysis Techniques

Data analysis was conducted using the (Miles & Huberman, 2012) model, which began with data reduction through selection, grouping, and simplification of important information from interviews, observations, and documentation (Zulfirman, 2022). The reduced data is then presented in narrative form to make it easier for researchers to understand the patterns and relationships that emerge. The final step is to draw conclusions on an ongoing basis by verifying the findings to ensure they are consistent with the field data (Figure 2).



**Figure 2.** The image depicts data analysis according to Miles and Huberman.

The analytical framework of this study uses Environmental Governance Theory, and Community-Based Tourism Theory (CBT), used to explain the structure, policies, and coordination mechanisms in zero-waste management, whereas Community-Based Tourism Theory (CBT) highlights the role, participation, and awareness of local communities and tourists in maintaining environmental sustainability. The combination of these two factors explains how environmental management in community-based tourism villages has become a platform for implementing zero-waste management towards eco-friendly tourism.

## RESULT AND DISCUSSION

### Implementation of Zero-waste

The zero-waste program in Wirokerten Tourism Village initially began as an activity at Blumbang Market, spearheaded by Pokdarwis together with market managers. The initiative then developed into a program that is currently still in the campaign and basic education stage, which is being implemented gradually, as stated by Rangga in a personal communication on October 26, 2025. "In practice, the zero-waste program in this village

is still in the form of a campaign that has been well implemented by the community, although its implementation is not yet comprehensive. This initiative is seen as a gradual process towards full zero-waste implementation, which continues to develop slowly but shows consistent progress." This effort can be seen from the community, which has begun to sort organic and inorganic waste, collect waste centrally, and promote the reduction of single-use plastics in tourism and UMKM, such as replacing single-use plastic containers with woven bamboo, banana leaves, and paper glass (Figure 3 & Figure 4). This is confirmed by a statement from a source that "we have eliminated the use of plastic containers and replaced them with woven bamboo and paper glass to be more environmentally friendly" (Bimo, Personal Communication, October 26). Bamboo weaving, banana leaves that are more easily biodegradable and can be used long-term, and paper glass are initial steps in supporting the reduction of tourism waste (Rahman & Anggalih, 2023).



**Figure 3.** The use of woven bamboo in Blumbang market.



**Figure 4.** The use of banana leaves in the Blumbang Market.

Several business owners stated that they have reduced their use of plastic and are trying to comply with the village's appeal. This is evident from the statement of one source, "Now many people are becoming aware of the dangers of plastic waste and are trying to reduce its use" (Sofian, Personal Communication, November 8). This is reinforced by the statement of one of the administrators

of *Desa Wisata* (Tourism Village): "Plastic takes a very long time to decompose and has the potential to cause long-term environmental impacts, including the emergence of microplastics. Over time, vendors and residents around Blumbang Market have shown increased awareness of these dangers and have begun to reduce their use of plastic." (Bimo, Personal Communication, October 26). The community and UMKM actors have shown fairly good acceptance of this Zero-waste initiative.

On the socio-economic side, they feel the benefits of a cleaner environment and more organized business spaces, as stated by the source: "Actually, waste has significant economic potential for the community, for example through its use as craft materials. However, so far, the most visible impact in Wirokerten Village is a more organized environment and improved plastic waste management compared to before." (Bimo, Personal Communication, October 26). The emergence of new economic potential through waste management training, such as eco-bricks and recycled crafts (Sakir & Setianingrum, 2021). These practices show that zero-waste has become part of tourism management orientation, although it is still in the form of gradual implementation and has not been fully standardized.

### Community and Institutional Roles

The role of the community, especially Pokdarwis, the village government, business actors, and the community, is an important element in the sustainability of the zero-waste program. Pokdarwis functions as the main driver of socialization and implementation of activities. Pokdarwis plays a role as a liaison between actors, from MSMEs to the village government. The village government provides policy support and facilities, such as tourist education, plastic waste disposal sites, waste banks, and assistance for MSMEs to switch to environmentally friendly packaging, as stated by a business actor in the Blumbang market: "Education related to plastic reduction is most intensive on Sundays, when zero-waste is strictly enforced and all packaging must be plastic-free. Additionally, the community has also begun implementing waste sorting" (Sofian, Personal Communication, November 8) (Figure 5 & Figure 6). Here, it is evident that the role of the Tourism Village administrators is crucial in conducting direct training and supervision of tourism village management activities, as they can strengthen participants' knowledge in implementing good tourism village management practices (Astiana et al., 2021).

The government also facilitates the community by providing various programs. "There are quite a number of government programs. For example, providing plastic waste disposal sites that can later be collected at waste Banks" (Alan, Personal Communication, October 26). Another source added, "The Wirokerten Village

Government has previously provided biopores and stackable buckets as a means of managing organic waste. Through these facilities, organic waste is left to soak and is then processed into fertilizer" (Alan, Personal Communication, October 26). Waste management methods such as stackable buckets and biopores are beginning to be implemented at the household level as an effort to process organic waste (Figure 7), which can then be turned into fertilizer that is beneficial to the environment (Salawati *et al.*, 2021; Umami *et al.*, 2024).



**Figure 5.** Waste sorting machine.



**Figure 6.** Waste sorting training.



**Figure 7.** Stacked buckets, waste banks, and biopores.

Meanwhile, the community and business operators participate through environmental clean-up activities, plastic reduction, and the promotion of environmentally friendly behavior to tourists. All business operators say, "We are ready to sort waste so that the environment is better maintained," showing that they are ready to follow village regulations. The role of the community has been running, although not evenly. This collaboration strengthens the principle of community-based tourism, where the community is not only the beneficiary but also the main actor in maintaining environmental sustainability (Pakpahan, 2018).

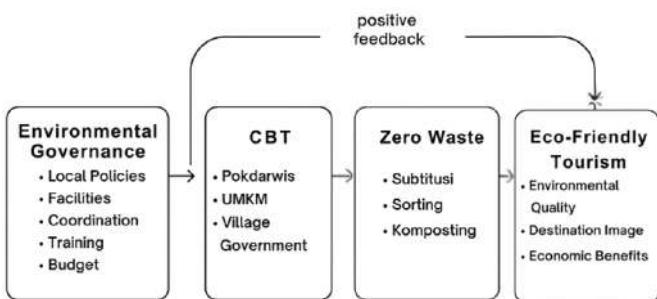
### Challenges and Lessons Learned

Although already underway, the zero-waste program faces a number of structural and technical obstacles. The main challenges include low consistency in the behavior of the community and tourists, the mentoring program has not been running sustainably, and there are no integrated operational standards at each tourist site. Several sources said that public awareness still varies; some actively sort waste, but others do not yet understand this obligation (Bimo, personal communication, October 26). Business actors also mentioned that "there needs to be direct supervision from the relevant parties, so that we know what the shortcomings are and are given guidance for the future to improve." (Sudaryana, Personal Communication, November 8). The source also added, "But unfortunately, the reality is that many visitors are still unaware, such as those who bring plastic bottled water and snacks from outside the Blumbang market, and many of them litter" (Bimo, Personal Communication, November 26). These challenges show that the zero-waste program is still in the adaptation stage and requires many adjustments. A composting program has also been implemented, although it is not yet running optimally due to limited facilities and management capacity. The source also added that there is no sustainability in terms of training and funding: "Indeed, in terms of maximizing it, especially in terms of funding, the system is not sustainable. So they only provide training once or twice but don't continue it and don't think about how to make it sustainable" (Bimo, Personal Communication, October 26). Adequate funding and sustainable training are key factors that determine the sustainability of the program, considering that behavioral change and strengthening the waste management system require stable resource support (Kurniawati *et al.*, 2025).

### DISCUSSION

The implementation of the zero-waste program in Wirokerten Tourism Village has shown gradual changes in waste reduction practices, in line with the principles of zero-waste management, namely reducing waste sources

from the outset through the selection of easily degradable materials (Maulidia & Azizah, 2025). This practice is in line with the concept of waste minimization, which requires material substitution and changes in consumption behavior to reduce waste generation, this connection reinforces the view that environmental protection is the foundation of sustainable tourism, where changes in the operations of tourism operators are a prerequisite for the sustainability of destinations, which is also found in research (Nuojua et al., 2024; Hau, 2024). When UMKM reduce plastic use and village governments provide supporting facilities and regulations, we see the initial integration of environmental governance through the role of local governments as providers of institutional structures that facilitate environmentally friendly behavior.



**Figure 8.** Zero-waste program conceptual diagram.

The transition to sustainable tourism requires consistency in the operational behavior of tourism stakeholders, as also demonstrated by research (Dolnicar & Greene, 2025). In perspective Community-Based Tourism (CBT) (Goodwin & Santilli, 2009), This finding is consistent with the concept of community empowerment. However, the degree of empowerment is not yet evenly distributed; some residents still do not understand waste sorting or still burn waste. This condition reinforces the findings (Fitriani et al., 2024), which states that behavioral change requires continuous intervention, especially in the form of consistent education and training. However, conditions on the ground show that empowerment is uneven; some residents do not understand waste sorting or still burn waste, so the process of internalizing environmental values is not yet optimal. This situation reinforces a key pillar of CBT: that community capacity must be continuously strengthened through ongoing education and training so that communities can effectively carry out their ecological role.

Environmental management in Wirokerten involves various actors, including Pokdarwis, the village government, UMKM, and the community, with varying levels of coordination. This pattern reflects the principle of polycentric environmental governance (Ostrom, 2010), which emphasizes the importance of having multiple decision-making centers that work

autonomously but interact with each other (Kellner et al., 2024). This is in line with the findings (Flouri et al., 2025) which states that Pokdarwis acts as a social initiator, while the village government provides regulations and supporting facilities. This polycentric structure shows that the effectiveness of zero-waste is highly determined by the quality of coordination between actors, because governance requires alignment of ecological goals, clear distribution of roles, and sustainable interaction mechanisms.

Low awareness among tourists was also found in the study (Fitriani et al., 2024). This shows that tourist behavior is a major obstacle to the success of environmental programs. Meanwhile, the unsustainability of training is in line with the findings (Suryawan et al., 2024). From a CBT perspective, this condition indicates that empowerment has not been fully achieved because increasing the capacity of communities and tourists requires repeated intervention, not sporadic intervention. Uneven education leads to inconsistent behavior, so that the implementation of zero-waste has not yet entered the stage of internalizing environmental values. This is consistent with the literature which emphasizes that ecological behavior will only be effective if it is built through a long-term learning process. Within the framework of polycentric governance, the success of zero-waste depends on the sustainability of regulations, assistance, and the distribution of roles among stakeholders.

This study has limitations because it was only conducted in one tourist village, so the findings are contextual and cannot be generalized to other areas with different social conditions and institutional capacities. In addition, the zero-waste program in Wirokerten is still in its early stages, so the study captures more of the dynamics of transition than long-term impacts, which limits the evaluation of the overall effectiveness of the governance model and CBT. These limitations affect the external validity of the study, so the results should be understood as an in-depth description of the implementation process in a specific local context. To strengthen the generalizability, future research should involve more tourist villages with different characteristics or use a longitudinal approach to assess the development of community capacity and the effectiveness of governance in the long term.

The assistance was not sustainable, so the village institutional structure was not strong enough to support long-term implementation. This emphasizes that environmental governance is not only a matter of the presence of actors, but also the continuity of interaction, monitoring, and the provision of incentives. This study has limitations in that its scope only covers one tourist village, while the zero-waste program in Wirokerten itself is still in its early stages, so that its long-term impact cannot yet be observed comprehensively. In line with the

findings (Fitriani et al., 2024; Suryawan et al., 2024) The inconsistency in behavior indicates that the implementation of zero-waste has not yet reached the stage of complete internalization of values. From an environmental governance perspective, this indicates that the rule enforcement system and monitoring mechanisms are not yet functioning optimally.

## CONCLUSION

This study confirms that the implementation of zero-waste management in Wirokerten Tourism Village is still progressing gradually; however, it demonstrates encouraging developments, particularly through reduced plastic use, increased levels of community participation, and the strengthened role of the Tourism Awareness Group (Pokdarwis) in coordinating environmental management initiatives. The integration of empirical field findings with perspectives on environmental governance and community-based tourism indicates that the success of the program is largely influenced by effective coordination among key actors, the capacity of the local community, and strong institutional support at the village level.

From a theoretical standpoint, this study contributes to the literature by proposing a conceptual model that links environmental governance, community empowerment, zero-waste implementation, and the formation of environmentally friendly tourism. This framework broadens the understanding of how village-level governance mechanisms can actively promote sustainable tourism practices and foster long-term environmental responsibility. From a policy perspective, the findings underscore the importance of formulating Village-level zero-waste standard operating procedures (SOPs), integrating zero-waste programs into the Village Medium-Term Development Plan (RPJMDes) and the Village Annual Work Plan (RKPDes), allocating a dedicated and regular budget, and establishing mechanisms for continuous monitoring, evaluation, and environmental education for both residents and tourists.

Future research is recommended to quantitatively evaluate the effectiveness of zero-waste programs, conduct comparative analyses among tourism villages with differing governance contexts, and develop community-based circular economy impact measurement models. Overall, this study provides both empirical evidence and a conceptual foundation for the development of a zero-waste governance model that has strong potential to be adapted and replicated in other tourism villages across Indonesia.

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