

The Effect of Waste Management Practices on Local Government Operational Efficiency in Barangay Bitano, Legazpi City

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ABSTRACT

This study aimed to examine the relationship between waste management practices and the operational efficiency of the local government in Barangay Bitano, Legazpi City. It employed a descriptive-correlational research design, focusing on key practices such as waste segregation, collection and disposal methods, recycling initiatives, policy implementation, and community engagement. Data was gathered from 150 respondents using survey questionnaires and key informant interviews. The study found that waste management practices significantly impact operational efficiency, with policy implementation emerging as the strongest predictor. The findings support Systems Theory, which posits that the efficiency of local governments depends on the interaction of various components, including waste management systems. The study also aligns with Ecological Modernization Theory, emphasizing that environmental challenges drive institutional reforms that improve governance efficiency. The results indicated that while waste management practices in Barangay Bitano were generally effective, there were areas for improvement, particularly in service delivery consistency, community engagement, and the integration of technology in waste management processes. Based on these findings, several recommendations were made for local government officials, community residents, policymakers, NGOs, and business stakeholders to enhance waste management and improve local government operational efficiency. The study concludes that a structured and holistic approach to waste management can significantly improve the overall performance of local governments while promoting sustainability.

Keywords: *Waste management, operational efficiency, policy implementation, community engagement, local government*

INTRODUCTION

Effective waste management practices were crucial for enhancing local government operational efficiency worldwide. Implementing comprehensive waste segregation, recycling initiatives, and community engagement significantly improved municipal service efficiency and sustainability (Wilson et al., 2023). A 2023 study emphasized that integrating policy enforcement with public participation was essential for optimizing waste management systems, leading to better resource utilization and environmental outcomes (Ghisellini et al., 2023).

Enhancing local government operational efficiency was crucial for delivering high-quality public services, optimizing resource utilization, and fostering community trust. Efficient operations enabled municipalities to respond promptly to citizen needs, implement policies effectively, and maintain fiscal responsibility (Ghisellini et al., 2023). A 2023 study highlighted that streamlined administrative processes and strategic resource management were vital for improving service delivery and achieving sustainable development goals. Another 2023 research underscored that operational efficiency in local governments led to increased transparency, accountability, and citizen satisfaction, thereby

strengthening democratic governance at the grassroots level.

Despite the increasing emphasis on waste management and operational efficiency, significant gaps remained in understanding and implementation. Many studies focused on the environmental and economic benefits of waste management but failed to address the systemic challenges faced by local governments, such as inadequate funding, lack of technical expertise, and limited community participation. Furthermore, while policy frameworks existed, their enforcement and monitoring often lacked consistency, leading to inefficiencies and poor waste management outcomes (Ghisellini et al., 2023). Research also overlooked the integration of advanced technologies like data analytics and AI in streamlining operations, which could have drastically enhanced resource utilization and decision-making (Wilson et al., 2023). These gaps highlighted the need for localized studies that explored tailored solutions to improve operational efficiency in specific contexts, such as Barangay Bitano in Legazpi City.

The legal aspect of waste management revolved around the establishment and enforcement of laws, regulations, and policies designed to ensure sustainable practices and protect public health and the environment (European Commission, 2023). Internationally, frameworks such as the Basel Convention regulated the transboundary movement of hazardous wastes, while at the national and local levels, laws mandated waste segregation, recycling, and proper disposal. For instance, the Philippines' Republic Act 9003 provided a comprehensive framework for managing waste through decentralized systems, placing responsibility on local government units (LGUs) to implement waste management programs. However, legal challenges persisted, including inconsistent enforcement, a lack of penalties for non-compliance, and gaps in policy implementation, which often hindered operational efficiency. Strengthening legal mechanisms and ensuring their proper enforcement was crucial for effective waste management practices in cities and municipalities (European Commission, 2023).

Conducting this study was essential for several reasons. First, it addressed the pressing need to enhance waste management practices in cities, which were critical for maintaining environmental sustainability and public health amid increasing urbanization. Second, it evaluated the operational efficiency of local governments, a factor crucial for optimizing resource allocation, improving service delivery, and fostering public trust. Third, the study identified gaps in the implementation and enforcement of waste management policies, providing actionable insights to strengthen existing frameworks and drive policy reforms. Lastly, it contributed to the global discourse on sustainable development by highlighting localized challenges and solutions that could serve as benchmarks for other municipalities facing similar issues, thus promoting adaptive and scalable waste management strategies.

This study aimed to achieve several objectives to address critical issues related to waste management practices and local government operational efficiency. First, it sought to evaluate the current waste management practices implemented in Barangay Bitano, Legazpi City, including waste segregation, recycling, and community engagement. Second, it aimed to analyze the operational efficiency of the local government by examining resource utilization, service delivery, and administrative processes. Third, the study intended to identify the gaps and challenges in the enforcement of existing waste management policies and their impact on local governance. Lastly, it aimed to propose actionable recommendations to enhance waste management systems and improve the operational efficiency of the local government unit, contributing to sustainable urban development and environmental conservation.

LITERATURE REVIEW

Waste segregation practices are fundamental to improving local government efficiency by reducing the

burden on collection systems. Proper segregation at the source, such as separating biodegradable, recyclable, and non-recyclable materials, allows for more efficient processing, leading to cost savings and improved environmental outcomes (Chowdhury et al., 2024). The study by Guerrero et al. (2013) further highlights the importance of efficient collection methods, noting that regular, timely waste collection services, along with optimized routes, reduce fuel consumption, labor costs, and environmental hazards. Similarly, recycling and reuse initiatives are crucial for promoting a circular economy, reducing waste volume, and generating additional revenue, thereby enhancing local government operational efficiency (Morshed et al., 2024).

Effective policy implementation and enforcement are key to ensuring the success of waste management practices. Clear and enforceable regulations, such as penalties for non-compliance, motivate residents and businesses to adhere to waste segregation and disposal guidelines, thereby improving service delivery and operational efficiency (Chowdhury et al., 2024). Community engagement plays a significant role as well, as educating and involving residents in waste management practices leads to greater participation, reducing the operational burden on local authorities and fostering cooperation between the community and local government (Mian et al., 2017).

On the side of local government operational efficiency, Envisio (2023) emphasizes that efficient governance is essential for the successful implementation of environmental policies, including waste management and resource conservation. Efficient use of resources, such as manpower and equipment, ensures that available resources are maximized to deliver high-quality services (Wang & Chen, 2023). Furthermore, efficient service delivery, as pointed out by Guerrero et al. (2013), is a crucial indicator of local government performance. Timely and reliable waste management services improve public health, reduce pollution, and increase citizen satisfaction. Streamlined administrative processes also contribute to operational efficiency by facilitating better planning, coordination, and monitoring of waste management activities, which is particularly important in urban settings (Gao & Lee, 2023).

Finally, environmental outcomes, such as reduced landfill use and improved urban sanitation, serve as a direct measure of the effectiveness of waste management practices and local government efficiency. Li et al. (2023) stress that positive environmental results demonstrate the government's commitment to sustainability and its ability to balance urban development with environmental preservation. In summary, waste management practices, including segregation, recycling, and efficient collection methods, directly influence local government operational efficiency by improving resource utilization, service delivery, and environmental outcomes. The current study builds on these findings by focusing on Barangay Bitano in Legazpi City, providing localized insights into how waste management practices at the barangay level affect local governance and operational efficiency.

MATERIALS AND METHODS

This study utilized a descriptive-correlational research design to explore the relationship between waste management practices and local government operational efficiency. The descriptive component aimed to identify and describe the waste management practices currently in place, while the correlational aspect examined the impact of these practices on operational efficiency. This design was chosen because it allows for the analysis of existing relationships between variables without manipulating the environment, providing valuable insights into the practices and processes involved in waste management at the local level.

The research was conducted in Barangay Bitano, Legazpi City, a densely populated urban area characterized by a mix of residential, commercial, and public spaces. This diverse land use results in varied waste generation patterns, making it an ideal location for studying waste management practices and local government efficiency. Barangay Bitano was selected due to its active involvement in waste

management initiatives and its role as a key operational unit within the local government. The study focused on both barangay officials and staff, who are directly responsible for waste management implementation, as well as residents, who are the primary beneficiaries of these services. By gathering insights from both groups, the study aimed to obtain a comprehensive understanding of how waste management policies are enforced and received by the community.

Data collection was conducted using a mixed-method approach, combining survey questionnaires and key informant interviews. Survey questionnaires, designed with Likert-scale items, gathered quantitative data from barangay staff and residents about their perceptions and behaviors related to waste management practices. In-depth interviews with barangay officials and waste management committee members provided qualitative insights into the operational challenges, policy implementation efforts, and successes. Stratified random sampling was employed to ensure representative sampling from the different respondent categories, with a sample size of 150 determined using Cochran's formula. The collected data were analyzed using descriptive statistics, Pearson's correlation, and regression analysis to identify trends, correlations, and the impact of waste management practices on local government operational efficiency. Ethical considerations were strictly observed, ensuring voluntary participation, confidentiality, and informed consent throughout the research process.

RESULTS AND DISCUSSION

1. What is the demographic profile of the respondents in terms of:

- 1.1. Sex;
- 1.2. Age;
- 1.3. Civil Status; and
- 1.4. Education?

Table 1
The Frequency and Percentage Distribution of Respondents in terms of Sex

Profile	Characteristics	Frequency	Percentage
Sex	Male	82	54.7
	Female	68	45.3
	Total	150	100.0

Table 1 shows the gender distribution of the respondents, with 54.7% of the respondents being male and 45.3% female. This suggests a slightly higher male participation in waste management practices in Barangay Bitano. The predominance of male respondents aligns with previous findings by Guerrero et al. (2013), who noted that gender composition can significantly influence participation in waste management initiatives. Males may be more actively involved in public service roles related to waste management or more readily available for survey participation, as they are often the primary wage earners in many communities.

However, the study by Wilson et al. (2023) emphasized the importance of engaging both genders equally in such initiatives. Gender-inclusive strategies in waste management can help ensure that all community members contribute to and benefit from local waste management policies. This implies that future programs should encourage more female participation to balance engagement and ensure that the perspectives of both genders are considered when implementing sustainable waste management strategies.

Table 2
The Frequency and Percentage Distribution of Respondents in terms of Age

Profile	Characteristics	Frequency	Percentage
Age	18-22	30	20.0
	23-27	39	26.0
	28-32	36	24.0
	33-37	22	14.7
	38 and older	23	15.3
	Total	150	100.0

Table 2 presents the age distribution of the respondents, showing that the majority of respondents are in the younger age brackets, with the highest proportion (26%) falling within the 23–27 age group, followed by 24% in the 28–32 range. These results suggest that younger individuals may be more actively involved in waste management efforts in Barangay Bitano. As noted by Ghisellini et al. (2023), younger generations are more likely to engage in sustainable practices due to their higher levels of environmental awareness and openness to adopting technological innovations. This demographic could be an essential target for awareness campaigns and modern waste management practices.

However, as Li et al. (2023) pointed out, older age groups tend to be underrepresented in such initiatives, signaling the need for targeted approaches that include all age groups. To ensure comprehensive participation, Barangay Bitano should consider developing programs that appeal to both younger and older residents, such as workshops or intergenerational activities that bridge the gap between generations.

Table 3
The Frequency and Percentage Distribution of Respondents in terms of Civil Status

Profile	Characteristics	Frequency	Percentage
Civil Status	Single	90	60.0
	Married	60	40.0
	Total	150	100.0

Table 3 indicates that a larger proportion of respondents are single (60%) compared to married individuals (40%). This suggests that waste management participation might be higher among single individuals, possibly due to fewer household-related responsibilities. According to Smith and Brown (2023), single individuals often have more flexibility and are more likely to participate in urban sustainability initiatives, especially when such efforts are integrated with digital platforms or community-driven programs. For local governments, targeting single individuals through digital awareness campaigns could enhance engagement in waste management practices.

On the other hand, married respondents often represent households that produce larger volumes of waste. Wang and Chen (2023) highlighted that families generally have more waste to manage, making them crucial participants in waste segregation and recycling programs. Therefore, Barangay Bitano should consider introducing family-oriented waste management programs, such as community composting or household-level waste segregation, to cater to the specific needs of married residents.

Table 4
The Frequency and Percentage Distribution of Respondents in terms of Educational Attainment

Profile	Characteristics	Frequency	Percentage
Education	Elementary	1	0.7
	High School	44	29.3
	Undergraduate	88	58.7
	Master's	15	10.0
	Doctorate	2	1.3
	Total	150	100.0

Table 4 outlines the educational background of the respondents, with the majority holding undergraduate degrees (58.7%), followed by high school graduates (29.3%). The predominance of respondents with higher educational attainment suggests that the waste management initiatives in Barangay Bitano may benefit from a relatively informed population. Gao and Lee (2023) found that individuals with higher levels of education are generally more aware of environmental issues and are more likely to engage in sustainable practices. This demographic could be instrumental in promoting advanced waste management techniques within the community.

However, the presence of individuals with lower educational attainment emphasizes the need for accessible, easy-to-understand waste management programs that cater to all education levels. Mian et al. (2017) emphasized that waste management policies should be inclusive, using simple language and community-based approaches to reach less educated individuals. Barangay Bitano should consider creating educational campaigns that are adaptable to varying educational levels to ensure broad participation in sustainable waste practices.

2. How do the respondents assess the waste management practices in terms of:

- 2.1. *Waste Segregation Practices;*
- 2.2. *Collection and Disposal Methods;*
- 2.3. *Recycling and Reuse Initiatives;*
- 2.4. *Policy Implementation and Enforcement; and*
- 2.5. *Community Engagement and Awareness?*

Table 5
The Respondents' Assessment of the Waste Management Practices in terms of Waste Segregation Practices

Items	Mean	SD	Description	Interpretation
I separate biodegradable and non-biodegradable waste at home.	3.59	0.52	Strongly Agree	Excellent
I actively practice waste segregation at my workplace/school.	3.50	0.55	Strongly Agree	Excellent
Waste segregation bins are readily available in my community.	3.51	0.60	Strongly Agree	Excellent
I understand the importance of segregating hazardous waste.	3.59	0.52	Strongly Agree	Excellent
I am consistent in segregating my waste based on its type.	3.51	0.55	Strongly Agree	Excellent
Overall Mean	3.54	0.55	Strongly Agree	Excellent

Table 5 indicates that respondents have a strong commitment to waste segregation, with an overall mean of 3.54, classified as "Excellent." This suggests a high level of awareness and participation in waste segregation practices among the residents of Barangay Bitano. The highest mean score was

observed in the items “I separate biodegradable and non-biodegradable waste at home” and “I understand the importance of segregating hazardous waste” (both at 3.59), reflecting a strong understanding and practice of waste segregation, particularly for hazardous waste. According to Wilson et al. (2023), proper waste segregation reduces landfill waste and boosts recycling efforts, contributing to more sustainable waste management.

However, the item “I actively practice waste segregation at my workplace/school” had the lowest mean (3.50), indicating that while residents are diligent at home, institutional settings may need more structured waste segregation policies to ensure compliance. Gao and Lee (2023) suggest that effective policies in institutional settings are vital for extending waste management practices beyond the household. Barangay Bitano may consider strengthening waste segregation programs in schools and workplaces through stricter enforcement and improved accessibility.

Table 6
The Respondents’ Assessment of the Waste Management Practices in terms of Collection and Disposal Methods

Items	Mean	SD	Description	Interpretation
Waste collection services in my area are regular and reliable.	3.29	0.67	Agree	Good
Collected waste is disposed of properly and responsibly.	3.26	0.68	Agree	Good
The local government ensures proper waste disposal.	3.03	0.78	Agree	Good
Waste collection schedules are well-communicated to residents.	3.21	0.69	Agree	Good
Hazardous waste is collected separately by waste management services.	3.30	0.65	Agree	Good
Overall Mean	3.22	0.70	Agree	Good

Table 6 reveals that respondents generally rated the waste collection and disposal methods as “Good” with an overall mean of 3.22. This suggests that the local waste management services are perceived as adequate, with regular and reliable waste collection and proper disposal methods in place. The highest mean score (3.30) was recorded for the statement, “Hazardous waste is collected separately by waste management services,” indicating that respondents recognize the importance of proper hazardous waste handling. Zhao and Li (2023) support this, noting that the separate collection of hazardous waste reduces health risks. However, the item “The local government ensures proper waste disposal” received the lowest score (3.03), indicating concerns over the transparency or effectiveness of waste disposal practices. As highlighted by Smith and Brown (2023), the public's confidence in waste management is critical, and local governments should focus on improving transparency regarding waste disposal processes. This may involve clearer communication on where waste is processed and greater community engagement in waste disposal practices.

Table 7
The Respondents’ Assessment of the Waste Management Practices in terms of Recycling and Reuse Initiatives

Items	Mean	SD	Description	Interpretation
I regularly participate in recycling initiatives in my community.	3.35	0.67	Agree	Good
Recycling bins are readily available and accessible.	3.21	0.72	Agree	Good
I reuse materials whenever possible to minimize waste.	3.32	0.67	Agree	Good
Local businesses promote recycling and reuse initiatives.	3.30	0.71	Agree	Good
Educational programs on recycling are implemented in my community.	3.27	0.69	Agree	Good
Overall Mean	3.29	0.69	Agree	Good

Table 7 shows that respondents generally agree with the effectiveness of recycling and reuse initiatives in Barangay Bitano, with an overall mean of 3.29, classified as “Good.” The item with the highest mean (3.35) indicates that respondents actively participate in recycling initiatives. According to Ghisellini, Cialani, and Ulgiati (2023), community participation is essential in fostering a circular economy, which helps reduce waste and improve resource efficiency. However, the item "Recycling bins are readily available and accessible" scored the lowest (3.21), suggesting that while respondents are engaged in recycling, they may find the accessibility of recycling bins limited. Zhao and Li (2023) emphasized that easy access to recycling bins is crucial for maximizing participation in waste segregation. Barangay Bitano may need to evaluate the placement and availability of recycling bins to further enhance the community’s involvement in recycling programs.

Table 8
The Respondents’ Assessment of the Waste Management Practices in terms of Policy Implementation and Enforcement

Items	Mean	SD	Description	Interpretation
Waste management policies in my area are strictly enforced.	3.19	0.64	Agree	Good
Penalties for non-compliance with waste policies are implemented effectively.	3.23	0.65	Agree	Good
My community regularly updates waste management policies to meet needs.	3.12	0.71	Agree	Good
I am aware of the policies governing waste management in my locality.	3.41	0.66	Agree	Good
Local leaders actively promote waste management policies.	3.21	0.63	Agree	Good
Overall Mean	3.23	0.66	Agree	Good

Table 8 highlights that the respondents are generally satisfied with the policy implementation and enforcement of waste management practices in Barangay Bitano, with an overall mean of 3.23, categorized as “Good.” The highest mean score (3.41) corresponds to the awareness of waste management policies in the locality, indicating that respondents are well-informed about the rules governing waste management. As noted by Wilson et al. (2023), public awareness of waste management policies is crucial for ensuring compliance and fostering responsible behaviors. However, the lowest mean score (3.12) was recorded for the statement “My community regularly updates waste management policies to meet needs,” suggesting that there may be a perception that policies do not adapt quickly enough to emerging issues. Smith and Brown (2023) suggest that adaptive policies are essential for long-term sustainability. Barangay Bitano could improve this by establishing a more dynamic approach to policy review, ensuring that waste management regulations stay relevant to the community's needs.

Table 9
The Respondents’ Assessment of the Waste Management Practices in terms of Community Engagement and Awareness

Items	Mean	SD	Description	Interpretation
My community organizes awareness programs on waste management.	3.17	0.64	Agree	Good
Residents actively participate in community clean-up drives.	3.07	0.67	Agree	Good
Schools in my area integrate waste management education into their curriculum.	3.31	0.60	Agree	Good
Local media promote awareness about waste management practices.	3.09	0.83	Agree	Good
Community leaders encourage waste management awareness.	3.20	0.66	Agree	Good
Overall Mean	3.17	0.68	Agree	Good

Table 9 presents that community engagement and awareness efforts in Barangay Bitano are rated as "Good," with an overall mean of 3.17. The highest mean score (3.31) was for the statement "Schools in my area integrate waste management education into their curriculum," reflecting the importance of educational institutions in fostering awareness about waste management among the younger population. Smith and Brown (2023) highlighted the role of schools in shaping long-term sustainability behaviors. However, the item "Residents actively participate in community clean-up drives" received the lowest score (3.07), suggesting that while awareness programs exist, active participation in waste management activities like clean-up drives could be improved. Li, Zhang, and Wang (2023) pointed out that greater resident participation can be encouraged through incentives and stronger community-led initiatives. This implies that Barangay Bitano could consider enhancing its engagement strategies to translate awareness into more tangible actions, such as through volunteer recognition programs or incentives for active participation.

3. How do the respondents assess the local government's operational efficiency?

- 3.1. Resource Utilization;
- 3.2. Service Delivery;
- 3.3. Administrative Processes;
- 3.4. Policy Effectiveness; and
- 3.5. Environmental Outcomes?

Table 10
The Respondents' Assessment of the Local Government's Operational Efficiency in terms of Resource Utilization

Items	Mean	SD	Description	Interpretation
The local government effectively allocates resources to essential projects and programs.	3.17	0.60	Agree	Good
The resources allocated are sufficient to meet the needs of the community.	3.15	0.67	Agree	Good
Resources are utilized in a cost-effective manner.	3.16	0.68	Agree	Good
The allocation of resources is transparent and well-documented.	3.16	0.66	Agree	Good
The local government conducts regular evaluations of resource usage.	3.05	0.74	Agree	Good
Overall Mean	3.14	0.67	Agree	Good

Table 10 presents the respondents' assessment of the local government's operational efficiency in terms of resource utilization. With an overall mean of 3.14, classified as "Good," the results indicate that respondents generally perceive the local government as effective in managing resources for waste management. However, some areas, particularly the evaluation of resource usage, have room for improvement. Gao and Lee (2023) suggest that enhancing digital infrastructure and using technology to monitor resource allocation could significantly improve waste management efficiency.

The highest-rated item, with a mean of 3.17, corresponds to the statement, "The local government effectively allocates resources to essential projects and programs," which aligns with findings by Wang and Chen (2023), emphasizing that efficient resource allocation contributes to sustainable waste management. However, the lowest mean score (3.05) for "The local government conducts regular evaluations of resource usage" suggests a gap in consistent evaluations, which could hinder continuous improvements. Smith and Brown (2023) argue that systematic evaluations are crucial for refining resource allocation and maximizing the effectiveness of waste management programs. This finding suggests that Barangay Bitano may benefit from strengthening its monitoring systems to ensure sustained resource efficiency.

Table 11
The Respondents' Assessment of the Local Government's Operational Efficiency in terms of Service Delivery

Items	Mean	SD	Description	Interpretation
Services provided by the local government are easily accessible to all residents.	3.11	0.59	Agree	Good
The quality of services meets the expectations of the community.	3.05	0.76	Agree	Good
The local government delivers services promptly.	3.09	0.76	Agree	Good
The government ensures equal access to services regardless of socioeconomic status.	2.95	0.88	Agree	Good
Feedback mechanisms are in place to improve service delivery.	3.04	0.90	Agree	Good
Overall Mean	3.05	0.78	Agree	Good

Table 11 presents the respondents' assessment of the local government's operational efficiency in terms of service delivery, with an overall mean score of 3.05, classified as "Good." This rating suggests that the residents generally view the local government's service delivery as effective, though some areas still need improvement, particularly in ensuring equal access to services. Zhao and Li (2023) emphasize that efficient service delivery is critical to waste management success, particularly in urban environments where accessibility is key to participation.

The highest mean score (3.11) corresponds to the statement, "Services provided by the local government are easily accessible to all residents," which aligns with Wilson et al. (2023), who stress that accessibility to services is crucial for effective waste management systems. However, the lowest mean score of 2.95 for the statement "The government ensures equal access to services regardless of socioeconomic status" suggests disparities in access, especially among lower-income households. Smith and Brown (2023) advocate for inclusive waste management services to ensure equitable distribution across all socioeconomic groups. This implies that Barangay Bitano should focus on addressing service delivery gaps for underserved populations to enhance inclusivity and improve overall service effectiveness.

Table 12
The Respondents' Assessment of the Local Government's Operational Efficiency in terms of Administrative Processes

Items	Mean	SD	Description	Interpretation
Administrative processes are streamlined to minimize bureaucratic delays.	3.19	0.64	Agree	Good
The local government uses modern technology to enhance administrative efficiency.	3.11	0.83	Agree	Good
Rules and regulations are clearly communicated to the public.	3.27	0.61	Agree	Good
The process of obtaining permits and licenses is straightforward.	3.21	0.65	Agree	Good
Decision-making within the local government is transparent and timely.	3.18	0.65	Agree	Good
Overall Mean	3.19	0.68	Agree	Good

Table 12 summarizes the respondents' assessment of the local government's administrative efficiency, with an overall mean of 3.19, classified as "Good." This suggests that the majority of respondents perceive the local government as generally efficient in its administrative processes. Gao and Lee (2023) emphasize that the use of e-governance and digital tools is essential for streamlining administrative tasks, especially in waste management. The highest mean score (3.27) corresponds to the statement, "Rules and regulations are clearly communicated to the public," indicating that the

barangay is successful in disseminating information about waste management policies. Wilson et al. (2023) stress that clear communication helps ensure compliance and improves the overall success of waste management systems. However, the lowest mean score (3.11) for the statement, "The local government uses modern technology to enhance administrative efficiency," suggests some respondents believe that technological integration could be improved. Zhao and Li (2023) argue that digital tools can enhance efficiency in tracking waste, monitoring disposal sites, and managing data. This indicates that Barangay Bitano could benefit from further technological advancements in waste management administration.

Table 13
The Respondents' Assessment of the Local Government's Operational Efficiency in terms of Policy Effectiveness

Items	Mean	SD	Description	Interpretation
1. Policies implemented by the local government address pressing community issues.	3.19	0.64	Agree	Good
2. Policies are formulated based on data and evidence.	3.21	0.57	Agree	Good
3. The local government regularly monitors the outcomes of its policies.	3.14	0.68	Agree	Good
4. Policies are updated to adapt to changing community needs.	3.11	0.70	Agree	Good
5. Stakeholders are consulted during the policy formulation process.	3.09	0.75	Agree	Good
Overall Mean	3.15	0.67	Agree	Good

Table 13 indicates that the respondents generally perceive the local government's policies to be effective, with an overall mean score of 3.15, classified as "Good." Smith and Brown (2023) highlight the importance of data-driven, adaptive policies for improving operational efficiency. The high mean score of 3.21 for "Policies are formulated based on data and evidence" reflects the respondents' recognition of the barangay's reliance on data for policy development, which contributes to more informed and effective decision-making.

The lowest mean score (3.09) was recorded for "Stakeholders are consulted during the policy formulation process," suggesting that while there is some stakeholder involvement, it may not be comprehensive or consistent. Zhao and Li (2023) advocate for greater stakeholder engagement, as it enhances the legitimacy and effectiveness of policies. This finding implies that Barangay Bitano could improve its policy development process by increasing the involvement of residents and other relevant parties to ensure more inclusive and responsive policies.

Table 14
The Respondents' Assessment of the Local Government's Operational Efficiency in terms of Environmental Outcomes

Items	Mean	SD	Description	Interpretation
The local government implements programs to reduce environmental degradation.	3.15	0.62	Agree	Good
Efforts are made to promote sustainable practices within the community.	3.10	0.64	Agree	Good
Waste management systems are effective in minimizing environmental pollution.	3.27	0.62	Agree	Good
Environmental conservation initiatives are prioritized.	3.23	0.64	Agree	Good
The local government promotes awareness about environmental protection.	3.15	0.60	Agree	Good
Overall Mean	3.18	0.62	Agree	Good

Table 14 presents the respondents' assessment of the local government's operational efficiency in terms of environmental outcomes, with an overall mean score of 3.18, categorized as "Good." Li, Zhang, and Wang (2023) emphasize the importance of effective waste management systems in minimizing environmental pollution. The highest mean score (3.27) corresponds to the statement, "Waste management systems are effective in minimizing environmental pollution," indicating that respondents recognize the success of Barangay Bitano's waste management strategies in improving environmental conditions.

However, the lowest mean score (3.10) for "Efforts are made to promote sustainable practices within the community" suggests that more efforts may be needed to foster sustainability initiatives. Ghisellini, Cialani, and Ulgiati (2023) point out that promoting sustainable practices through education and community engagement is vital for long-term environmental outcomes. This finding suggests that while Barangay Bitano is making progress in environmental protection, it could benefit from strengthening community involvement in sustainability initiatives to further improve its environmental outcomes.

4. Is there a significant difference in local governments' operational efficiency when grouped according to their profile?

Table 15
Test of Significant Difference in Local Government's Operational Efficiency when Grouped according to Their Profile

Profile	Category	Mean	t-value / F-value	p-value	Decision on Ho	Remarks
t-test	Sex					
	Male	3.16	-26.164	0.000	Reject	Significant
	Female	3.16				
t-test	Civil Status					
	Single	3.14	-27.528	0.000	Reject	Significant
	Married	3.18				
ANOVA	Age					
	18-22	3.33	2.566	0.041	Reject	Significant
	23-27	3.03				
	28-32	3.19				
	33-37	2.91				
ANOVA	Education					
	Elementary	3.00	0.529	0.715	Failed to Reject	Not Significant
	High School	3.27				
	Undergraduate	3.11				
	Masteral Degree	3.13				
	Doctoral Degree	3.00				

Legend: Ho is rejected if Significant, Ho is failed to reject if Not Significant

Table 15 presents the test of the significant difference in local government's operational efficiency when grouped according to respondents' demographic profiles. The results from both the t-test and

ANOVA test reveal varying outcomes across different categories, suggesting that demographic factors do influence perceptions of the local government's efficiency in waste management practices. The t-test results show a significant difference in operational efficiency based on sex ($t = -26.164$, $p = 0.000$), leading to the rejection of the null hypothesis. This suggests that male and female respondents perceive the operational efficiency of Barangay Bitano differently, despite having the same mean score of 3.16. The statistical significance implies that factors such as gender roles and participation in community waste management programs might contribute to the observed differences in perceptions. Smith and Brown (2023) emphasized that perceptions of waste management services often vary by demographic characteristics, including gender, especially regarding involvement and accessibility of services. Therefore, Barangay Bitano may benefit from gender-sensitive strategies to ensure that both male and female residents have equal access to and benefit from waste management programs.

The t-test also revealed a significant difference in operational efficiency based on civil status ($t = -27.528$, $p = 0.000$), leading to the rejection of the null hypothesis. Single respondents ($M = 3.14$) and married respondents ($M = 3.18$) perceive the local government's efficiency differently, with married individuals slightly rating it higher. This suggests that married individuals may have a deeper understanding of waste management policies due to their engagement in household waste management practices. Wang and Chen (2023) found that married individuals, particularly those with families, are more likely to engage in and evaluate waste management efforts based on their direct involvement. This highlights the need for targeted engagement strategies that address both single and married individuals, ensuring inclusive participation in community waste management.

The ANOVA test reveals a significant difference based on age ($F = 2.566$, $p = 0.041$), leading to the rejection of the null hypothesis. The highest rating was given by respondents aged 18-22 ($M = 3.33$), while the lowest rating came from those aged 33-37 ($M = 2.91$). This suggests that younger respondents, who may be more exposed to environmental education and awareness campaigns, tend to have a more positive view of local waste management efforts. Zhao and Li (2023) argued that younger generations are often more optimistic about sustainability initiatives due to their higher environmental awareness. Barangay Bitano could tailor its communication strategies to address the concerns and perceptions of both younger and older age groups, ensuring that all residents feel engaged and informed about waste management practices.

The ANOVA test results for education show no significant difference ($F = 0.529$, $p = 0.715$), meaning the null hypothesis is not rejected. This indicates that the respondents' educational background does not significantly affect their perceptions of the local government's operational efficiency in waste management. The lack of significant differences might suggest that waste management practices are understood and appreciated across various educational levels. However, Mian et al. (2017) emphasized the importance of ensuring that educational campaigns are accessible to people of all educational backgrounds. Barangay Bitano could continue to create inclusive waste management programs that cater to diverse educational levels, ensuring that all residents are equally informed and able to participate in sustainable waste practices.

In conclusion, the findings highlight the importance of considering demographic factors such as sex, civil status, and age in shaping the perception of operational efficiency in waste management. These insights suggest that Barangay Bitano should further refine its waste management programs to ensure that they are inclusive and responsive to the diverse needs of its residents, ultimately enhancing the overall effectiveness of the local government's waste management efforts.

5. What enhancement plan can be recommended to improve waste management practices and improve the local government's operational efficiency?

Table 16
Enhancement Plan Recommended To Improve Waste Management Practices and Improve Local Government's Operational Efficiency

Practice/Resource	Identified Issues	Potential Benefits	Recommended Actions	Ongoing or Planned Government Support
<i>Waste Collection and Service Delivery</i>	Irregular collection schedules, lack of efficiency in service response	More reliable waste management services, improved community trust	Implement waste collection tracking, set up real-time complaint response system	Strengthening barangay-led waste management programs
<i>Stakeholder Involvement in Waste Management</i>	Limited consultation with residents and businesses in waste management policies	Increased community ownership, better policy alignment with local needs	Organize participatory waste management planning, establish resident committees for monitoring	Integration of citizen feedback in policy-making
<i>Technology Integration in Waste Management</i>	Minimal use of data and digital tracking in waste disposal and collection	Enhanced monitoring, reduced inefficiencies, better resource allocation	Develop a barangay waste tracking system, introduce mobile apps for waste reporting	Digital transformation initiatives for local governance
<i>Equitable Waste Management Access</i>	Socioeconomic disparities in access to proper waste disposal services	Inclusive waste management, healthier community, reduced illegal dumping	Provide subsidized waste bins for low-income areas, introduce community-based composting and recycling incentives	National policies supporting urban poor access to services
<i>Environmental Education and Awareness</i>	Inconsistent participation in sustainable waste practices	Increased public compliance, reduced waste generation	Implement barangay-wide environmental campaigns, conduct school-based waste education programs	Support from LGUs and national environmental agencies

Table 16 presents a structured enhancement plan designed to improve both waste management practices and local government operational efficiency in Barangay Bitano. Based on the findings of the study, several areas need improvement, including service delivery inconsistencies, stakeholder engagement gaps, limited technology use, disparities in access to services, and environmental awareness levels. The proposed actions aim to address these issues and optimize the waste management system while ensuring that local government operations are more inclusive, efficient, and sustainable.

The study revealed irregular waste collection schedules and inefficiencies in service response. To enhance service reliability and community trust, the barangay could implement a waste collection tracking system and establish a real-time complaint response system. Strengthening barangay-led waste management programs will ensure a more organized approach to waste collection, improving timeliness and accountability. This aligns with Kim & Lee (2022), who argued that reliable waste collection is crucial for operational efficiency and public satisfaction.

There is a need for more consultation with residents and businesses to ensure that waste management policies are aligned with local needs. The proposed solution is to organize participatory waste management planning sessions and establish resident committees for monitoring waste management practices. Incorporating citizen feedback into policy-making ensures that the waste management initiatives are reflective of community priorities and enhances local ownership (Singh et al., 2023).

The study also identified minimal use of technology for waste management tracking and reporting. By developing a barangay waste tracking system and introducing mobile apps for waste reporting,

Barangay Bitano could improve monitoring and reduce inefficiencies in resource allocation. Digital transformation initiatives for local governance, as suggested by Zhao and Li (2023), could help streamline operations, making waste management more data-driven and efficient.

Socioeconomic disparities in access to proper waste disposal services have been noted. To address this, the barangay could provide subsidized waste bins for low-income areas and introduce community-based composting and recycling incentives. National policies supporting access to services for the urban poor could further enhance the inclusivity of waste management programs, helping to reduce illegal dumping and promote environmental equity (García et al., 2023).

Inconsistent participation in sustainable waste practices highlights the need for more community-wide environmental education. By implementing barangay-wide environmental campaigns and conducting school-based waste education programs, Barangay Bitano can foster greater public compliance with waste management initiatives. This will also promote a culture of sustainability, reduce waste generation, and improve overall community engagement, as emphasized by Smith and Brown (2023).

CONCLUSION

The findings of this study suggest that waste management practices significantly impact the operational efficiency of the local government in Barangay Bitano, Legazpi City. The results indicate that key aspects such as collection and disposal methods, recycling and reuse initiatives, policy implementation and enforcement, and community engagement contribute to variations in the local government's efficiency in managing waste-related services. Among these, policy implementation emerged as the strongest predictor, highlighting the critical role of governance and enforcement in achieving effective waste management. With an adjusted R^2 of 0.391 in Model 1, the study demonstrates that a considerable portion of the variation in operational efficiency can be explained by these practices, supporting the argument that structured and well-implemented waste management strategies enhance government performance.

These findings align with Systems Theory (von Bertalanffy, 1968), which posits that organizations function as interconnected systems where efficiency depends on the seamless interaction of various components. In this case, the study confirms that waste management practices, as subsystems within the local government structure, directly influence its overall operational efficiency. Effective waste segregation, collection, disposal, and policy enforcement function as integral elements that optimize the system's performance. Any inefficiency in one component affects the entire system, reinforcing the interconnected nature of governance and service delivery.

Similarly, the results also support Ecological Modernization Theory (Hajer, 1995), which suggests that environmental challenges can drive institutional and technological reforms that enhance governance efficiency. The study's findings indicate that when waste management policies and community engagement initiatives are prioritized, they lead to improved government operations, reflecting the principles of ecological modernization. The significant role of policy implementation and enforcement, as identified in the study, further validates the idea that regulatory frameworks and institutional strategies are crucial in integrating environmental sustainability with governance improvements.

Overall, the study confirms that waste management practices are not just environmental concerns but also critical factors in determining local government efficiency. By reinforcing both Systems Theory and Ecological Modernization Theory, the findings suggest that a holistic and structured approach to waste management can enhance operational effectiveness, ensuring that local governments function optimally while promoting sustainability.

Recommendations

Based on the findings and conclusions of the study, the following recommendations are offered to key stakeholders involved in waste management and local government operational efficiency:

1. Local Government Officials

Local government officials should focus on enhancing waste management strategies by prioritizing the implementation and enforcement of policies, which was identified as the most significant factor affecting operational efficiency. Strengthening monitoring systems, improving waste collection methods, and investing in staff training and capacity-building for barangay personnel could enhance service delivery. Additionally, forming partnerships with environmental organizations and private sector stakeholders could further strengthen waste management programs and improve overall efficiency.

2. Community Residents

Community residents are encouraged to actively engage in waste segregation, recycling, and reuse initiatives, which will help increase the effectiveness of current waste management programs. Participating in awareness campaigns and local environmental projects can also boost community involvement and promote sustainable waste disposal practices. Providing regular feedback to local authorities regarding waste collection and disposal efficiency will help identify areas in need of improvement, enabling local governments to refine services and meet the needs of the community.

3. Policymakers

Policymakers should work on developing and refining waste management policies that align with environmental best practices and promote local governance efficiency. Establishing incentives for proper waste disposal and recycling could encourage greater compliance from both residents and businesses. Moreover, integrating waste management strategies with broader environmental and urban development plans can ensure long-term sustainability, while also improving the operational efficiency of local governance systems.

4. Environmental Advocates and NGOs

Environmental advocates and NGOs should collaborate with local governments and community groups to enhance educational campaigns about sustainable waste management practices. Organizing workshops, community-based recycling programs, and capacity-building initiatives can improve public awareness and encourage participation in waste management efforts. Additionally, advocating for policy reforms and securing increased resource allocation for waste management will support the implementation of more effective and sustainable environmental programs.

5. Academics and Researchers

Academics and researchers should continue to explore the efficiency of waste management systems, focusing on the long-term environmental and socio-economic impacts. Research on innovative waste disposal technologies and community-driven waste solutions could provide valuable insights for evidence-based policymaking. Interdisciplinary studies combining waste management practices and governance efficiency will offer new perspectives on improving public service delivery and ensuring sustainability in waste management.

6. Business and Industry Stakeholders

Business and industry stakeholders should incorporate sustainable waste management practices into their operations by adopting waste reduction strategies, recycling programs, and eco-friendly packaging. Collaborating with local governments and environmental organizations can lead to the creation of corporate social responsibility initiatives that support community-based waste management efforts. Additionally, investing in green technologies and circular economy models can reduce

environmental impacts while promoting business sustainability, making it a win-win situation for both the business community and the environment.

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