Waste management practices and sustainability perception in restaurants on Avenida central, Santiago De Veraguas

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Abstract

The study focuses on characterizing waste management practices and documenting the perception of sustainability in restaurants on the central avenue of Santiago, Veraguas. The investigation is based on a quantitative approach, with a descriptive and applied scope, and designs a type of non-experimental, cross-sectional study. The type of sampling is not probabilistic for convenience and is used as a data collection technique in a structured survey. The final sample of 5 establishments was validated by experts and the survey obtained a reliability coefficient Cronbach's Alpha of α = 0.914. The results show dichotomous operational management, where it is observed that 60% of restaurants "consistently" apply waste separation (Mean = 4.00) and where there is a strong opinion (Mean = 4.80) that the practice is positive for the prestige of the community, as opposed to administrative management being deficient. 60% of those surveyed mentioned that they "rarely" (Average = 2.80) control the amount of waste they produce, which hinders the possibility of realizing savings, even when the majority is willing to pay for capacity (Average = 4.40). which greatly limits the possibility of extending the halls to the entire province.

Keywords: Waste control, Waste management, corporate reputation, restaurants, sustainability.

INTRODUCTION

The management of waste in the restaurant sector is essential for achieving sustainability, as it encompasses environmental, economic, and social dimensions. Globally, the restaurant industry faces challenges in implementing responsible waste management practices and resource optimization, as evidenced by Urrea et al. (2023) and García et al. (2025), who emphasize the importance of minimizing waste and promoting recycling.

In Latin America, Pittaluga (2020) highlights that waste management is an indispensable factor in reducing environmental impacts and fostering an eco-friendly culture within restaurants. In Panama, Farnum et al. (2024) recognize that the establishment of an integrated waste management system can contribute to enhancing the country's overall sustainability.

The regulatory framework provided by Law 276, along with the promotion of models based on reduction, recycling, and the circular economy, establishes a normative basis for such management. Furthermore, De La Cruz Cabrera et al. (2020) indicate that waste handling and disposal in Panama reflect a reality characterized by high waste generation and an insufficient system for its adequate management. Consequently, collaboration among the private sector, public institutions, and citizens is critical to the

success of efficient waste management in restaurants.

Waste management constitutes a determining factor in achieving sustainability in restaurants, particularly with respect to organic waste and packaging, which require appropriate handling (Cellete Gómez et al., 2022). Studies have demonstrated that the adoption of sustainable practices—such as reduction, reuse, recycling, the use of biodegradable materials, and awareness-raising—contributes to optimizing management and closing material cycles in this sector (De Niz Sedano & Nájera González, 2023).

Nevertheless, implementation encounters challenges related to infrastructure, organizational culture, and regulations, especially in local contexts such as Avenida Central, Santiago (García et al., 2025). Within the Panamanian regulatory framework, integrated waste management presents additional difficulties due to institutional dispersion and the need to strengthen local governance and citizen participation to ensure environmental and social sustainability (United Nations Development Programme [UNDP], 2021).

Therefore, this research focuses on analyzing waste management practices and perceptions of sustainability in restaurants located on Avenida Central, Santiago, Veraguas Province. Accordingly, the study seeks to address the following research question: What are the waste management practices and what is the perception of sustainability among restaurants on Avenida Central, Santiago?

In recent years, various studies have shown that effective waste management represents an opportunity for restaurants to achieve sustainability. Pittaluga (2020) notes that minimizing waste quantities through optimal management reduces the environmental damage caused by restaurants. Similarly, De Niz Sedano and Nájera González (2023) point out that the sector has shown increasing interest in waste recycling, reflecting a growing commitment to sustainability.

García et al. (2025) assert that when restaurants assume this responsibility, they contribute to a future characterized by environmental balance and respect. Despite progress and interest from some establishments in implementing waste management practices, significant obstacles hinder their widespread adoption. The literature remains limited, often restricted to case studies, which precludes the generalization of findings.

The absence of clear sampling criteria introduces biases, limiting the applicability of results to other restaurants. At the national level, updated data on recycling facilities are lacking. A comprehensive analysis of the supply chain and an evaluation of the social and economic impacts of waste are therefore necessary.

Waste management serves as a key determinant of sustainability in restaurants in Santiago de Veraguas by preventing food losses, mitigating climate change, achieving economic savings, and strengthening social cohesion. Research highlights that restaurants with trained personnel possessing adequate knowledge of waste management can reduce the volume of uneaten food (Etuah et al., 2023; Reardon et al., 2024; Tomaszewska et al., 2024).

Moreover, waste management through composting and the valorization of food waste can mitigate methane emissions by up to 30%, reduce the carbon footprint, restore soil, and conserve water (Auler et al., 2020; Rivier et al., 2022; Yang et al., 2025). Consequently, restaurants that invest in staff training, improved storage practices, and efficient waste disposal processes often realize savings that exceed initial investments while enhancing their reputation among increasingly environmentally conscious customers (Montesdeoca-Calderón et al., 2024; Way et al., 2025).

In this manner, waste management emerges as an effective strategy for generating economic, social, and environmental benefits by ensuring the efficient and responsible use of food resources.

The general objective of this research is to characterize waste management practices and

document perceptions of sustainability in restaurants on Avenida Central, Santiago. This will enable an understanding of how the waste management practices implemented by these establishments relate to their overall sustainability. This topic is essential for addressing the challenge of minimizing environmental impact faced by all enterprises today (Abubakar et al., 2022).

MATERIALS AND METHODS

The following study adopts a quantitative approach, as it seeks to measure and characterize the study's variables through numerical data. Mora Ramírez (2022) indicates that this approach provides specific data on current conditions that can be explained, thereby facilitating an objective analysis of waste management and sustainability in restaurants.

Regarding the research design, a non-experimental cross-sectional design was employed, given that the variables were not manipulated and the data were collected at a single point in time. Torrez (2020) notes that non-experimental research establishes conditions for presenting solutions to problems and evaluating them critically. With respect to the cross-sectional design, Rubiano (2024) states that such studies explore the characteristics of a population at a specific point in time.

Furthermore, this study is classified as descriptive, as it will detail how restaurants manage their waste and their perceptions of sustainability. In this regard, Guevara Alban et al. (2020) explain that descriptive research aims to understand common situations through a precise description of activities, without establishing causal relationships between variables. The study is of an applied nature, as Castro Maldonado et al. (2023) indicate that applied research focuses primarily on identifying environmental problems and subsequently seeking solutions based on knowledge acquired through basic research.

The population of this research consists of the 12 restaurants located on Avenida Central, Santiago, Veraguas Province. These establishments play an essential role in the local economy, serving as an economic driver and functioning as social and cultural hubs where local gastronomy is expressed. This sector generates significant quantities of organic and inorganic waste, making it ideal for analyzing waste management practices.

To conduct this analysis, non-probabilistic intentional sampling was used, selecting those establishments that met the following inclusion criteria: (1) formal and continuous operation during the study period, (2) regular generation of organic and inorganic waste as part of their business model, (3) availability of personnel willing to participate voluntarily in the study, and (4) representation of the diversity within the local gastronomic sector, including both fast-food establishments and traditional restaurants.

The final sample comprised 5 restaurants that agreed to participate and completed the questionnaire adequately, representing 41.7% of the total population. Although this coverage percentage is substantial in absolute terms, the non-probabilistic nature of the sampling and the small sample size limit the statistical generalizability of the findings to the entire population of gastronomic establishments in the province or the central region of the country. This limitation is explicitly acknowledged in the interpretation of the results.

The intentional selection enabled the inclusion of establishments with varying operational characteristics, thereby facilitating a rich and diverse description of waste management practices in the specific local context of Avenida Central, Santiago, as noted by Toledo et al. (2023). Similarly, this strategy supported comparative analysis across establishment types, allowing the identification of common patterns and relevant

differences in waste management.

To facilitate data collection, a survey was applied as the primary technique. Through the use of a structured questionnaire, this method enables the acquisition of meaningful and representative data from the selected sample (Zúñiga et al., 2023). In this context, the chosen technique was implemented with the specific objective of gathering detailed information on current waste management practices in the restaurants of Avenida Central, Santiago, as well as identifying the strategies and procedures employed in their daily operations to minimize environmental impact.

Additionally, a structured questionnaire consisting of closed-ended questions was used as the instrument. These questions were specifically designed to capture quantitative information relevant to waste management processes, classification and final disposal methods, and the primary operational and regulatory challenges faced by restaurants in this domain, as highlighted by Hadi et al. (2023).

The survey was validated through the expert judgment of 7 specialists in environmental management and logistics, who assessed the adequacy, clarity, and sufficiency of the items. Subsequently, a pilot test was conducted in the establishments included in the sample, yielding a Cronbach's alpha reliability coefficient of $\alpha = 0.914$. This value demonstrates excellent internal consistency of the instrument and confirms its reliability for measuring the study's variables.

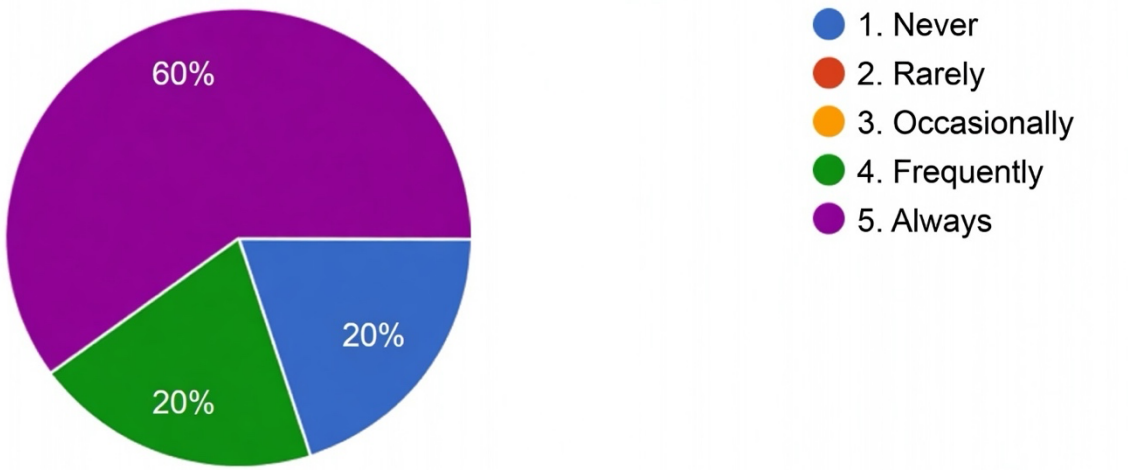
RESULTS

Sample and Descriptive Analysis of Waste Management

The analysis included a final sample of 5 restaurants (N = 5) located on Avenida Central, Santiago.

Figure 1.

Frequency with which restaurants apply protocols to separate organic from inorganic waste.

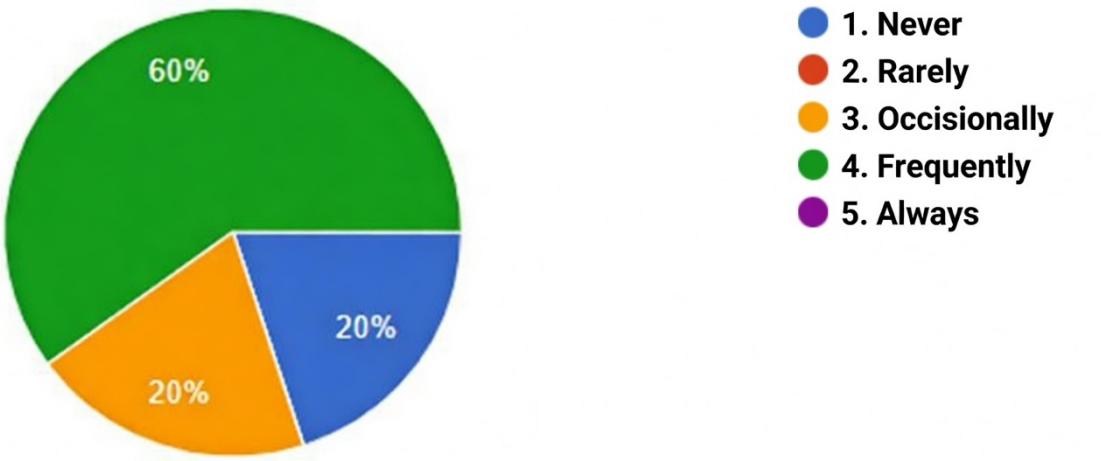


Note. As shown in Figure 1, 60% of the restaurants predominantly always apply the waste separation protocol, while 20% never do so, and another 20% do so frequently.

This indicates the presence of good practices in more than half of the cases, yet a significant gap persists where implementation remains insufficient.

Figure 2.

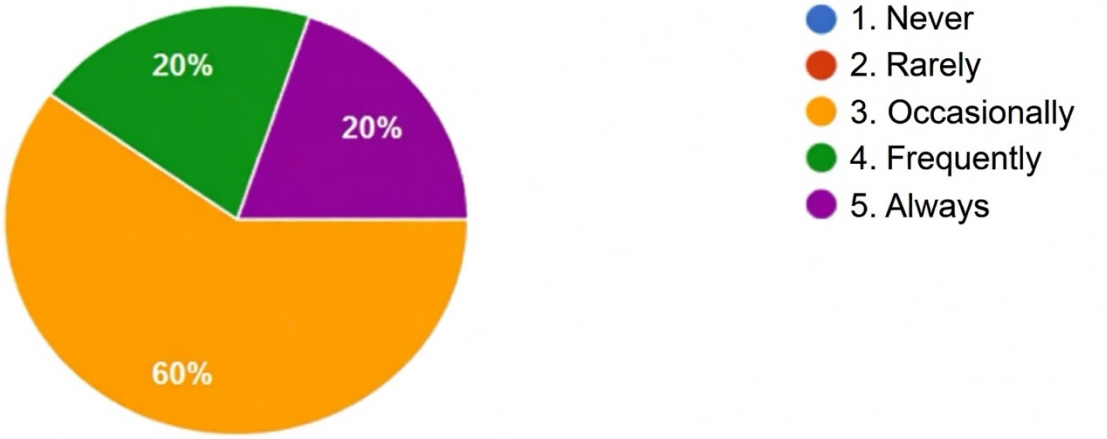
Regularity with which the business trains its staff on proper waste handling.



Note. Figure 2 reveals that 60% of the establishments frequently train their personnel on appropriate waste management, whereas 20% never provide such training, reflecting a clear lack of regularity and commitment to environmental employee education, and the remaining 20% do so occasionally.

Figure 3.

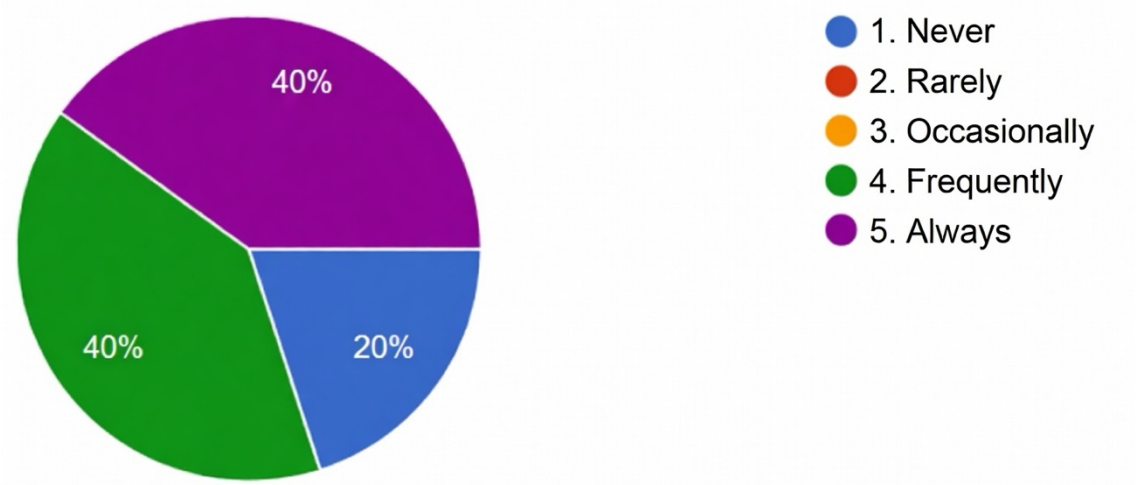
Frequency with which organic waste is used for composting, defined as the process of transforming these materials into natural fertilizer.



Note. Figure 3 demonstrates that 60% of the restaurants occasionally use organic waste for composting, while 20% always do so, and another 20% do so frequently.

Figure 4.

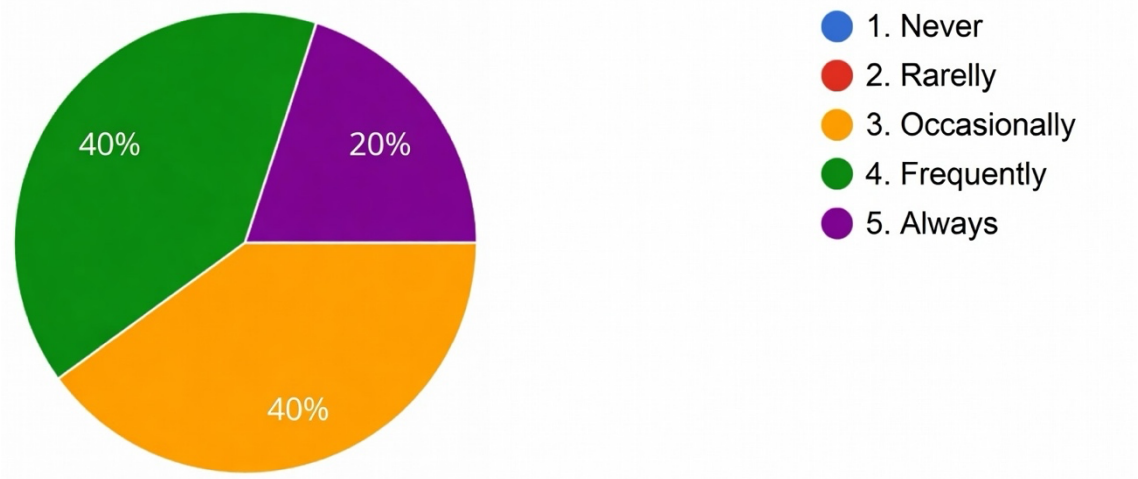
Frequency with which the restaurant separates and sells recyclable materials to a company responsible for recycling.



Note. As visualized in Figure 4, 40% of the restaurants always separate and sell materials for recycling, another 40% do so frequently, and the remaining 20% never engage in this practice.

Figure 5.

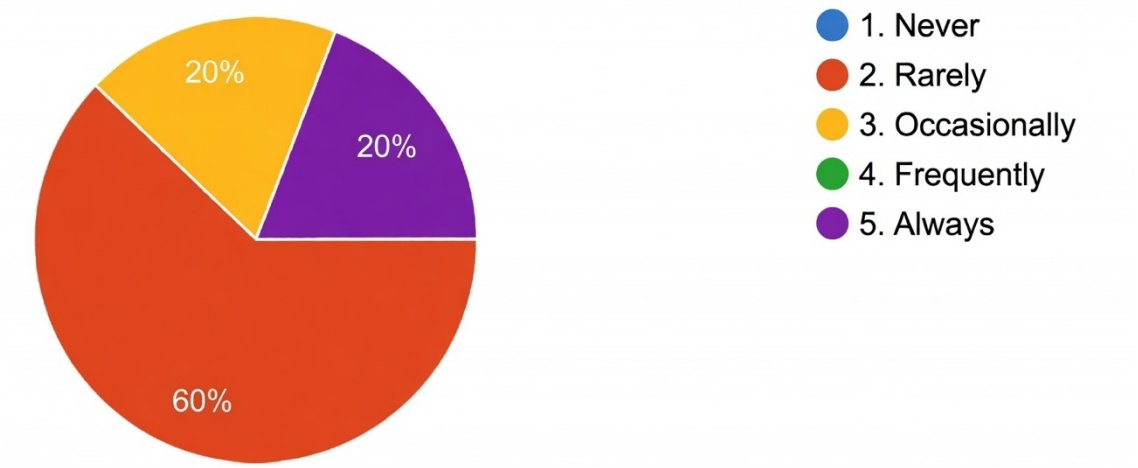
Frequency with which restaurants prioritize the purchase of supplies with biodegradable packaging.



Note. Figure 5 indicates that 40% of the restaurants frequently prioritize the acquisition of sustainable packaging, another 40% do so occasionally, and 20% always prioritize it. This suggests that fewer than half of the participants exhibit consistent prioritization.

Figure 6.

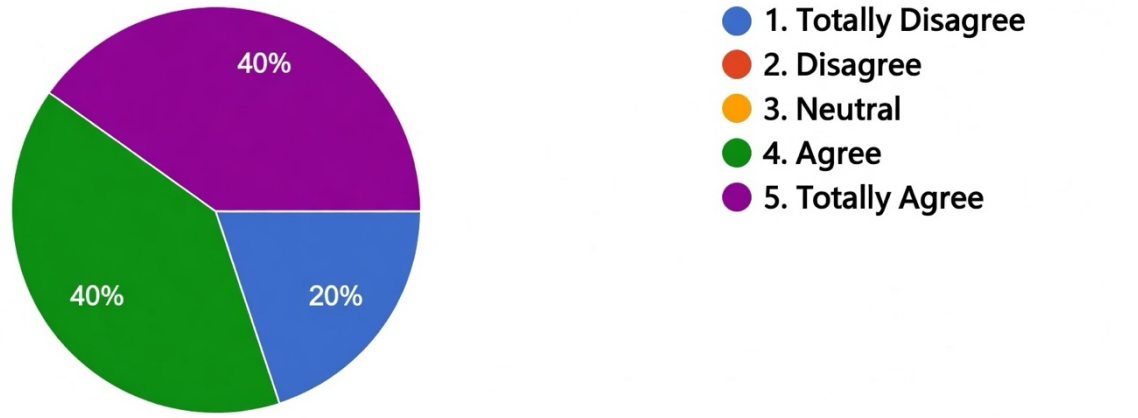
Frequency with which control is maintained over the quantity of waste generated.



Note. In Figure 6, it is observed that 60% of the restaurants rarely maintain control over the quantity of waste produced, while 20% do so occasionally, and the other 20% report always monitoring the waste generated.

Figure 7.

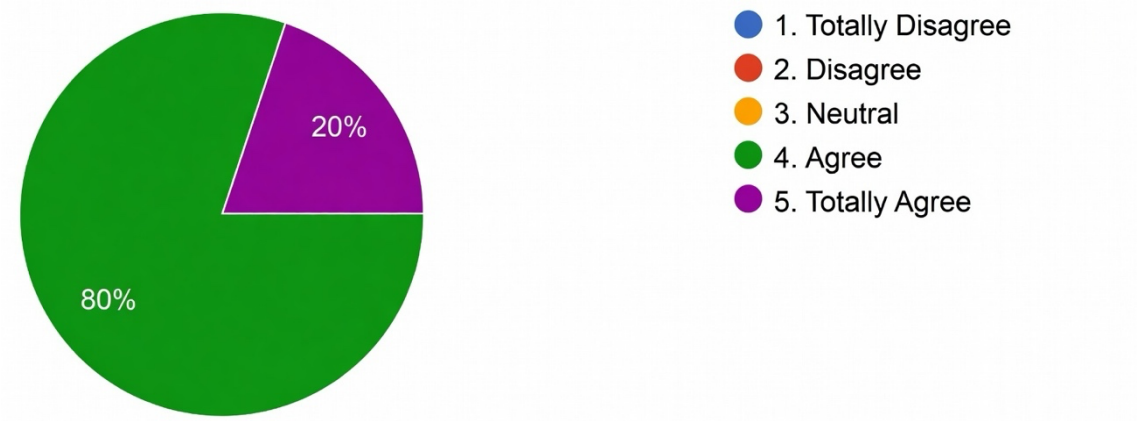
Perception regarding tangible economic savings derived from waste management.



Note. As depicted in Figure 7, 40% of respondents strongly agree that waste management generates economic savings, another 40% agree, while 20% strongly disagree.

Figure 8.

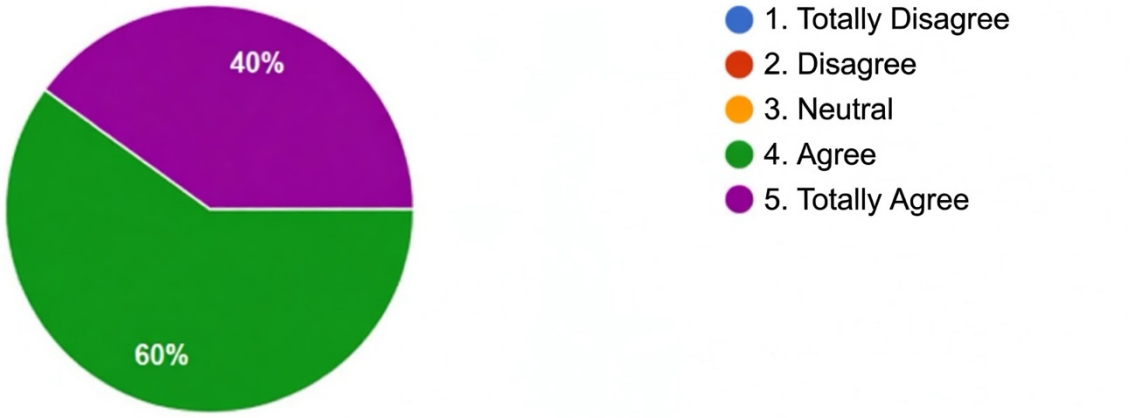
Perception of respondents concerning the ability of waste management practices to reduce food waste.



Note. Figure 8 reflects that the majority, 80% of respondents, agree that implementing these practices significantly reduces waste, while the remaining 20% strongly agree, indicating complete consensus on the positive impact of sustainable practices.

Figure 9.

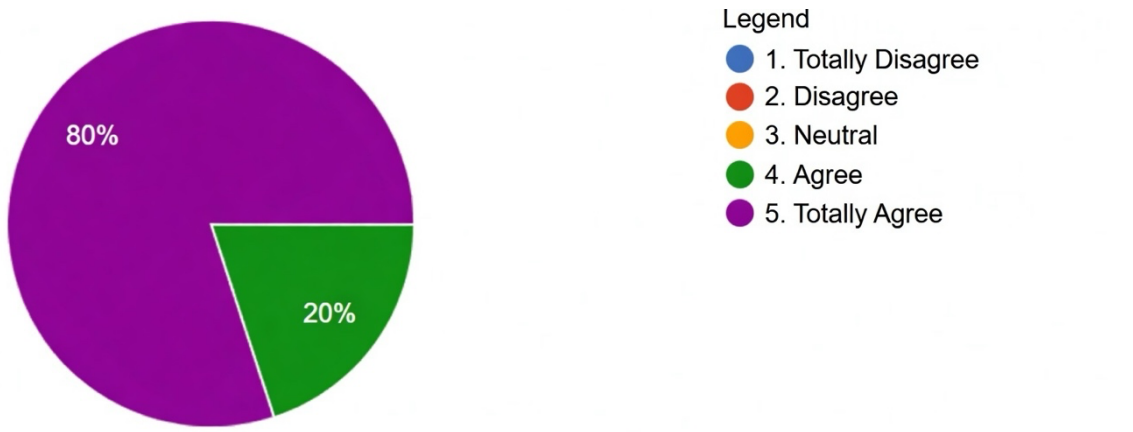
Level of agreement among respondents regarding the priority of investing in staff training on sustainable practices.



Note. According to Figure 9, 60% of respondents agree on prioritizing investment in sustainability training, and another 40% strongly agree with this statement. This demonstrates a balanced consensus on the importance of investing in personnel training for sustainable practices.

Figure 10.

Impact of the restaurant's environmental practices on its community reputation.



Note. As visualized in Figure 10, the majority, 80% of respondents, strongly agree that responsible environmental practices improve their business's reputation, with the remaining 20% also agreeing. This reflects a broad consensus that implementing environmental practices can enhance public image within society.

DISCUSSION

The findings of this study confirm that waste management practices are present among the restaurants on Avenida Central, Santiago, and that there is a positive perception regarding their contribution to sustainability. The overall interpretation of the results suggests that, although there is considerable adoption of separation protocols and a high valuation of environmental reputation, operational management lacks rigorous quantitative control mechanisms.

This indicates that the implementation of waste management practices is currently manifested more prominently in the social dimension (community image) and the environmental dimension (physical separation) than in the strictly economic dimension, owing to the absence of precise measurement of generated waste.

When contrasting these results with the literature reviewed, notable alignments emerge. The high perception that responsible practices enhance business reputation aligns with the observations of Pittaluga (2020), who emphasizes that waste management promotes an eco-friendly culture. Similarly, the majority of respondents' willingness to invest in training, along with the observed co-occurrence between training and perceived waste reduction, reinforces the arguments advanced by Urrea et al. (2023) and García et al. (2025), who stress the importance of resource optimization and recycling promotion to address industry challenges. Nevertheless, a persistent gap remains between intention and technical practice.

A critical discrepancy arises when examining waste control. While authors such as De La Cruz Cabrera et al. (2020) note the insufficiency of the waste management system in Panama, and Farnum et al. (2024) advocate for integrated systems, the present results indicate that the majority of restaurants rarely maintain control over the quantity of waste generated. This finding is consistent with the local challenges identified by García et al. (2025) concerning infrastructure and organizational culture limitations in Avenida Central, Santiago.

Although frequent separation of materials is reported, the absence of quantification metrics prevents establishments from clearly visualizing the tangible economic benefits theoretically expected, resulting in a management approach that, while well-intentioned, remains incomplete in its technical execution.

The primary contribution of this study lies in demonstrating the existing disconnection between the high frequency of waste separation and the low frequency of administrative control in the specific context of Avenida Central, Santiago. Unlike previous studies

that were limited to generalizations or lacked specific sampling criteria in the region, this research quantifies local operational behavior.

It is documented that sustainability is predominantly perceived as a reputational and ethical asset rather than as a consolidated cost-efficiency strategy, given that the lack of data recording hinders the maximization of potential economic savings.

From a practical perspective, these findings imply that restaurants should transition from mere physical separation of waste to the implementation of waste audits and weighing records. Without data on the volume of waste generated, effective reduction management becomes difficult. In the realm of public policy and local governance, the high willingness to engage in training represents an opportunity for institutions to strengthen the implementation of Law 276 through technical educational programs—not merely normative ones—that equip business owners with the skills to monetize waste management via loss control and circular economy principles.

Nevertheless, the study presents limitations that must be considered when interpreting the results. First, the small final sample size (N = 5) significantly restricts the generalizability of the findings to the entire gastronomic sector in the province. Second, given its non-experimental and cross-sectional design, the data capture a specific moment in time and rely on respondents' self-perceptions, which may introduce social desirability bias, particularly on environmental topics. Furthermore, the absence of external data from recycling facilities prevents triangulation of the information reported by restaurants with the actual final destination of materials.

For future research directions, it is recommended to expand the sample to encompass greater diversity in gastronomic business models and to employ mixed-methods approaches that incorporate direct observations or waste audits to compare self-reported data with physical reality. Additionally, it would be pertinent to investigate the actual financial impact of implementing waste control measures, thereby transforming perceptions of savings into concrete accounting evidence.

CONCLUSIONS

The objective of characterizing waste management practices and documenting perceptions of sustainability among the restaurants on Avenida Central, Santiago de Veraguas, revealed an asymmetrical implementation of these practices across their different dimensions. The findings indicate that, whereas the social and environmental dimensions exhibit widespread commitment to the separation of organic and inorganic waste, coupled with near-unanimous perception that such practices enhance the business's reputation within the community, the economic dimension remains underutilized due to the absence of systematic quantitative controls over generated waste.

This dichotomy between high-frequency physical separation and low-frequency administrative control constitutes what this study terms the "management gap," whereby the majority of establishments handle waste in an operational manner but not administratively. Consequently, the prevailing perception of potential savings cannot be transformed into verifiable financial efficiency.

The principal contribution of this work lies in its characterization of sustainability practices within a specific local context, providing evidence that, in Avenida Central, Santiago, these practices are currently in a phase of social legitimization. Actions are undertaken primarily to comply with regulations and to enhance reputational standing rather than as part of a consolidated, data-driven circular economy strategy. A positive co-occurrence was identified between staff training and the perceived reduction of waste, confirming that training is regarded as a priority investment. Nevertheless, the

lack of systematic records regarding the quantity of waste produced restricts the restaurants' ability to monetize the impact of their environmental practices.
This demonstrates that the implementation of existing regulations has successfully influenced operational behavior but must evolve toward a more technical phase that incorporates control metrics.

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