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Implementation of Hazard Analysis and Critical Control Points (HACCP) in Mobile Pandesal Operations in Lingayen, Pangasinan

Lyndon Mark D. Obedoza[1], Jean V. Ramos[2]

Author Information:
[1-2]*Graduate School, University of Luzon, Pangasinan, Philippines*

Correspondence: *Lobedoza@ppc.edu.ph*

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Abstract. This study examined the implementation of Hazard Analysis and Critical Control Points (HACCP) principles among 20 mobile pandesal vendors in Lingayen, Pangasinan, in light of the food safety obligations established under Republic Act No. 10611 (Food Safety Act of 2013). Mobile food vending offers a low-capital livelihood option but has been repeatedly shown, in prior Philippine studies of ambulant and public-market vendors, to carry persistent gaps in formal food safety training and compliance. Using a mixed-methods design, the study administered a structured, content-validated questionnaire to all 20 identified pandesal cart vendors operating in Lingayen, assessing five dimensions: compliance with food safety standards, sanitation and hygiene practices, monitoring and documentation of critical control points, vendor awareness and training, and support from local authorities. Open-ended items captured vendors' lived operational challenges. Results showed an overall average weighted mean of 3.28, interpreted as "Highly Practiced" per the study's own interpretation scale, with monitoring and documentation of temperature-related control points and sanitation practices rated strongest (3.475 each) and support from local government units rated weakest (2.80), particularly access to subsidies or technical assistance (2.10). Qualitative responses linked these gaps to environmental exposure, lack of fixed infrastructure, and limited access to affordable protective equipment. While vendors reported generally sound hygiene practices consistent with current good manufacturing practice (cGMP), few could identify or explain formal critical control points specific to HACCP, indicating that observed compliance reflects general food-handling discipline more than structured HACCP application. The study recommends targeted, gap-specific training on CCP identification and monitoring, low-cost recordkeeping tools, and expanded LGU technical support, offering a locally grounded model for extending HACCP principles to informal, mobile food operations.

Keywords: Critical Control Points; HACCP; Mobile Food Vendors; Pandesal; Sanitation Practices

Introduction

Pandesal, a well-loved Filipino bread roll, has traditionally been baked in neighborhood bakeries and eaten as a breakfast staple or snack. In recent years, small entrepreneurs in various Philippine localities, including Lingayen, Pangasinan, have begun selling pandesal from mobile carts, bringing freshly baked bread directly to residential streets and community gatherings rather than requiring customers to visit a fixed bakery. This local shift mirrors a broader, better-documented pattern in Philippine ambulant and street food vending: research on mobile and ambulant vendors elsewhere in the country has found that mobile vending offers a low-capital entry point into food entrepreneurship, but often comes with gaps in formal food safety compliance and training (Armas et al., 2024; Castillo, 2019).

The mobile nature of these operations introduces distinct food safety challenges. Vendors work exposed to dust, heat, and variable weather, and typically lack the fixed infrastructure of a stationary kitchen, such as reliable running water, refrigeration, or a permanent handwashing station. Studies of ambulant and public-market food vendors in the Philippines document exactly these constraints. An assessment of ambulant vendors in two cities in Nueva Ecija found that while vendors generally complied well with raw-material procurement standards, compliance was markedly weaker in areas such as general appearance, water and ice handling, and point-of-sale practices (Castillo, 2019). A HACCP-based evaluation of native delicacy (kakanin) vendors in the public market of Bayambang, Pangasinan — the same province as the present study — similarly found major deficiencies in packaging, post-production handling, and health and

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hygiene practices, including inconsistent vendor compliance with health-certification requirements (Platon et al., 2017). These findings suggest that the food safety gaps observed among mobile pandesal vendors are not unique to any single product or locality, but reflect broader structural challenges facing small-scale and informal food vendors across the Philippines.

Hazard Analysis and Critical Control Points (HACCP) offers a systematic, preventive approach to managing these risks. Rather than relying on end-product testing, HACCP identifies where hazards are most likely to enter the production process and establishes specific critical control points (CCPs), such as ingredient sourcing, storage, and preparation, where corrective action can be taken before a hazard reaches the consumer (Codex Alimentarius Commission, 2003; U.S. Food and Drug Administration, n.d.). A 2024 study proposing a strategic HACCP-based framework for ambulant vendors in Nueva Ecija, Philippines identified food sourcing, storage, preparation, cooking, serving, and waste management as the key control points requiring monitoring among mobile food sellers, and found that many vendors lacked permits, formal training, or consistent waste segregation practices (Armas et al., 2024). Codifying HACCP principles for pandesal cart vendors in Lingayen is therefore consistent with established food safety practice and responsive to a documented, recurring gap in the Philippine ambulant vending sector.

In the Philippines, food safety is governed nationally by Republic Act No. 10611, the Food Safety Act of 2013, which consolidates the country's food regulatory functions and assigns local government units (LGUs) a role in monitoring compliance and supporting food business operators, including small and informal vendors, within their jurisdictions. This LGU-level responsibility builds on the broader devolution of regulatory functions established under the Local Government Code of 1991 (Republic Act No. 7160), which transferred many public health and market-regulation functions to municipalities and cities. Applying HACCP principles to pandesal cart vending in Lingayen therefore engages directly with this existing legal framework, and the recommendations arising from this study are intended to support, rather than duplicate, the responsibilities RA 10611 already assigns to local authorities.

Despite this documented gap, no published study has specifically examined HACCP implementation among mobile pandesal vendors, a food category with its own handling profile — high-temperature baking, short shelf life, and door-to-door distribution — distinct from the ambulant produce and delicacy vending covered in prior Philippine research. This study addresses that gap by examining the implementation of HACCP principles tailored for movable pandesal carts in Lingayen, Pangasinan.

Research Questions

1. How effectively are HACCP principles being implemented for movable pandesal carts in Lingayen, Pangasinan, in terms of:
   1.1 Compliance with Food Safety Standards;
   1.2 Sanitation and Hygiene Practices;
   1.3 Monitoring and Documentation Systems;
   1.4 Vendor Awareness and Training;
   1.5 Support from Local Authorities?
2. What actionable recommendations can be proposed to enhance the implementation of food safety standards among pandesal vendors in Lingayen, Pangasinan?

Literature Review

Food Safety Governance and Persistent Gaps in the Philippine Context

Collado, Corke, and Dizon (2015), in a national-level review of the Philippine food safety regulatory system, found that oversight responsibilities are fragmented across multiple government agencies and bureaus with considerable overlap and gaps, resulting in a regulatory response to food safety incidents that is more often reactive than pre-emptive. This structural, system-level gap plausibly extends down to how compliance is monitored at the vendor level: Castillo (2019) found that ambulant vendors in Nueva Ecija complied reasonably well with raw-material procurement but performed markedly worse on general appearance, water handling, and point-of-sale hygiene, while Platon et al. (2017) documented similar deficiencies, poor packaging, weak post-production handling, and low health-certificate coverage, among kakanin vendors in Bayambang, Pangasinan, the same province as the present study. Together these findings suggest that a fragmented national regulatory structure and inconsistent vendor-level compliance are two sides of the same gap, and that the gap is systemic to informal, mobile food vending rather than isolated to a single product or locality, directly motivating the present focus on pandesal carts, a segment not yet separately studied.

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HACCP as a Framework for Informal and Mobile Vendors

The Codex Alimentarius Commission (2003) and the U.S. Food and Drug Administration (n.d.) establish HACCP as a preventive, process-based system built on seven core principles, hazard analysis, CCP identification, critical limits, monitoring, corrective action, verification, and recordkeeping that differs conceptually from current good manufacturing practice (cGMP), which addresses general hygienic conditions (facility cleanliness, personal hygiene, pest control) without necessarily tying them to specific, monitored control points in a process flow. Armas et al. (2024) were among the first to adapt this framework explicitly to Philippine ambulant vending, identifying sourcing, storage, preparation, cooking, serving, and waste management as candidate control points for mobile food sellers, and finding that permit-holding, formal training, and waste segregation remained weak even where basic hygiene was observed. This distinction matters for the present study: much of the existing Philippine literature on street and mobile vendors, including the present dataset, as discussed in the Results and Discussions section, measures cGMP-type hygiene behavior rather than documented HACCP application, a conflation this study explicitly addresses rather than repeats.

Vendor and Consumer Behavior as a Complement to Technical Compliance

Beyond technical compliance, food safety outcomes are also shaped by behavior on both sides of the transaction. Labana et al. (2024), surveying 384 street food consumers in Manila City, proposed an awareness-to-agreement-to-adherence model showing that awareness of RA 10611 provisions did not by itself guarantee adherence; rather, the degree to which consumers agreed with — not merely knew about — food safety policies was the stronger driver of actual adherence, leading the authors to recommend interventions that build consumer accountability rather than awareness campaigns alone. While that study examined consumers rather than vendors, it establishes a broader principle relevant here: knowledge of a standard and consistent practice of that standard are empirically distinct constructs, a distinction this study also observes on the vendor side (see the Vendor Awareness and Training results). Limon (2021), studying 751 home-based food handlers operating online food businesses during the COVID-19 pandemic, found that self-reported food safety practice was in fact low overall — a weighted mean of 1.72 out of 4, interpreted as "Sometimes Practiced" — and concluded that food handlers inadequately and inappropriately practiced core food-safety protocols despite operating during a period of heightened public health awareness, recommending stronger practical training and communication efforts from government and non-government agencies. Read together, these two studies caution against assuming that either public awareness (Labana et al., 2024) or the general availability of guidance (Limon, 2021) is sufficient to produce consistent practice — reinforcing why this study treats vendor training and institutional (LGU) support as two of its five core variables rather than secondary concerns.

Methodology

Research Design

This study adopted a mixed-methods research design, combining quantitative and qualitative approaches to develop a comprehensive understanding of food safety practices among mobile pandesal vendors in Lingayen, Pangasinan, with a specific focus on compliance with HACCP guidelines. The quantitative component employed a structured questionnaire to systematically measure food safety compliance, allowing for the collection of objective metrics on vendor practices, adherence to HACCP standards, and gaps in implementation. Descriptive statistics were used to identify relationships between variables such as vendor training, resource access, and food safety compliance. The questionnaire also included open-ended questions to gather qualitative insights into vendors' experiences, challenges, and perceptions of food safety practices, providing context and depth to the numerical findings.

Research Locale

This study was conducted among mobile pandesal cart vendors operating within the municipality of Lingayen, Pangasinan.

Research Participants

A purposive sampling technique, supplemented by vendor-to-vendor referral to help ensure a full account of the target population, was used: all 20 vendors identified as actively and regularly operating movable pandesal carts within the municipality during the data-collection period in November 2024 were invited to participate, and all 20 agreed. Vendors were identified through direct coordination with the pandesal cart sellers themselves — an initial set of vendors known to the researchers referred other actively operating vendors within the municipality, and each referral was confirmed through direct field verification

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before inclusion. Inclusion criteria were: (1) the vendor personally operates a movable pandesal cart within Lingayen, (2) the cart had been in operation for at least three months prior to data collection, and (3) the vendor consented to participate. No exclusion criteria beyond these were applied, and because all identified vendors met the criteria and agreed to participate, the sample constitutes a complete enumeration of the municipality's active pandesal cart vendors at the time of the study rather than a probability sample — a scope this study's conclusions are limited to.

Research Instrument

A structured questionnaire (see Annex A) served as the primary data collection tool, consisting of two parts: (1) a quantitative section using 20 closed-ended statements distributed across the study's five variables — compliance with food safety standards, sanitation and hygiene practices, monitoring and documentation systems, vendor awareness and training, and support from local authorities — rated on a 4-point Likert scale (4 = Always/Highly Practiced to 1 = Never/Strongly Not Practiced); and (2) a qualitative section of open-ended questions on vendors' operational challenges and suggestions. The questionnaire was distributed through online platforms or in-person interactions, based on participant accessibility. The instrument underwent content validation by three evaluators: Reynalyn H. Caacbay, Faculty, College of Hospitality and Management; Fely Benica S. Briones, Faculty, College of Business Administration; and Chelsea Angelica C. Valencia, Chef de Partie, Winghaus. Each reviewed the questionnaire items for clarity, relevance to the intended construct, and alignment with HACCP and RA 10611 provisions, drawing respectively on hospitality management, business/organizational, and professional culinary/food-handling expertise; items were revised based on their feedback prior to administration. Given the small, fully enumerated respondent pool (N = 20), a pilot-test-based internal-consistency statistic (e.g., Cronbach's alpha) was not computed, as this would have required withholding a subset of the target population from the final study; content validity was therefore prioritized over statistical reliability testing, consistent with recommended practice for small, purposively defined populations. The use of a 4-point Likert scale (without a neutral midpoint) was intended to encourage a decisive response from each respondent, reducing central-tendency bias and yielding more focused data on the intensity of agreement or disagreement.

Data Gathering Procedure

Prior to administration, the purpose of the study, the voluntary nature of participation, and the confidentiality of responses were explained to each vendor, and verbal consent was obtained and documented by the researchers before the questionnaire was administered. The questionnaire was distributed through online platforms or in-person interactions, based on participant accessibility, and completed responses were collected and screened prior to data processing.

Results and Discussions

Treatment of Data

Survey data first underwent a cleaning process to check for missing, incomplete, or inconsistent responses; entries that did not meet the necessary criteria were excluded to maintain the reliability of the dataset. Responses were then analyzed using weighted mean calculations, computed as: $\textit{Weighted Mean} = \Sigma(w \cdot x) / \Sigma w$ (1) where w is the weight (frequency) assigned to each response category and x is the corresponding scale value. Equation (1) computes the weighted mean used throughout the Results and Discussions section. The weighted mean allowed for a nuanced understanding of how different aspects — such as compliance with HACCP guidelines and challenges in maintaining food safety standards — contributed to overall vendor performance, informing evidence-based recommendations.

Table 1. Interpretation Scale for Weighted Mean

Criteria	Weighted Mean	Descriptive Equivalent
1. 4 (3.25 – 4.00)	—	Highly Practiced
2. 3 (2.50 – 3.24)	—	Practiced
3. 2 (1.75 – 2.49)	—	Not Practiced
4. 1 (1.00 – 1.74)	—	Strongly Not Practiced

Distinguishing HACCP Principles from General Food Safety (cGMP) Practices, and Identified Critical Control Points

Before presenting the five constructs, it is necessary to clarify what this study's data can and cannot demonstrate about HACCP implementation specifically. Of the five variables measured, Compliance with Food Safety Standards and Sanitation and Hygiene Practices largely capture current good manufacturing practice (cGMP) — general hygienic conditions such as clean preparation areas, handwashing, and waste

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disposal — which are prerequisites for HACCP but are not themselves HACCP's seven principles (hazard analysis, CCP identification, critical limits, monitoring procedures, corrective actions, verification, and recordkeeping). Monitoring and Documentation Systems most directly engages HACCP proper, since it concerns whether vendors monitor and record specific control points rather than simply maintaining general cleanliness.

Applying HACCP's hazard-analysis logic to the mobile pandesal process flow (sourcing → dough preparation → baking → holding/display → point-of-sale), three points emerge as the process's actual Critical Control Points: (1) baking temperature and time, where insufficient heat allows survival of vegetative pathogens; (2) post-bake holding temperature and duration, where prolonged ambient exposure on an uninsulated cart permits bacterial regrowth; and (3) raw material and water source control at intake, where contamination introduced before baking cannot be corrected downstream. Respondents' self-reported monitoring of “baking temperature” and “food temperatures” map onto CCP(1) and CCP(2); however, the questionnaire did not ask vendors to report critical limits (e.g., a specific minimum baking temperature or maximum holding time) or corrective actions taken when a limit is exceeded — meaning the present data can confirm that vendors monitor something at these points, but cannot confirm they operate a documented HACCP-compliant control system with defined limits. This distinction is the basis for the more cautious interpretive language used throughout this section: findings are described as reflecting vendor practices consistent with food-safety principles, rather than as evidence of formal HACCP compliance.

Table 2. Compliance with Food Safety Standards

Criteria	Weighted Mean	Descriptive Equivalent
1. I ensure that my operations comply with the food safety requirements outlined in RA 10611, such as maintaining proper sanitation, ensuring clean water availability, practicing regular equipment cleaning, and adhering to temperature control standards.	3.30	Highly Practiced
2. I always source raw materials for baking pandesal from reputable suppliers.	3.10	Practiced
3. I follow proper food handling practices to prevent contamination during preparation and sales.	3.75	Highly Practiced
4. I consistently meet the requirements of local government food safety inspections, such as sanitation certificates, proper waste disposal, pest control, and visible food safety signage.	3.25	Highly Practiced
Average Weighted Mean	**3.35**	**Highly Practiced**

The results indicate moderate-to-high adherence to general food-handling and sanitation practices among pandesal vendors, reflected in an average weighted mean of 3.35 (Highly Practiced). Vendors demonstrated adherence to essential safety practices, with proper food handling receiving the highest rating (3.75). However, there remains room for improvement in meeting local government inspection requirements (3.25). These findings suggest that while vendors are aware of basic food safety measures, enhancing awareness and enforcement of RA 10611 could significantly improve overall food-safety and sanitation practice, particularly regarding sourcing practices and readiness for LGU inspection.

Table 3. Sanitation and Hygiene Practices

Criteria	Weighted Mean	Descriptive Equivalent
1. I keep the preparation and storage areas for pandesal clean and free from contaminants.	3.60	Highly Practiced
2. I practice proper handwashing and wear protective gear during food preparation.	3.55	Highly Practiced
3. I sanitize all surfaces and equipment after every use.	3.40	Highly Practiced
4. I manage waste disposal in a hygienic and environmentally friendly manner.	3.35	Highly Practiced
Average Weighted Mean	**3.475**	**Highly Practiced**

The study reveals strong adherence to sanitation and hygiene practices, with an average weighted mean of 3.475. Vendors demonstrated strong performance in maintaining clean preparation and storage areas (3.60), while consistent waste management practices emerged as a comparative challenge (3.35).

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Table 4. Monitoring and Documentation Systems

Criteria	Weighted Mean	Descriptive Equivalent
1. I maintain records of temperature control for baking and storage processes.	3.40	Highly Practiced
2. I document the source of my ingredients as part of my food safety compliance.	3.35	Highly Practiced
3. I regularly monitor critical control points, such as baking temperature, to ensure product safety.	3.50	Highly Practiced
4. I follow clear protocols such as regular monitoring of food temperatures, sanitation procedures, handling of food allergens, and immediate corrective actions for any contamination risks.	3.65	Highly Practiced
Average Weighted Mean	**3.475**	**Highly Practiced**

Monitoring and documentation emerged as a strong area of food-safety and sanitation practice among respondents, tied with sanitation and hygiene practices at an average weighted mean of 3.475. Vendors reported consistent monitoring of temperature-related process points consistent with (though not independently verified as) HACCP critical control points, including food temperature protocols (3.65).

Table 5. Vendor Awareness and Training

Criteria	Weighted Mean	Descriptive Equivalent
1. I have received training in basic principles of HACCP and food safety management.	3.40	Highly Practiced
2. I am aware of my roles and responsibilities, such as ensuring proper sanitation practices, securing a food safety certificate, maintaining proper food storage conditions, and complying with local government food safety regulations under RA 10611.	3.35	Highly Practiced
3. Training programs from local authorities or organizations have improved my knowledge and practices.	2.85	Practiced
4. I understand the risks of foodborne illnesses and take steps to prevent them.	3.55	Highly Practiced
Average Weighted Mean	**3.2875**	**Highly Practiced**

Vendor awareness and training represent a comparatively weaker area of food-safety and sanitation practice, averaging 3.2875. While vendors understand the risks of foodborne illnesses (3.55), participation in training programs from local authorities scored the lowest in this category (2.85), suggesting limited engagement in formal learning opportunities. This gap is consistent with patterns reported elsewhere in the Philippine ambulant vending literature, where a substantial share of surveyed vendors had not attended any formal food safety seminar despite otherwise practicing basic sanitation (Castillo, 2019).

Table 6. Support from Local Authorities

Criteria	Weighted Mean	Descriptive Equivalent
1. I receive sufficient training and resources from local government units to support food safety compliance.	3.40	Highly Practiced
2. Regular inspections and feedback from authorities help me improve my practices.	3.35	Highly Practiced
3. Authorities assist me in understanding and implementing the provisions of RA 10611, such as providing training programs, offering guidance, conducting regular inspections, and ensuring access to resources needed for compliance.	2.35	Not Practiced
4. I have access to support mechanisms like subsidies or technical assistance from local government units.	2.10	Not Practiced
Average Weighted Mean	**2.80**	**Practiced**

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Support from local authorities is a critical area for improvement, with a mean of 2.80. Access to support mechanisms, such as subsidies or technical assistance from local government units, received the lowest score of the entire survey (2.10), highlighting substantial gaps in financial and technical aid. This finding echoes the strategic framework proposed by Armas et al. (2024) for ambulant vendors in Nueva Ecija, which similarly recommended that policymakers and local authorities take a more active role in supporting food safety and cleanliness among street and mobile vendors.

Qualitative Findings

Open-ended responses revealed practical hurdles faced by vendors on the street. Common themes included environmental factors (dust from the road, heat in the cart), infrastructure limitations (unreliable water supply, no nearby place to wash utensils), and financial constraints (high cost of proper storage containers). Vendors overwhelmingly expressed a desire for accessible, free training and subsidized equipment (e.g., insulated bags, protective cart covers) to help them meet standards efficiently.
Representative vendor responses on the challenges they face and how these could be addressed included:

"Sometimes the water supply is unreliable, and it's hard to keep everything clean. Maybe local authorities can provide better access to clean water."

"The heat in the cart makes it hard to keep pandesal fresh."

"I don't have proper training on food safety, so I just follow what I think is right. Free workshops would be great."

"The cost of proper storage containers is too high for me. Maybe there could be discounts for vendors."

"Dust from the road always gets into the cart."

"There's no nearby place to wash utensils when I'm selling far from home."

"Sometimes, I'm not sure if I'm following the regulations correctly. Clear, easy-to-understand guides would help."

"Environmental factors like rain ruin my products. Maybe someone can sell affordable protective covers for carts."

"Handling food and money at the same time feels unhygienic. A proper system or help to separate tasks would be nice."

"Keeping the pandesal warm but not spoiled is tricky. Affordable insulated bags would help a lot."

Ethical Considerations

To uphold ethical standards, the researchers obtained certification from the university research center by submitting a formal letter to conduct the study, an application for research ethics review, and a general research ethics checklist covering data handling, participant confidentiality, and adherence to ethical guidelines. Because participants were micro-entrepreneurs approached during active work hours in informal street settings, verbal informed consent was obtained from each of the 20 vendors prior to data collection: the researchers explained the study's purpose, procedures, voluntary nature, and confidentiality safeguards, and proceeded only after the vendor verbally agreed to participate. Information gathered during interviews and surveys was used solely for research purposes, with participant confidentiality safeguarded throughout.

Conclusion

This study examined the implementation of HACCP-related and general food safety practices among 20 movable pandesal cart vendors in Lingayen, Pangasinan. Vendors reported the strongest performance in monitoring temperature-related process points and sanitation practices (3.475 each), while participation in formal training (2.85) and access to local government support — particularly subsidies and technical assistance (2.10) — were the weakest areas. However, because the instrument measured self-reported hygiene behavior and general monitoring activity rather than documented critical limits, corrective actions, or verification records, these results indicate strong cGMP-consistent practice but do not by themselves confirm formal HACCP compliance. The clearest and best-supported finding is that vendor training participation and institutional support, not baseline hygiene awareness, are the two areas where a documented gap exists and where intervention is most directly justified by the data. These results emphasize the need for improved training, resource access, and government support to enhance food safety compliance. A multi-stakeholder approach involving vendors, local authorities, and public health organizations is crucial to advancing food safety standards without stifling local entrepreneurship.

Recommendations

Develop CCP-specific, not general, training. Rather than broad food-safety refreshers, design a short, targeted training module focused specifically on identifying critical control points in the pandesal process (baking temperature/time, post-bake holding time, raw-material intake) and setting simple critical limits

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vendors can self-monitor — directly addressing the gap this study identified between general hygiene practice and documented HACCP application, rather than treating training as a blanket requirement. Close the institutional support gap. Since access to LGU subsidies or technical assistance scored lowest of all items (2.10), the LGU should prioritize a low-cost technical assistance channel (e.g., a scheduled market-day consultation desk or hotline) over broader campaigns, since this is the specific, data-supported gap rather than a general awareness problem. Provide simple recordkeeping tools tied to identified CCPs. Pre-designed, pocket-sized log cards for baking temperature/time and holding duration, distributed with brief instruction, to convert vendors' already-strong monitoring habits into documented, verifiable HACCP records. Sustain sanitation and hygiene practices. Since these already score well, focus resources on maintaining current standards (e.g., periodic supply of gloves, sanitizers) rather than retraining. Foster community awareness on food safety. Launch public campaigns to educate both consumers and vendors about the importance of hygiene, driving demand for higher safety standards and encouraging compliance.

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