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A selected-indicator comparison persistent gaps in sanitation and health behavior in two South Tangerang markets, Indonesia

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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Abstract

Traditional food markets are essential food-distribution settings, yet inadequate sanitation, weak waste handling, and inconsistent clean and healthy living behavior can intensify environmental-health and food-safety risks. This study compared selected sanitation and health-behavior conditions in Pasar Ciputat and Pasar Modern BSD, South Tangerang, using documented 2014 baseline data and 2026 field observations. A partial-replication, repeated cross-sectional design was applied. Repeated structured environmental observations were conducted over seven consecutive days, 21-27 April 2026, covering weekdays and the weekend. Twelve directly observable binary indicators were selected from the 2008 Healthy Market guideline and Minister of Health Regulation Number 17 of 2020, encompassing waste management, drainage, handwashing facilities, toilets, and smoke-free behavior. An indicator was coded Yes only when the criterion was present and functional across the observation window; any confirmed absence, dysfunction, or contrary observation was coded No. Percentages therefore represent selected-indicator fulfillment, not full regulatory certification. Pasar Ciputat increased from two of twelve fulfilled indicators in 2014 (16.7%) to three in 2026 (25.0%), owing to the observed availability of covered waste bins. Pasar Modern BSD retained seven fulfilled indicators in both periods (58.3%). Across both markets, trader-level

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waste separation, absence of standing water, soap availability, and smoke-free behavior remained unmet. Across the selected indicators, the two markets exhibited a persistent facility-behavior gap. Infrastructure provision should be accompanied by routine supervision, functional maintenance, trader education, smoke-free implementation, and coordinated environmental-health governance.

Keywords: *healthy market, market sanitation, environmental health, clean and healthy living behavior, waste management*

1. Introduction

Traditional markets remain central to Indonesia's everyday food system because they connect households, traders, small suppliers, and local agricultural products within relatively affordable retail environments. Their public-health importance, however, extends beyond commercial exchange. Markets concentrate food, organic waste, water use, human mobility, pest habitats, and repeated hand contact in dense spaces; sanitation failures can therefore create pathways for diarrheal disease, respiratory infection, foodborne disease, vector proliferation, and environmental contamination (Cronk et al., 2015; Purnama et al., 2025).

Indonesia's Healthy Market policy framework addresses these risks by defining minimum environmental-health standards for people's markets. Minister of Health Regulation Number 17 of 2020 formally replaced the earlier Decree of the Minister of Health Number 519/Menkes/SK/VI/2008 while retaining the central expectation that markets should be clean, safe, comfortable, and supportive of Clean and Healthy Living Behavior (PHBS) (Kementerian Kesehatan Republik Indonesia, 2008, 2020). This regulatory continuity permits cautious longitudinal comparison of selected observable conditions, including waste separation, covered bins, drainage, handwashing facilities, toilets, and smoke-free conduct, without treating the selected items as a complete certification instrument.

The urgency of market sanitation is reinforced by recent public-health guidance. The World Health Organization's Five Keys for Safer Traditional Food Markets emphasize market cleanliness, contamination prevention, safe food products, reduced unsafe animal contact, and protection of market workers and consumers (World Health Organization, 2023). In Indonesia, the strategy has been piloted to improve hygiene and sanitation standards in traditional food markets; the initiative was motivated partly by a national Ministry of Health survey indicating that only slightly more than 10% of 448 surveyed traditional markets in 28 provinces met health and sanitation standards (World Health Organization Indonesia, 2024). Market sanitation is therefore a recurring governance concern within Indonesian urban and peri-urban food systems.

The issue also intersects with One Health. Traditional food markets are contact zones in which humans, food products, animals or animal products, waste streams, water, vectors, and built infrastructure interact. The One Health Joint Plan of Action 2022-2026 frames such risks as multidimensional and requiring integrated human, animal, plant, and environmental-health capacity (World Health Organization et al., 2022). Research on traditional food markets similarly identifies market design, hygiene monitoring, waste separation, and traffic separation as relevant measures for reducing zoonotic spillover and contamination risks (Ghatak et al., 2023). A focused sanitation-and-behavior checklist is therefore consistent with broader prevention logic, provided that its limited scope is stated explicitly.

Despite the policy framework, many Indonesian Healthy Market studies remain single-time assessments. Fikri and Prameswari (2024), for example, assessed market sanitation under Minister of Health Regulation Number 17 of 2020 and found that the evaluated market did not reach the applicable healthy-market threshold. Cross-sectional assessments are useful, but they cannot distinguish newly emerging problems from conditions that have improved or persisted. The present study addresses this limitation through a partial replication of the 2014 assessment of Pasar Ciputat and Pasar Modern BSD (Siregar, 2015). It asks three questions: how did the twelve selected sanitation and PHBS indicators

differ between 2014 and 2026; which gaps remained persistent; and which management responses are most relevant to the observed facility-behavior pattern?

2. Methods

This study used a partial-replication design with a repeated cross-sectional comparison. The 2014 baseline was obtained from Siregar's undergraduate thesis, Penilaian Status Kesehatan dan Kelayakan Pasar Tradisional Ciputat dan Pasar Modern BSD Tahun 2014 (Siregar, 2015). The 2026 component consisted of repeated structured environmental observations at Pasar Ciputat and Pasar Modern BSD over seven consecutive calendar days, 21-27 April 2026, spanning five weekdays and two weekend days. Observations were undertaken during active trading periods to capture variation in market activity, visitor density, and weather-sensitive conditions such as temporary standing water. The same researcher applied one standardized checklist at both sites after reviewing the regulatory definitions and the wording of the 2014 items. No independent duplicate rating was conducted; inter-rater reliability was therefore not estimated.

The observation instrument was developed by selecting items with equivalent operational meaning in the 2008 Healthy Market guideline and Minister of Health Regulation Number 17 of 2020. The full regulatory instruments cover broader domains, including laboratory examination, technical measurement, and multi-component scoring. To preserve longitudinal comparability and reduce subjective judgment, this study retained twelve directly observable binary indicators related to waste management, cleanliness, drainage, handwashing facilities, toilet availability, and PHBS. Each item was coded Yes only when the condition was observed as present and functional across the field period. Any confirmed absence, non-functionality, or contrary observation during the field week resulted in a No classification. This conservative rule was intended to identify operational gaps rather than best-case conditions.

The analysis was descriptive. The primary outcome was the selected Healthy Market indicator fulfillment score, calculated as the number of fulfilled indicators divided by twelve and expressed as a percentage. This score is a study-specific summary of the selected directly observable items and must not be interpreted as full regulatory compliance, accreditation, or certification. A secondary analysis separated facility or environmental-sanitation indicators (items 1, 2, 4, 5, 6, 7, 8, 9, and 10) from behavior indicators (items 3, 11, and 12). Because the study involved two purposively selected markets, two observation years, and no individual-level random sample, inferential statistics were not applied.

The twelve baseline values were re-extracted from the item-level sanitation and PHBS checklist and accompanying descriptions in Siregar (2015). Items were retained only when their observable meaning could be matched to the 2026 definitions, and no missing value was imputed. The original summary reported eight fulfilled indicators for Pasar Modern BSD but identified only seven indicator numbers (1, 2, 4, 6, 7, 8, and 10). The explicit item-level entries were treated as the auditable source, producing a corrected score of seven of twelve indicators (58.3%). Appendix A maps each selected item to its regulatory domain and longitudinal coding rule. The study collected no interviews, personal identifiers, biological specimens, or individual-level health data; field photographs were limited to facilities and did not depict identifiable persons.

Table 1. Selected observation indicators used in the partial-replication study

No.	Domain	Observable indicator
1	Sanitation and facilities	Waste bin separating wet and dry waste is available in the market area
2	Sanitation and facilities	Waste bins are covered or have lids
3	Waste behavior	Traders separate wet and dry waste at kiosk level
4	Sanitation and facilities	Drainage channels are not clogged

No.	Domain	Observable indicator
5	Sanitation and facilities	No standing water is found in the market area
6	Sanitation and facilities	The market area is visibly clean from scattered waste
7	Sanitation and facilities	Handwashing facilities are available
8	Sanitation and facilities	Handwashing facilities provide running water
9	Sanitation and facilities	Soap is available at handwashing facilities
10	Sanitation and facilities	Market toilets are available and usable
11	PHBS	Traders do not smoke in the market area
12	PHBS	Visitors do not smoke in the market area

Note: The twelve indicators are selected directly observable items from broader regulatory instruments. "Yes" denotes fulfillment under the operational definition; "No" denotes non-fulfillment.

3. Results

3.1. Overall selected-indicator change from 2014 to 2026

The selected-indicator score showed a modest increase in Pasar Ciputat and no measurable change in Pasar Modern BSD. Pasar Ciputat fulfilled two of twelve selected indicators in 2014 (16.7%) and three in 2026 (25.0%), an increase of one indicator or 8.3 percentage points. Pasar Modern BSD fulfilled seven documented indicators in both 2014 and 2026 (58.3%). The between-market difference therefore persisted across the twelve-year interval: Pasar Modern BSD retained a stronger facility profile, but neither market fulfilled all twelve selected indicators.

The only measurable improvement occurred in a facility indicator at Pasar Ciputat: covered waste bins were observed in 2026. No improvement was recorded for trader-level waste separation, standing-water control, soap availability, or smoke-free behavior. The 2014-2026 pattern should therefore not be interpreted as system-wide program progress or causal program impact. It represents a limited facility change in one market and persistence of the same incomplete selected-indicator profile in the other.

Table 2. Recalculated selected Healthy Market indicator fulfillment score by market and year

Market	Year	Selected indicators fulfilled	Selected-indicator score	Fulfilled indicator numbers
Pasar Ciputat	2014	2/12	16.7%	4, 10
Pasar Ciputat	2026	3/12	25.0%	2, 4, 10
Pasar Modern BSD	2014	7/12	58.3%	1, 2, 4, 6, 7, 8, 10
Pasar Modern BSD	2026	7/12	58.3%	1, 2, 4, 6, 7, 8, 10

Note: The selected-indicator score equals the number of fulfilled selected indicators divided by 12. It is not a full Healthy Market compliance or certification score.

3.2. Indicator-level findings

At indicator level, Pasar Ciputat retained two fulfilled conditions from the baseline: unclogged drainage and usable toilets. In 2026, covered waste bins were additionally observed. The market nevertheless remained classified as unmet for market-area waste segregation, trader-level separation, absence of standing water, visible cleanliness from scattered waste, handwashing facilities, running water, soap, and smoke-free behavior

among traders and visitors. Within the selected checklist, the observed improvement was therefore narrow and did not extend across the waste-handling and hygiene chain.

Figure 1. Number of selected Healthy Market indicators fulfilled in Pasar Ciputat and Pasar Modern BSD, 2014 and 2026.

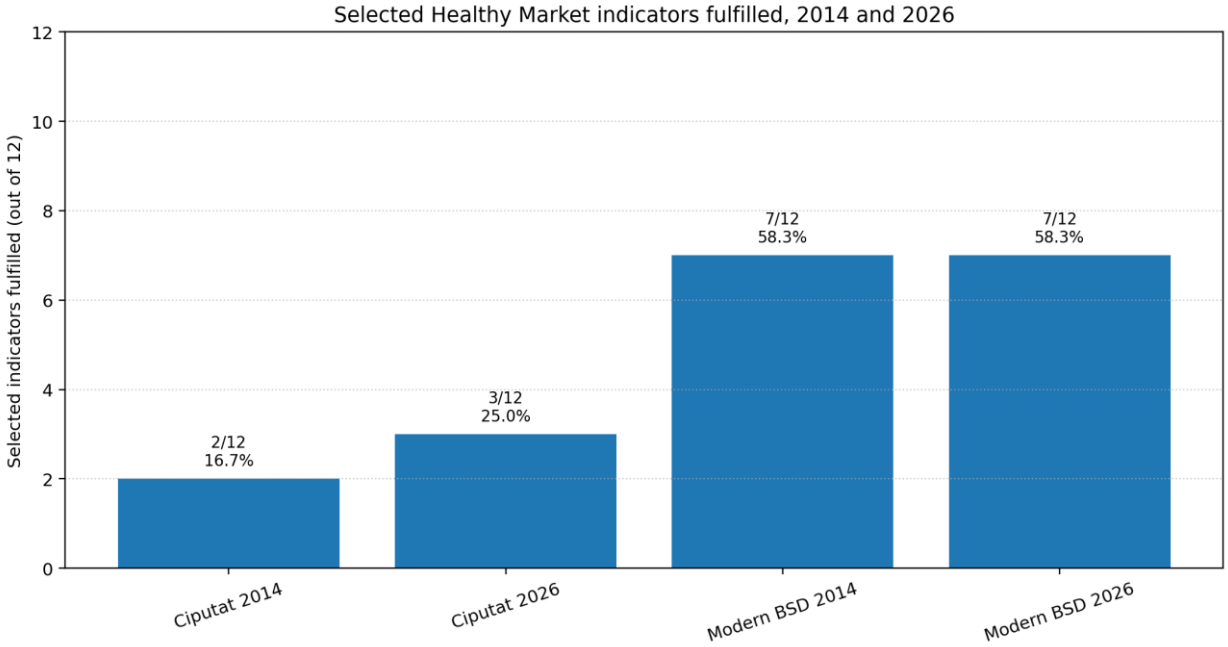

Table 3. Selected-indicator fulfillment matrix for 2014 and 2026

No.	Indicator	Ciputat 2014	Ciputat 2026	BSD 2014	BSD 2026
1	Waste bin separating wet and dry waste is available in the market area	No	No	Yes	Yes
2	Waste bins are covered or have lids	No	Yes	Yes	Yes
3	Traders separate wet and dry waste at kiosk level	No	No	No	No
4	Drainage channels are not clogged	Yes	Yes	Yes	Yes
5	No standing water is found in the market area	No	No	No	No
6	The market area is visibly clean from scattered waste	No	No	Yes	Yes
7	Handwashing facilities are available	No	No	Yes	Yes
8	Handwashing facilities provide running water	No	No	Yes	Yes
9	Soap is available at handwashing facilities	No	No	No	No
10	Market toilets are available and usable	Yes	Yes	Yes	Yes
11	Traders do not smoke in the market area	No	No	No	No
12	Visitors do not smoke in the market area	No	No	No	No

Note: "No" indicates that the criterion was absent, nonfunctional, or contradicted by a confirmed observation under the study protocol. The 2014 entries were recoded from Siregar (2015) using equivalent operational meanings.

3.3. Waste management and the facility-behavior gap

Waste management showed the clearest contrast between facility availability and routine practice. Pasar Ciputat did not fulfill the market-area waste-segregation indicator in either

year, indicating that a visible wet-dry separation system was not consistently observed. Covered waste bins were observed in 2026, representing a limited change from the 2014 baseline. Covered bins can reduce direct exposure of organic waste to flies, rodents, rainwater, and odor dispersion, but their presence alone does not establish source separation or safe downstream handling.

Pasar Modern BSD had a more developed market-area segregation facility. Figure 2 documents differentiated containers that can support separation of non-organic, residual, and reusable waste streams. The trader-level segregation indicator nevertheless remained unmet. Thus, area-level containers had not translated into consistently observable sorting at the point of waste generation. Possible explanations include insufficient monitoring, incentives, enforcement, or daily supervision, but these mechanisms were not measured and require further study.

Figure 2. Segregated waste containers at Pasar Modern BSD, South Tangerang, documented during 21-27 April 2026

Source: 2026 field documentation

3.4. Drainage, standing water, cleanliness, and hygiene facilities

Drainage channels were classified as unclogged in both markets and both observation periods. The absence-of-standing-water indicator, however, remained unmet at both sites. These indicators capture different conditions: an open drainage channel may coexist with floor-gradient problems, wastewater discharge, rainfall retention, or cleaning practices that allow water to accumulate. Standing water should therefore be interpreted as a residual environmental-risk indicator rather than as a duplicate measure of drainage obstruction.

Visible cleanliness from scattered waste differed between the markets. Pasar Modern BSD fulfilled this selected indicator in both years, whereas Pasar Ciputat did not. The contrast may reflect differences in cleaning frequency, waste-transfer routines, trader practices, or management arrangements, but the study did not measure those mechanisms directly. The result nevertheless shows why facility procurement and daily operation should be assessed separately.

Handwashing infrastructure also differed. Pasar Ciputat did not fulfill the indicators for handwashing facilities, running water, or soap in either year. Pasar Modern BSD fulfilled the facility and running-water indicators, but not soap availability. A station without soap

represents incomplete hygiene readiness. In market settings, readiness requires not only physical infrastructure but also water supply, soap replenishment, accessibility, visibility, and maintenance throughout trading hours.

3.5. PHBS and smoke-free behavior

The three behavior indicators were the weakest component of the selected checklist. Trader smoking, visitor smoking, and trader-level waste separation were classified as unmet at both sites in both years. The behavior subscore was therefore 0% in all four market-year observations. This finding indicates no observed change in these selected behaviors over the comparison period; it does not establish why the behaviors persisted.

Table 4 summarizes the contrast. Pasar Modern BSD fulfilled seven of nine selected infrastructure indicators but none of the three behavior indicators. Pasar Ciputat increased from two to three selected infrastructure indicators and also remained at zero behavior indicators. Within the limited checklist, infrastructure availability was therefore not accompanied by observable improvement in trader-level separation or smoke-free conduct.

Table 4. Selected infrastructure and behavior subscores

Market-year	Infrastructure indicators fulfilled	Infrastructure score	Behavior indicators fulfilled	Behavior score
Ciputat 2014	2/9	22.2%	0/3	0.0%
Ciputat 2026	3/9	33.3%	0/3	0.0%
Modern BSD 2014	7/9	77.8%	0/3	0.0%
Modern BSD 2026	7/9	77.8%	0/3	0.0%

Note: Infrastructure and behavior subscores are calculated only from the selected indicators defined in Table 1.

4. Discussion

The principal finding is a persistent separation between selected facility conditions and selected behaviors. Pasar Modern BSD retained more infrastructure indicators than Pasar Ciputat, yet trader-level waste separation, soap availability, absence of standing water, and smoke-free conduct remained unmet. This pattern is compatible with the Theory of Planned Behavior, which proposes that behavior is influenced by attitudes, perceived social norms, and perceived behavioral control (Ajzen, 2020). The present study did not measure those constructs, however, and therefore does not test the theory or establish that any particular psychological mechanism caused the observed behavior. Future work should examine whether trader perceptions, peer norms, perceived convenience, or managerial expectations explain the persistence of non-compliance at the point of practice.

The handwashing findings reinforce the distinction between facility presence and operational readiness. WHO and UNICEF guidance identifies community hand hygiene as a population-health measure relevant to diarrheal disease and acute respiratory infection prevention (World Health Organization & United Nations Children's Fund, 2025). In a market, a sink or tap is insufficient if soap is not available consistently. Pasar Ciputat's result represents a basic infrastructure gap within the selected indicators, whereas Pasar Modern BSD's lack of soap is more consistent with an operational-maintenance gap. Direct assessment of procurement, replenishment schedules, and responsible personnel is needed before attributing the problem to a specific management failure.

The smoke-free finding is also consequential. Tobacco control remains a global public-health priority and is monitored under Sustainable Development Goal indicator 3.a.1 (World Health Organization, 2025). Smoking in a food-trading environment exposes workers and visitors to secondhand smoke and contributes ash, cigarette butts, and odor. The persistence of smoking observations is consistent with insufficient implementation of smoke-free norms, but the study did not assess signage, sanctions, designated areas,

enforcement frequency, or stakeholder attitudes. These factors should be examined before drawing conclusions about the source of the implementation gap.

The waste findings also have implications for resource recovery. Organic market waste can enter composting or other recovery pathways only when upstream segregation is reliable. UNEP has emphasized the ecological and human-health consequences of poorly managed waste (United Nations Environment Program, 2021). In the present study, the absence of consistent trader-level separation may constrain recovery even where area-level differentiated bins are available. A waste-chain approach would therefore require source separation at kiosks, supervised transfer, appropriate temporary storage, coordinated transport, and feedback to traders; the effectiveness of these measures should be evaluated in future intervention research.

This study has several limitations. It examined only two purposively selected markets, so the findings cannot be generalized to all markets in South Tangerang or to the Healthy Market Program as a whole. The baseline was re-extracted from an undergraduate thesis rather than from a purpose-built longitudinal database, and differences in documentation between 2014 and 2026 may have introduced classification error. The 2026 observations were vulnerable to observer effects, temporal variation, and weather or seasonal conditions, and no independent duplicate rating was available to estimate inter-rater reliability. Binary coding simplified complex conditions and discarded information about frequency, severity, duration, and spatial distribution. The selected twelve-item checklist excluded laboratory food-safety testing, water-quality analysis, vector-density measurement, and other domains contained in the full regulatory instruments. Finally, the descriptive design identifies differences and persistence but cannot attribute them causally to the Healthy Market Program, market management, trader motivation, social norms, or enforcement.

5. Conclusion

This partial-replication study found limited selected-indicator improvement at Pasar Ciputat and a stable but incomplete profile at Pasar Modern BSD between 2014 and 2026. The central result is a persistent facility-behavior gap: some bins, drainage, toilets, and handwashing infrastructure were present, whereas trader-level waste separation, soap availability, standing-water control, and smoke-free conduct remained unmet. These findings apply only to the twelve selected directly observable indicators and do not constitute full regulatory certification or a causal evaluation of the Healthy Market Program. For the conditions examined, priorities include routine supervision, reliable soap and water maintenance, trader-based source separation, practical smoke-free implementation, and coordination among health, environmental, market-management, and trader organizations. Repeated monitoring with stable operational definitions would allow future assessments to distinguish sustained change from one-time inspection results.

6. Acknowledgment

The authors acknowledge the 2014 baseline assessment and the 2026 field documentation used for the partial-replication analysis.

7. Ethics Statement

This study was limited to non-participant observation of environmental conditions in publicly accessible market areas. No interviews, identifiable personal data, biological specimens, or individual-level health information were collected; informed consent and human-subject ethical approval were therefore not applicable to the environmental observation reported here. Field photographs were restricted to facilities and excluded identifiable persons

8. Funding

No external funding is declared for this study.

9. Conflict of Interest

The authors declare no competing interests.

10. Author Contributions

Conceptualization, A.Y.S. and W.B.B.A.; methodology, A.Y.S. and W.B.B.A.; investigation and data curation, A.Y.S.; formal analysis, A.Y.S.; supervision, W.B.B.A.; writing-original draft, A.Y.S.; writing-review and editing, A.Y.S. and W.B.B.A. Both authors approved the final manuscript.

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