

ORIGINAL RESEARCH ARTICLE

Environmental Burden versus Economic Benefit: Community Perception of an Animal Slaughterhouse (RPH) in a Residential Area of Wiradesa District, Pekalongan Regency, Indonesia

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ABSTRACT

Animal slaughterhouses (Rumah Potong Hewan, RPH) are strategic public facilities for supplying safe animal-source food, but when sited within a settlement, their operation directly affects residents' environmental comfort. This study characterized the residents living around the RPH in Wiradesa District, Pekalongan Regency, Central Java, and quantified their perception of the facility along two axes: environmental burden (odor, waste, water pollution) and socio-economic benefit. A descriptive field survey was conducted with 28 residents living within a 1 km radius, selected purposively to represent the four cardinal directions from the facility; perception was measured on a three-point Likert scale (1 = not, 2 = moderately, 3 = very disturbing/beneficial) and summarized with a class-range procedure whose cut-offs are reported explicitly for each sub-variable. Most respondents were male (71.4%), of productive to mature age, senior-high-school educated (46.4%), and worked as laborers (57.1%). Across the nine environmental indicators, perception scored 536 of a possible 756 (70.9%), classified as "moderately disturbing"; within this, the waste sub-variable alone reached the highest ("disturbing") category (142/168; 84.5%), driven by direct discharge of liquid waste into the river and open accumulation of solid waste, whereas odor and water pollution were "moderately disturbing." In contrast, residents rated the facility as "beneficial" (139/168; 82.7%), principally for easy access to meat (85.7%) and local employment. Reported as two directional scales rather than a single composite, the results describe a social dilemma in which a genuine, waste-led environmental burden is tolerated because of the RPH's economic and food-supply value. Prioritizing wastewater treatment (IPAL) and routine sanitation is recommended to lower the environmental burden while preserving the benefits the community values.

Keywords: *community perception; environmental externality; food security; slaughterhouse waste; social dilemma*

INTRODUCTION

The animal slaughterhouse (Rumah Potong Hewan, RPH) is an essential public facility for producing meat that is safe, healthy, whole, and lawful (ASUH), and the slaughtering process is required to maintain hygiene, health, and halal standards across the whole production chain (Gaznur et al., 2021; Mail et al., 2021). Animal welfare during handling, from unloading through slaughter, must minimize pain and distress because it affects both the animal's physiological state and the quality of the resulting meat (EFSA Panel on Animal Health and Welfare, 2020; Nurhayati et al., 2022). Meat is a highly nutritious animal-source food but also an excellent medium for microbial growth (Geiker et al., 2021), and its enzymatic activity rapidly degrades protein and fat, making it perishable and demanding careful post-slaughter handling (Pellissery et al., 2020).

Because contamination risk is highest during evisceration and can recur at later stages such as carcass splitting, chilling, cutting, packaging, and distribution, RPH management is expected to apply Good Manufacturing and Good Hygienic Practices throughout the chain (Mail et al., 2021). Yet field evaluations of category-II RPH in Indonesia have repeatedly found gaps between actual sanitation and the regulatory standard (Gaznur et al., 2017), even as demand for slaughtering services grows with local meat consumption (Maulana et al., 2024). Where an RPH sits within a residential area, these shortfalls are experienced directly by neighboring households as odor, waste, and water pollution impacts repeatedly documented for abattoirs operating inside residential neighborhoods of developing countries (Adeyemo, 2002; Bustillo-Lecompte & Mehrvar, 2015).

The RPH does not operate in isolation from the livestock economy it serves. Livestock

enterprises are a recognized pillar of household income and of food and nutrition security in developing countries (Smith et al., 2013), and in Central Java smallholder beef and small-ruminant systems remain central to rural livelihoods (Setianto & Wakhidati, 2026). An RPH is the downstream node where this livestock economy meets the consumer, so its social acceptance is economically and environmentally consequential; in practice, the community living beside the facility decides the balance.

While the technical dimensions of RPH operation sanitation, welfare compliance, and effluent treatment are comparatively well studied, the perspective of the neighboring community has received less systematic attention, even though it ultimately determines whether the facility is socially sustainable. Perception studies elsewhere in Indonesia, in Kolaka (Nurlaha et al., 2020) and Poasia, Kendari (Haruna & Sulistiawati, 2024), show that community perception of an RPH is shaped jointly by environmental discomfort and socio-economic dependency, and that this balance shifts with siting and local waste management (Nisa et al., 2023). Comparable appraisals of livestock-sector activities and products in Central Java confirm that residents and consumers weigh environmental and economic considerations together (Aji et al., 2026; Azani et al., 2023). To date, however, no published study has examined the RPH in Wiradesa District, Pekalongan Regency a facility located in the middle of a residential area — which offers a distinct case for understanding how an affected community weighs environmental burden against economic benefit. This study was therefore conducted to (i) describe the characteristics of residents living around the facility and (ii) quantify their perception of the RPH along environmental (odor, waste, water pollution) and socio-economic benefit dimensions, so as to provide an empirical basis for improving its management and community acceptance.

MATERIALS AND METHODS

Time and location

The study was carried out over one month, from 22 November to 21 December 2025, around the RPH in Kepatihan Sub-district, Wiradesa District, Pekalongan Regency, Central Java, Indonesia. The facility is located in a residential area and discharges into an adjacent watercourse. The fieldwork window fell entirely within the local rainy season, a point that bears on the

interpretation of the seasonal odor indicators reported below.

Study design, population, and sample

We used a descriptive quantitative survey design, consistent with community-appraisal studies previously reported for this region (Azani et al., 2023). The population comprised all residents living within a 1 km radius of the RPH, recorded as 75 people at the time of the study. Because this population is small and geographically bounded, the researchers adopted a near-census, descriptive approach rather than an inferential one: the Slovin formula with a 15% margin of error, $75 / (1 + 75 \times 0.15^2) = 27.9$, was used only to guide sample size, yielding 28 respondents. Respondents were then purposively selected based on their residence relative to the four cardinal directions (north, east, south, west) from the RPH, so all sides potentially affected by its operation were represented, including the upwind and downwind and upstream and downstream sectors. Because selection was purposive, results are descriptive of this community and are not generalized by statistical inference; percentages are reported to one decimal place and interpreted with the sample size ($n = 28$).

Instrument and variables

Perception was measured with a closed-ended questionnaire covering four sub-variables: odor (five indicators: general aroma, dry-season odor, rainy-season odor, odor intensity, odor persistence); waste (two indicators: direct disposal of liquid waste into the river, accumulation of solid waste); water pollution (two indicators: malodorous water, turbid/contaminated water); and perceived benefit (two indicators: ease of access to meat, contribution to local employment). Items were adapted from prior community-perception studies of slaughterhouses (Haruna & Sulistiawati, 2024; Nurlaha et al., 2020) and consumer-appraisal instruments used in the regional livestock sector (Aji et al., 2026), and the research team reviewed them for contextual relevance before use. Responses used a three-point Likert scale (3 = very, 2 = moderately, 1 = not disturbing/beneficial); the scale's coarseness is acknowledged as a limitation. By design, the dry- and rainy-season odor items were retrospective self-reports, because fieldwork spanned a single (rainy) season.

Data collection and analysis

We collected data through direct field observation and structured interviews at each respondent's residence; we drew secondary information from relevant literature and RPH records. Quantitative responses were analyzed with the Likert summated scale. For each sub-variable, the class range was computed as (maximum total – minimum total) / 3, where the maximum and minimum totals are the highest (3) and lowest (1) scores multiplied by the number of respondents and the number of indicator items; this yields three categories whose cut-offs are

reported explicitly (Table 3 and Figure 2) so that each classification can be verified. Because the benefit scale runs opposite in direction to the three environmental scales, the environmental sub-variables were summed and classified separately from benefit, and no single combined "disturbance" total across all four sub-variables was computed, as such a figure would not be interpretable.

RESULTS AND DISCUSSION

Respondent characteristics

Table 1. Characteristics of resident respondents living within 1 km of the RPH in Wiradesa District, Pekalongan Regency (n = 28).

Variable	Category	n	%
Sex	Male	20	71.4
	Female	8	28.6
Age (years)	17–26	7	25.0
	27–36	8	28.6
	37–46	5	17.9
	47–65	8	28.6
Education	Elementary school	5	17.9
	Junior high school	5	17.9
	Senior high school	13	46.4
	Bachelor's degree	5	17.9
Occupation	Laborer	16	57.1
	Homemaker	5	17.9
	Teacher	5	17.9
	Trader	2	7.1

Note: Percentages are rounded to one decimal place; the 47–65 band is wider than the others and should be read with that in mind.

Table 1 describes the residents interviewed around the RPH in the neighboring community, not the facility's workforce. Male respondents predominated (71.4%). Because interviews were conducted at each residence during the day, this most plausibly reflects who was available and willing to respond as head of household rather than any feature of slaughterhouse employment, and is treated here as a response bias to report rather than interpret substantively. Respondents were spread fairly evenly across the productive and mature age groups (27–36 and 47–65, 28.6% each), so the neighborhood combines younger working-age residents with older, long-settled ones whose length of residence conditions how they judge a long-standing facility.

Senior-high-school graduates formed the largest educational group (46.4%), with primary, junior-secondary, and tertiary levels each at 17.9%, indicating a mixed educational profile typical of a semi-urban sub-district center. Occupationally, laborers dominated (57.1%),

followed by homemakers and teachers (17.9% each) and traders (7.1%). The residents most exposed to the RPH are therefore predominantly lower- and middle-income households, for whom nearby, affordable meat and local employment are economically meaningful consistent with the documented importance of the smallholder livestock economy to household incomes and food security in the region (Setianto & Wakhidati, 2026; Smith et al., 2013).

Community perception of odor

Odor obtained a cumulative score of 278, placing it in the "moderately disturbing" category (Figure 1). Odor persistence was the most severe indicator, rated very disturbing by 60.7% of respondents, whereas most rated general aroma as not disturbing (60.7%). Perceived odor was markedly stronger for the rainy season (53.6% moderately and 35.7% very disturbing) than for the dry season, where most respondents (60.7%) reported no disturbance. Because fieldwork covered only the rainy season, the two seasonal

indicators are retrospective self-reports and should be read as recalled impressions rather than contemporaneous observations.

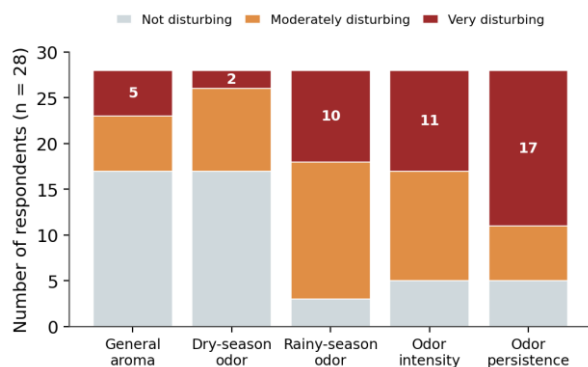


Figure 1. Distribution of respondent ratings across the five odor indicators (n = 28). Odor persistence and rainy-season odor concentrate in the "very" and "moderately disturbing" categories, whereas general aroma and dry-season odor are dominated by "not disturbing" responses.

That persistent odor is the single most disturbing indicator is consistent with international evidence that environmental odor is itself a recognized nuisance and potential health stressor for exposed communities (Schiffman & Williams, 2005), and that residential proximity to livestock- and waste-related odor sources predicts perceived annoyance among citizens (Blanes-Vidal et al., 2012). The seasonal contrast reported by residents fits the expectation that higher rainy-season humidity accelerates decomposition of organic waste and suppresses odor dispersion by wind, so that ammonia and other odor-active gases accumulate near the settlement. The pattern therefore points less to the slaughtering activity itself than to the handling of the solid and liquid wastes it generates. Differences in perceived disturbance may also reflect distance from the facility and length of exposure, with long-settled residents tending toward partial olfactory desensitization; neither variable was measured here, and both are recommended for future work.

Community perception of waste

The waste sub-variable scored 142, which, against the class-range cut-offs for a two-indicator sub-variable (Table 3, Figure 2), falls in the highest "disturbing" category rather than the middle one, the only environmental sub-variable to do so. Both indicators contributed: direct disposal of liquid waste into the river, rated very disturbing by 53.6% of respondents, and open accumulation of solid waste, rated very disturbing by 67.9%. Open accumulation and untreated discharge of abattoir waste in residential

neighborhoods is a recurrent environmental problem in developing countries (Adeyemo, 2002). Yet slaughter waste is fundamentally a recoverable resource: blood, offal, fat, and other residues can be redirected to fertilizer, feed, and other value-added products rather than emitted as waste (Jayathilakan et al., 2012). Waste emerges as the most severely rated environmental sub-variable; on the community's own account, it is the clearest signal in these data and identifies waste handling as the first priority for intervention.

Liquid RPH effluent laden with blood and digestive residue carries a very high organic load, high chemical and biochemical oxygen demand, nitrogen, and fat, so its direct discharge into a river raises pollutant concentrations and emits strong odor (Bustillo-Lecompte & Mehrvar, 2015). Treatment is feasible: electrocoagulation and comparable methods substantially reduce the chemical oxygen demand, ammonia, and fat–oil content of such effluent (Narulita et al., 2025). The "disturbing" rating reported by residents therefore signals a concrete, addressable need for wastewater treatment before discharge, rather than a diffuse complaint.

Community perception of water pollution

Water pollution scored 116 ("moderately disturbing"), composed of malodorous water (62), rated very disturbing by 60.7% of respondents, and turbid/contaminated water (54), rated moderately disturbing by 64.3%. The pattern indicates that seepage or discharge from RPH waste has affected the organoleptic quality of nearby water more strongly through odor than through turbidity an early, sensory signal of contamination that typically precedes measurable chemical change.

Water pollution around slaughterhouse facilities is commonly linked to the absence of an adequate wastewater treatment installation (IPAL), which allows the high-organic-load effluent to seep toward groundwater or enter surface water directly (Bustillo-Lecompte & Mehrvar, 2015; Narulita et al., 2025); comparable community concern over abattoir effluent has been documented both regionally (Nurlaha et al., 2020) and in other developing-country settings (Adeyemo, 2002). Where residents still rely on shallow groundwater for daily needs, this raises a health concern that warrants direct water-quality measurement of effluent and well-water sampling in future studies.

Community perception of benefit

Despite these environmental concerns, residents rated the RPH as "beneficial": the benefit sub-variable scored 139, in the highest category against its cut-offs (Table 3, Figure 2). Ease of access to meat was the most strongly endorsed indicator, rated very easy by 85.7% of respondents, while contribution to local employment was endorsed more moderately, distributed between the "very" and "moderately beneficial" responses. This dualism environmental complaint alongside a clearly positive economic appraisal is the core of the community's stance.

A livestock-processing facility close to a settlement helps maintain local food and

nutrition security and shortens the meat-distribution chain, improving physical and economic access to animal protein for nearby households (Smith et al., 2013). The value residents place on meat access and quality is reflected in regional consumer studies (Aji et al., 2026) and in local demand for meat-processing and slaughtering services (Maulana et al., 2024), while the facility's contribution to local employment particularly for the laborers who make up most respondents (Table 1) supports household economies within the wider regional livestock economy (Setianto & Wakhidati, 2026).

Overall perception and the social dilemma

Table 3. Recapitulation of community perception with class-range cut-offs (n = 28); environmental sub-variables are classified separately from benefit.

Sub-variable	Items	Score	Range	Cut-offs	Category
Odor	5	278	140–420	233.3 / 326.7	Moderately disturbing
Waste	2	142	56–168	93.3 / 130.7	Disturbing (highest)
Water pollution	2	116	56–168	93.3 / 130.7	Moderately disturbing
Environmental subtotal	9	536	252–756	420.0 / 588.0	Moderately disturbing
Benefit	2	139	56–168	93.3 / 130.7	Beneficial (highest)

Note: A single combined total across all four sub-variables is deliberately not reported, because the benefit scale runs opposite in direction to the three environmental scales.

Read as two directional scales rather than one averaged figure (Figure 2), environmental perception of the RPH scored 536 of a possible 756 (70.9%) across the nine environmental indicators as "moderately disturbing," while benefit reached the highest "beneficial" category (139/168; 82.7%). Waste and benefit are the two sub-variables that cross into the top zone, in opposite valence: the community registers its sharpest environmental objection to waste at almost the same relative intensity with which it affirms the facility's economic value. This is the empirical signature of a social dilemma.

Such dilemmas characterize communities living beside facilities that deliver clear economic value alongside environmental externalities: acceptance is sustained by the economic and food-supply functions even where discomfort, especially odor and waste annoyance, is acknowledged (Azani et al., 2023; Blanes-Vidal et al., 2012; Nurlaha et al., 2020). The policy implication is specific rather than general: the facility's social sustainability depends on reducing the waste burden first, without eroding the

economic role that underpins tolerance. Coupling wastewater treatment, for example, electrocoagulation of RPH effluent (Narulita et al., 2025) within a cleaner-production framework for slaughterhouses (Bustillo-Lecompte & Mehrvar, 2015) with routine sanitation offers a concrete pathway to move the environmental rating from "moderately disturbing" toward "not disturbing," while preserving the benefits residents value.

Limitations and future research

Several limitations bound these findings. The study covers a single facility with a small, purposively selected sample (n = 28), so results describe this community rather than RPH-adjacent communities in general. The three-point scale is coarse and compresses variance, and the instrument was reviewed for relevance but not subjected to formal validity and reliability testing; future work should adopt a validated, finer-grained instrument and, where feasible, an importance–performance framework to rank intervention priorities (Aji et al., 2026). Fieldwork spanned a single rainy-season month,

so the dry-season indicators rest on recall. Finally, water-quality inference rests on perception rather than measurement. Adding respondent distance from the RPH, length of residence, wind direction, and at least one round of effluent and groundwater sampling would materially strengthen the causal reading of these perceptions.

CONCLUSION

Residents living near the RPH in Wiradesa District, Pekalongan Regency, were predominantly male (71.4%), of productive to mature age, senior-high-school educated (46.4%), and employed as laborers (57.1%). Their environmental perception of the facility odor, waste, and water pollution combined fell into the "moderately disturbing" category (536 of 756 across nine indicators; 70.9%), with the waste sub-variable alone reaching the highest "disturbing" category, driven by direct disposal of liquid waste into the river and open accumulation of solid waste. In contrast, perception of the facility's socio-economic benefit reached the highest "beneficial" category (139 of 168; 82.7%), driven by ease of access to meat and local employment. Reported as two directional scales, the results describe a social dilemma in which a waste-led environmental burden is tolerated because of the RPH's economic and food-supply functions. Prioritizing optimization of the wastewater treatment installation (IPAL) and improved sanitation waste handling first is recommended to reduce the environmental burden while sustaining the socio-economic benefits the facility provides.

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Author contributions

M.: conceptualization, methodology, investigation, data curation, and writing of the original draft. S.E.T.: supervision, methodology, validation, and writing review and editing. M.E.M.: formal analysis and writing review and editing. I.H.: supervision and writing review and editing. All authors read and approved the final manuscript.

Ethics statement

This study involved human respondents and followed standard social-research ethical

practice. Participation was voluntary, informed verbal consent was obtained from each respondent before the interview, and respondent identities were kept anonymous and reported only in aggregate.

Conflict of interest

The authors declare no conflict of interest.

Data availability statement

The datasets generated and analyzed during the current study are available from the corresponding author upon reasonable request.

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