

PUBLIC PERCEPTIONS AND ACCEPTANCE OF ECOENZYME-BASED ENVIRONMENTALLY FRIENDLY SOAP IN LHOKSEUMAWE CITY

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Abstract

Ecoenzyme-based soap, formulated using fermented organic waste, may support household-level waste management and greener cleaning practices. This study examined public perceptions, acceptance, and perceived social and environmental implications of ecoenzyme-based environmentally friendly soap in Lhokseumawe City. A convergent mixed-methods design based on the Theory of Planned Behavior was used. Quantitative data were obtained from 54 questionnaire respondents and analyzed descriptively, while qualitative data were collected through in-depth interviews with 10 key informants and analyzed thematically using NVivo 12. Community perception was positive (mean = 4.29), with environmental friendliness receiving the highest rating (mean = 4.72). Acceptance was strong (mean = 4.50), led by interest in using ecoenzyme soap as an alternative to conventional soap (mean = 5.00). Family support, perceived ease of use, environmental benefits, and perceived safety were important enabling factors. However, limited technical knowledge, product availability, and affordability may constrain sustained use. The findings indicate that high stated acceptance reflects behavioral intention rather than verified routine adoption. Education on production and use, quality standardization, and improved access are needed to translate favorable perceptions into sustained household practice.

Keywords: community acceptance; eco-friendly soap; ecoenzyme; sustainable waste management

INTRODUCTION

Organic household waste remains a practical environmental challenge because it is generated continuously and is often discarded without recovery. Ecoenzyme, also called garbage enzyme in parts of the literature, is a fermented product of fruit or vegetable residues, a sugar source, and water. It has attracted attention as a community-scale form of organic-waste valorization, although product properties and suitable uses depend on raw materials, fermentation conditions, and formulation (Barman et al., 2022; Vidalia et al., 2023). For this reason, ecoenzyme incorporated into a cleaning formulation should be evaluated not only as a technical product but also as a household innovation whose adoption is shaped by public understanding and access.

Environmentally significant behavior is influenced by social, contextual, and individual factors rather than environmental concern alone (Stern, 2000). The Theory of Planned Behavior (TPB) explains behavioral intention through attitude toward a behavior, subjective norms, and perceived behavioral control (Ajzen, 1991). In the context of ecoenzyme-based soap, these constructs are reflected in perceived environmental and practical benefits, social support from family and community, and the perceived ability to obtain, make, and use the product.

Prior green-consumption research identifies an attitude-behavior gap: consumers may view products favorably but still refrain from adoption when price, availability, credibility, product performance, or knowledge is uncertain (Gleim et al., 2013; Joshi & Rahman, 2015). Studies of green purchase intention likewise underline the relevance of TPB-related factors in developing-country contexts (Yadav & Pathak, 2016). However, limited work combines these behavioral dimensions with ecoenzyme-based cleaning products at the local household level. This study therefore aimed to analyze community perceptions and acceptance of ecoenzyme-based soap in Lhokseumawe City and to identify the social and environmental implications perceived by participants.

LITERATURE REVIEW

Ecoenzyme-Based Soap and Sustainable Household Practice

Organic-waste recovery is consistent with circular-economy thinking, which emphasizes reducing waste and retaining resource value through reuse and recovery practices (Kirchherr et al., 2017). Reviews describe ecoenzyme as a potential product of fermented organic residues with applications explored in sanitation and environmental management (Barman et al., 2022; Vidalia et al., 2023). Nevertheless, evidence of a product's environmental or sanitary potential does not establish that a specific ecoenzyme-soap formulation is safe, effective, or widely adopted. Product quality, standardization, user knowledge, price, and availability should therefore be considered separately from perceived benefits.

Theory of Planned Behavior and Green Product Acceptance

TPB proposes that intentions are informed by attitudes, subjective norms, and perceived behavioral control (Ajzen, 1991). For this study, perception captured respondents' knowledge and appraisals of the soap's cleaning quality, environmental benefits, and perceived skin safety. Subjective norms represented perceived family, peer, and community support. Perceived behavioral control represented ease of use, access or production, and price suitability. Acceptance was measured directly through interest in using the soap, willingness to switch from conventional soap, and intention to continue using it.

The literature suggests that green-product adoption is not solely a matter of positive attitudes. Consumer uncertainty and situational barriers may interrupt the path from environmental concern to purchase or use (Gleim et al., 2013; Joshi & Rahman, 2015). The present study contributes a local mixed-methods account of how perceived product benefits, social influence, and practical constraints coexist in the acceptance of ecoenzyme-based soap.

METHOD

This study applied a convergent mixed-methods design. Quantitative and qualitative strands were collected and analyzed separately before being interpreted together. The quantitative component described respondents' perceptions, subjective norms, perceived behavioral control, and acceptance. The qualitative component explored reasons underlying these assessments and participants' views on social and environmental implications. This study applied a convergent mixed-methods design. Quantitative and qualitative strands were collected and analyzed separately before being interpreted together. The quantitative component described respondents' perceptions, subjective norms, perceived behavioral control, and acceptance. The qualitative component explored reasons underlying these assessments and participants' views on social and environmental implications.

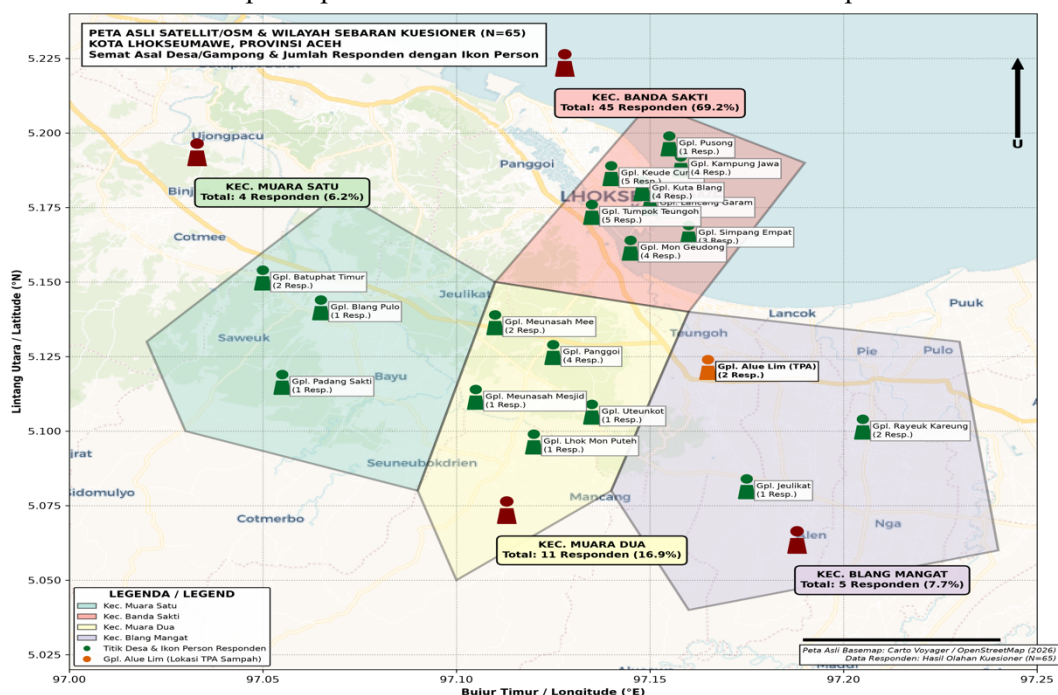


Figure 1. Real OpenStreetMap spatial distribution map displaying questionnaire respondent allocations (N = 65), sampled villages (Gampongs), and human pictogram icons across Lhokseumawe City

Table 1. Informant Classification and Coding Scheme

Informant Code	Informant Category	Description
IP	Government / Relevant Institution	Informants with authority or direct involvement in environmental policy, programs, or waste management regulation.
IPA	Practitioners / Academics	Informants possessing technical knowledge, research background, or practical experience in ecoenzyme production and green innovations.
IM	Community / Household Users	Informants representing actual or prospective household users of ecoenzyme-based soap.

Source: Primary data processed, 2026.

Ten key informants were selected purposively for in-depth interviews based on their relevant experience, knowledge, or policy involvement in environmental management and community contexts. To preserve participant anonymity and confidentiality, all personal identities were excluded from the report and replaced by structured informant codes (Table 1). These codes categorize participants into government/institutional stakeholders (IP), practitioners and academics (IPA), and community household members (IM), facilitating systematic data tracing during qualitative thematic analysis.

The quantitative dataset comprised 65 questionnaire responses collected using a five-point Likert scale (1 = strongly disagree to 5 = strongly agree). Respondents were selected through purposive-voluntary sampling based on their willingness to participate and status as household members in the city. Consequently, the findings describe the participating respondents and are not intended for statistical generalization to all residents of Lhokseumawe City. Ten key informants—comprising government officials, academics, and community members—were selected purposively for in-depth interviews based on their relevant experience, knowledge, or involvement in environmental and community contexts. Participation was voluntary and informed consent was obtained.

The questionnaire consisted of 15 items designed to capture the constructs of interest. Six items assessed perception, three items assessed subjective norms, three items assessed perceived behavioral control, and three items assessed acceptance. Descriptive statistics, including means, standard deviations, minimum values, and maximum values, were calculated for the quantitative data. Interview transcripts were coded thematically using NVivo 12, following an inductive-deductive approach to identify dominant themes. Integration considered whether qualitative themes converged with, complemented, or qualified the quantitative patterns. The analysis is descriptive and does not statistically test causal relationships among TPB constructs.

RESULTS AND DISCUSSION

Overview of Construct Scores

All four quantitative constructs showed positive mean scores above 4.00 on the five-point scale (Table 1). Acceptance produced the highest mean (4.50), followed by community perception (4.29), subjective norm (4.08), and perceived behavioral control (4.01). These findings describe a favorable response pattern among the study participants; they should not be interpreted as evidence of actual purchase frequency, routine use, or causality.

Table 1. Summary of construct scores

Construct	Number of indicators	Mean score	Interpretation
Community perception	6	4.29	Positive
Subjective norm	3	4.08	Positive
Perceived behavioral control	3	4.01	Positive
Acceptance	3	4.50	Positive

Source: Primary data processed, 2026.

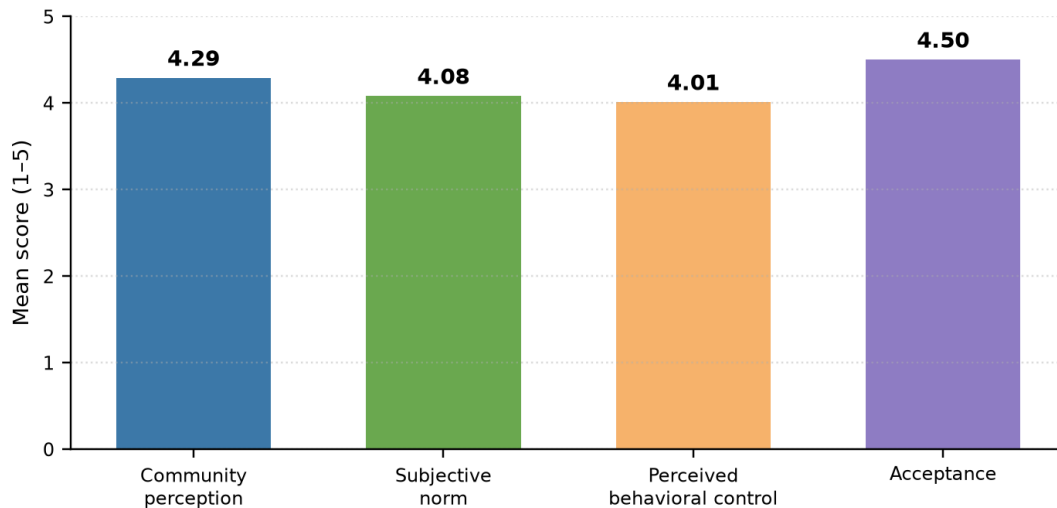


Figure 1. Comparative mean scores of the study constructs

Source: Primary data processed, 2026.

Community Perceptions of Ecoenzyme-Based Soap

Environmental benefit was the strongest component of perception. The statement that ecoenzyme soap is more environmentally friendly than conventional soap obtained a mean of 4.72, and the statement that its use can reduce environmental pollution obtained a mean of 4.63 (Table 2). Respondents also rated cleaning quality (4.28) and perceived skin safety (4.32) positively. The latter result reflects respondents' perception of safety, not a clinical or laboratory verification of product safety.

Knowledge of ecoenzyme's origin from organic-waste fermentation was favorable (4.17), whereas understanding of the basic production process was the lowest perception item (3.63). This pattern suggests that environmental appeal can develop more readily than technical literacy. It also supports the need for practical education and standardized information so that interest in the product is matched by an adequate understanding of preparation, use, storage, and limitations.

Table 2. Community-perception indicators

Indicator	Mean	SD
Knowledge that ecoenzyme originates from organic-waste fermentation	4.17	0.98
Understanding of the basic process of making ecoenzyme soap	3.63	1.15
Perceived cleaning quality of ecoenzyme soap	4.28	0.74
Perceived skin safety of ecoenzyme soap	4.32	0.73
Perceived contribution to reducing environmental pollution	4.63	0.57
Perceived environmental friendliness relative to conventional soap	4.72	0.52

Source: Primary data processed, 2026.

Social Support, Perceived Control, and Acceptance

Subjective norms were positive overall (mean = 4.08). Family support was the strongest social item (4.29), followed by positive perceived community acceptance (4.05) and encouragement from friends or the surrounding environment (3.89). The qualitative analysis similarly highlighted family, socialization, and community support as themes related to acceptance. This result is compatible with TPB, in which perceived social approval can shape intention (Ajzen, 1991).

Perceived behavioral control was also positive (mean = 4.01), but access was a relative constraint. Ease of daily use obtained the highest score (4.27), whereas ease of obtaining or making the product was lower (3.78); price suitability was rated 3.97. The interview themes of access, price, technical knowledge, and convenience thus qualify the favorable acceptance pattern. In practical terms, participants may be interested in ecoenzyme soap while still facing barriers to obtaining ingredients, learning the process, or maintaining use.

Table 3. Acceptance indicators

Indicator	Mean	SD
Interest in using ecoenzyme soap as an alternative to conventional soap	5.00	0.00
Willingness to switch from conventional soap to ecoenzyme soap	4.32	0.71
Intention to use ecoenzyme soap continuously in the future	4.18	0.73
Overall acceptance	4.50	–

Source: Primary data processed, 2026.

The decline from initial interest (5.00) to willingness to switch (4.32) and continued-use intention (4.18) is substantively important. It indicates that strong enthusiasm does not by itself establish sustained adoption. This distinction resembles the attitude–behavior gap identified in research on green consumption, where practical and informational barriers can inhibit action despite favorable evaluations (Gleim et al., 2013; Joshi & Rahman, 2015). Accordingly, future programs should combine environmental messaging with accessible product supply, realistic pricing, technical demonstrations, and clear quality guidance.

Qualitative Analysis Using NVivo 12

Interview data from 10 key informants were coded and visualized using NVivo 12. The outputs were used to make the thematic interpretation transparent and to complement the descriptive survey findings. Word size, coding frequency, and heatmap intensity indicate relative prominence or distribution within the coded material; they do not independently establish causal effects, product efficacy, or actual routine use.

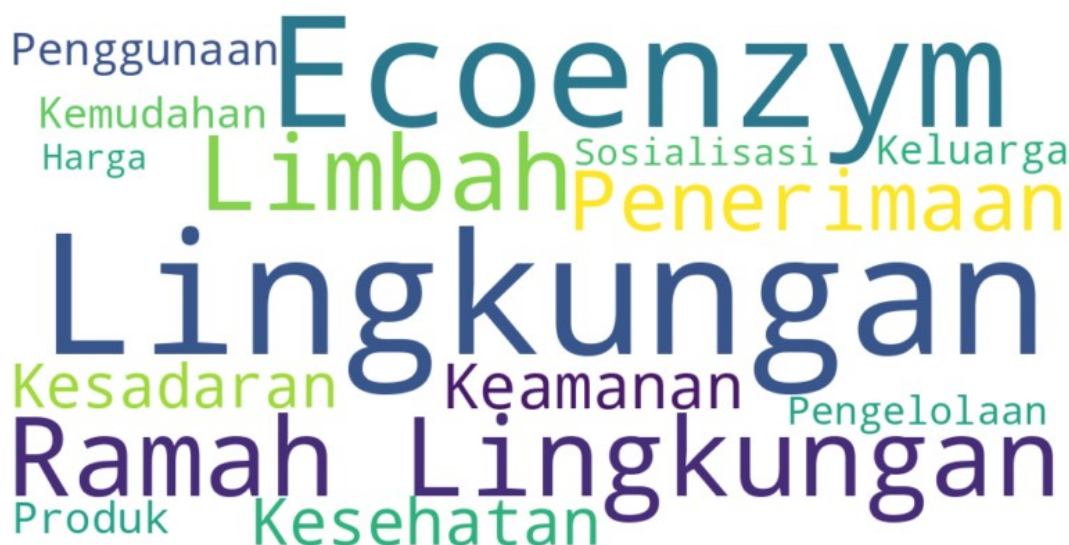


Figure 2. Word-cloud output of interview themes

Source: NVivo 12 analysis of interview data, 2026.

The word cloud foregrounds environment, ecoenzyme, and environmentally friendly as the most frequently expressed ideas, with waste, acceptance, health, safety, price, ease, socialization, and family also visible. This output answers the first research question by showing that participants primarily framed ecoenzyme soap as an environmental and waste-management innovation. It complements the survey result in which environmental friendliness received the highest perception score.

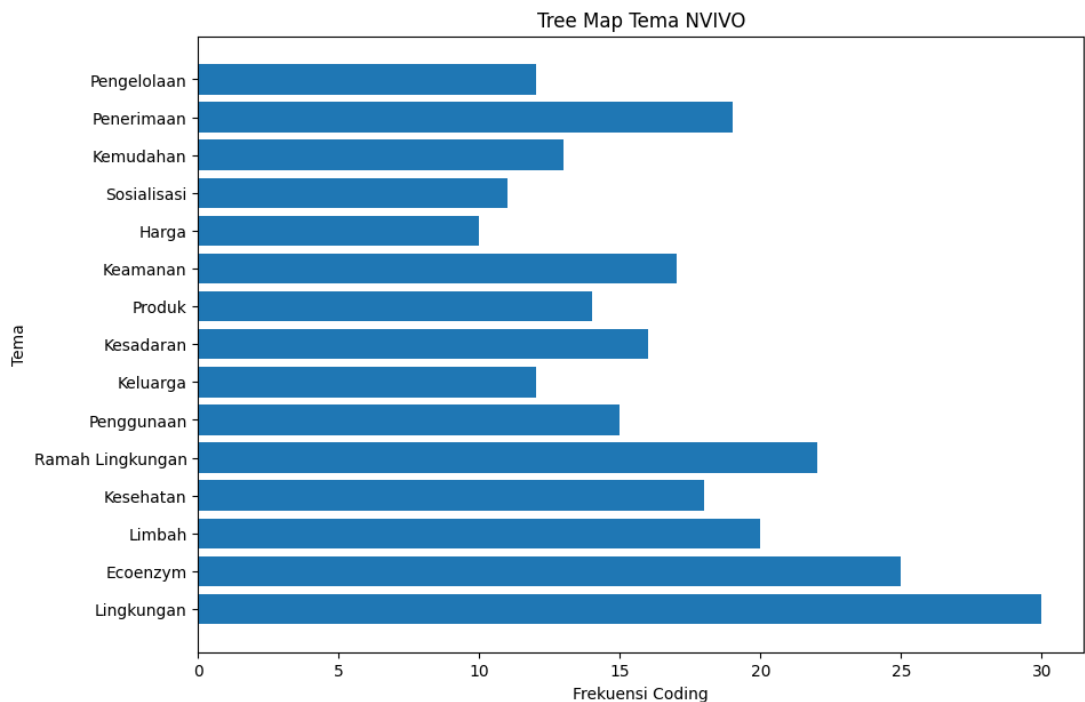


Figure 3. NVivo 12 thematic coding-frequency output

Source: NVivo 12 analysis of interview data, 2026.

The coding-frequency output provides a clearer ranking of the themes. Environment was coded most often (30 references), followed by ecoenzyme (25), environmentally friendly (22), waste (21), health (20), and acceptance (18). The concentration of environmental themes reinforces the conclusion that perceived ecological benefit is the principal basis for favorable perceptions. The continued appearance of acceptance, health, safety, and use-related themes shows that adoption is evaluated through both environmental and practical considerations.

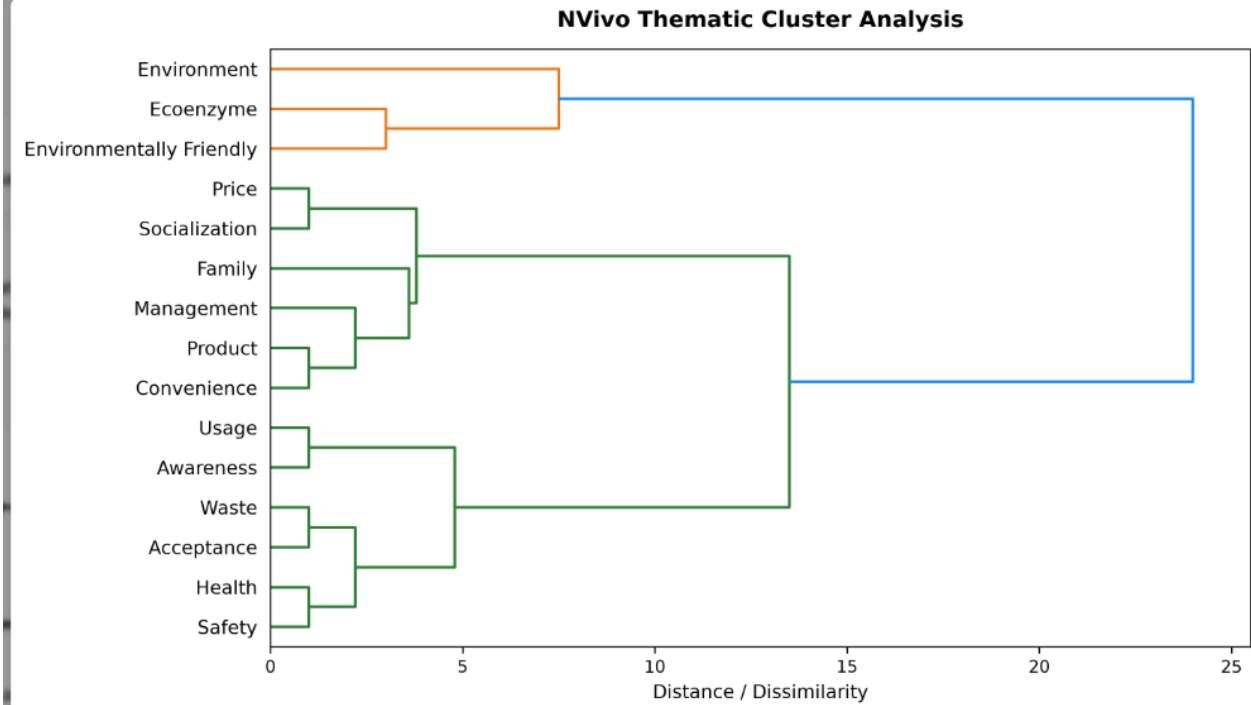


Figure 4. NVivo 12 hierarchical thematic proximity output

Source: NVivo 12 analysis of interview data, 2026.

The dendrogram shows three connected thematic domains. First, environment–ecoenzyme–environmentally friendly form the core interpretive domain. Second, safety–health–acceptance links perceived product assurance with willingness to use. Third, price–socialization–family links adoption to socio-economic and social-support conditions. The output addresses the second research question by explaining why strong initial acceptance can remain conditional: positive environmental beliefs must be accompanied by social encouragement, accessible information, and feasible cost and access conditions.

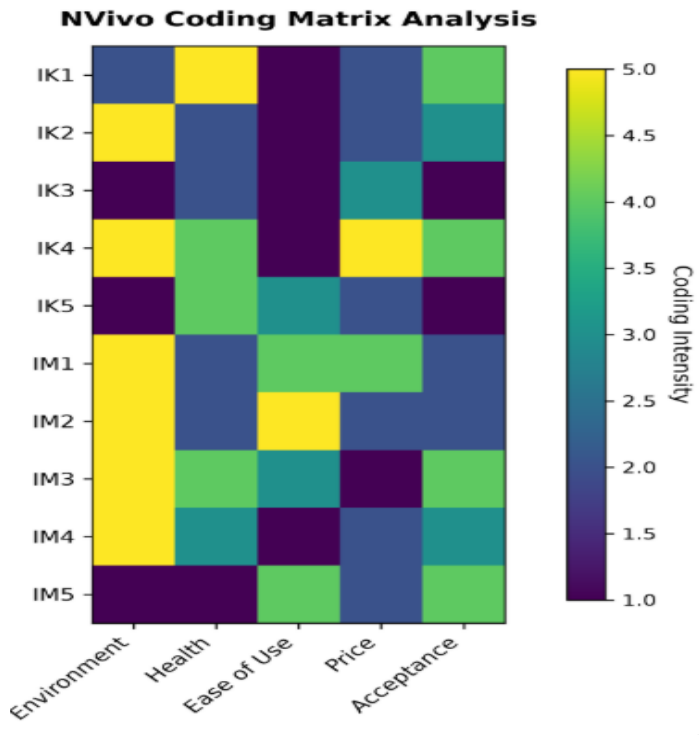


Figure 5. NVivo 12 coding matrix of informants and major themes

Source: NVivo 12 analysis of interview data, 2026.

The coding matrix displays variation across individual informants. Environmental references are prominent across several informants, whereas health, ease, price, and acceptance are distributed unevenly. This variation is consistent with the quantitative results: ease of use was evaluated positively, but access to or production of the soap was less favorable. Thus, the qualitative evidence supports a differentiated interpretation: respondents value the innovation, but the conditions for sustained use are not equally available to all participants.

The mind map integrates the qualitative findings with the study framework. Acceptance is connected to community perception (knowledge, safety, environmental benefit, and health), subjective norms (family support, social environment, and socialization), perceived behavioral control (ease of use, price, and product access), and potential social-environmental implications (waste reduction, environmental awareness, and behavioral change). It therefore directly answers the third research question: ecoenzyme soap is perceived as a potential vehicle for household waste awareness and greener practice, but these implications remain perceived potential rather than experimentally measured outcomes.

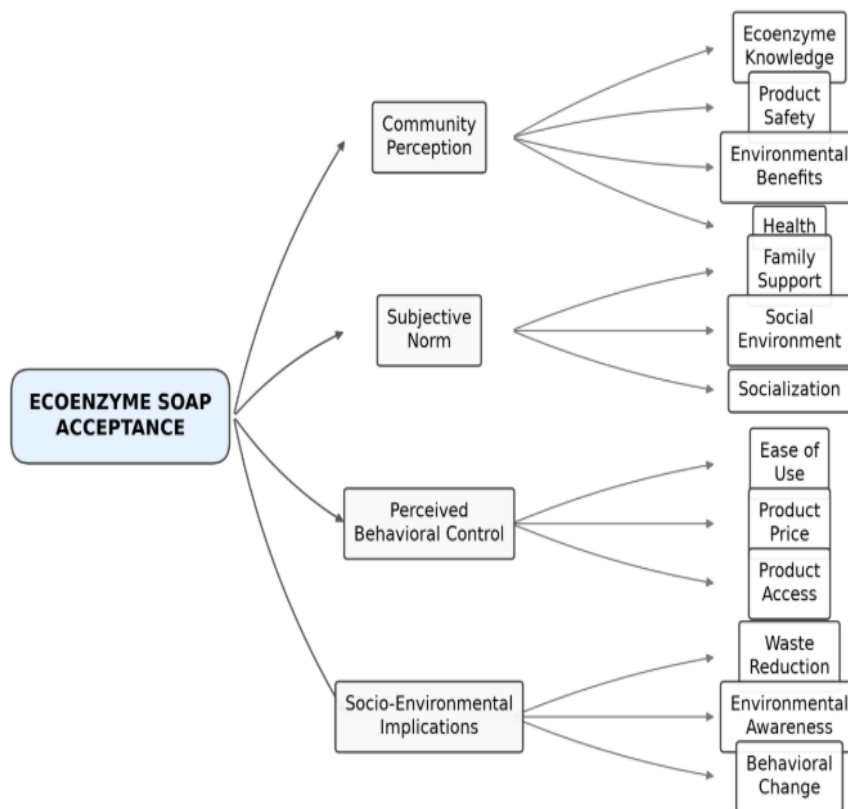


Figure 6. NVivo 12 mind map of factors shaping ecoenzyme-soap acceptance

Source: NVivo 12 analysis of interview data, 2026.

Table 4. NVivo 12 synthesis aligned with the research objectives

Research objective	NVivo 12 evidence	Integrated answer
Describe community perceptions of ecoenzyme soap	Environment, ecoenzyme, and environmental friendliness dominate the word cloud and coding-frequency output; health and safety are also recurring themes.	Perceptions are primarily grounded in environmental benefit, with health and perceived safety reinforcing product appraisal.
Explain community acceptance and its supporting or limiting conditions	The dendrogram and coding matrix link acceptance with safety, health, family, socialization, price, access, and ease.	Acceptance is positive but conditional on social support, practical access, technical knowledge, and affordability.
Identify perceived social and environmental implications	The mind map connects acceptance to waste reduction, environmental awareness, and behavioral change.	Ecoenzyme soap is perceived as a possible household-level pathway for waste awareness and greener practice, not as verified evidence of measured environmental impact.

Source: NVivo 12 analysis of interview data and integrated primary-data interpretation, 2026.

Integrated Social and Environmental Implications

Taken together, the NVivo 12 outputs and quantitative results address all study objectives. Environmental benefit is central to community perception; acceptance is strengthened by family support and ease of use but constrained by access, price, and technical knowledge; and the expected social-environmental contribution lies in greater awareness of organic-waste recovery and greener household practice. These findings describe participant perceptions and

intentions, not direct measurements of waste reduction, pollution reduction, health outcomes, or product performance. The findings position ecoenzyme-based soap as a potential entry point for household discussion of waste recovery and greener cleaning practice. Its contribution to a circular economy depends on whether households can obtain reliable information, use formulations that meet applicable quality and safety expectations, and sustain the practice beyond initial interest. Future research should use a larger and more diverse sample, verify product performance through laboratory testing, and measure actual adoption, repeat use, and waste-management outcomes.

CONCLUSION

Participants in Lhokseumawe City reported positive perceptions and strong acceptance of ecoenzyme-based environmentally friendly soap. The survey and NVivo 12 findings converge in showing that environmental benefit is the most important basis of favorable perception, while health, perceived safety, family support, and ease of use reinforce acceptance. The NVivo 12 outputs also show that price, product access, socialization, and technical knowledge qualify this acceptance, explaining why stated interest should not be treated as evidence of routine adoption. Participants perceived the product as a potential means of supporting waste awareness and greener household behavior, but this study did not measure environmental, health, or product-performance outcomes directly. Practical education, standardized technical guidance, and improved access to affordable products or materials are therefore recommended. Because the study is descriptive and based on purposive-voluntary participation, the findings should not be generalized statistically to the entire population. Further research should test product performance and safety and assess actual, sustained household use.

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