

Determinants of household food waste in East Kalimantan, Indonesia, based on an urban-rural regression analysis

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²Doctoral Program of Agricultural Sciences, Faculty of Agriculture, Universitas Mulawarman. Jl. Pasir Balengkong No. 1, Kampus Gunung Kelua, Samarinda 75119, East Kalimantan, Indonesia

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Abstract. Daulika P, Saragih B, Mariyah. 2026. Determinants of household food waste in East Kalimantan, Indonesia, based on an urban-rural regression analysis. *Asian J Agric* 10 (1): g100119. <https://doi.org/10.13057/asianjagric/g100119>. Food waste is a critical issue affecting environmental quality, economic efficiency, and food security. In East Kalimantan, more than 50% of generated waste is attributed to food waste, yet empirical evidence comparing urban-rural determinants of household food waste in Indonesia remains limited. This study examines the determinants of household food waste across urban and rural settings in East Kalimantan using a quantitative household survey and multiple linear regression analysis. Model significance was assessed using t-tests and F-tests, while explanatory power was evaluated using the coefficient of determination (R^2). The results indicate clear contextual differences. In urban areas, household income, food processing practices, and food storage significantly influence food waste. In rural areas, significant determinants include household income, food acquisition methods, and food storage. Notably, income and food storage are consistent predictors in both contexts, whereas food processing is more salient in urban households and food acquisition is more salient in rural households. These findings suggest that food-waste reduction strategies should be context-specific: urban interventions should prioritize consumer education and household expenditure planning, while rural interventions should focus on improving food acquisition efficiency, strengthening local food utilization, and promoting household-based organic recycling to support sustainable food security.

Keywords: East Kalimantan, food security, food waste, household behavior, urban-rural

INTRODUCTION

Food security ensures that all people have continuous access to sufficient, safe, and nutritious food for an active and healthy life. It is commonly understood through four dimensions: availability, access, utilization, and stability. In recent years, these dimensions have been increasingly threatened by climate change, population growth, urbanization, economic instability, and disruptions in food supply systems. Within this context, household food waste has become a critical issue because it reflects an imbalance in the food system: while some households still struggle to obtain adequate food, edible food is discarded at the consumption stage. Food loss and waste reduction is closely related to efforts to improve food security, resource efficiency, and environmental sustainability (Shafiee-Jood and Cai 2016; Spang et al. 2019). The UNEP Food Waste Index Report 2024 estimates that 1.05 billion tonnes of food waste were generated globally in 2022, with around 60% occurring at the household level (UNEP 2024). This indicates that household-level food waste is an important entry point for understanding food waste reduction because household practices, habits, planning, and consumption behavior play a significant role in the generation of food waste (Hebrok and Boks 2017; Schanes et al. 2018; Vittuari et al. 2023).

In Indonesia, food waste is also a major concern. National estimates show that Indonesia generated

approximately 23-48 million tonnes of food loss and waste annually during 2000-2019, equivalent to 115-184 kg per capita per year (Bappenas 2021). This condition has implications for waste management, economic losses, food availability, and environmental burdens (Bappenas 2021; Farahdiba et al. 2022). Previous studies indicate that food waste in Indonesia is influenced by consumption patterns, income, household behavior, food purchasing practices, storage, and waste-management capacity (Soma 2020; Kurniawan et al. 2022; Niha et al. 2022; Kusumawardani et al. 2023). However, much of the existing discussion remains concentrated at the national level or in urban contexts, where market access, retail choice, consumption management, and lifestyle-related food practices are more visible (Soma 2020; Mulyo et al. 2022; Kusumawardani et al. 2023). Evidence comparing rural and urban household food waste in Indonesia has begun to emerge, but it remains limited and context-specific (Lybaws et al. 2025).

The distinction between urban and rural or peri-urban households is important because the determinants of food waste may vary across spatial and household contexts. Previous studies show that household food waste is associated with income, sociodemographic characteristics, food purchasing behavior, household habits, food provisioning, storage, and consumer attitudes (Secondi et al. 2015; Stancu et al. 2016; Russell et al. 2017; Hermanussen et al. 2022; Bilska et al. 2024). Urban households may experience different food waste drivers

because of differences in retail access, purchasing frequency, food availability, and consumption patterns (Soma 2020; Mulyo et al. 2022). In contrast, rural and peri-urban households may have different food procurement, preparation, storage, and disposal practices. Therefore, household food waste should not be treated as a uniform phenomenon. Strategies that are effective in urban areas may not automatically be suitable for rural or peri-urban households because food access, planning, storage capacity, and consumption behavior may differ substantially (Boulet et al. 2021; Lybaws et al. 2025).

East Kalimantan, Indonesia, provides a relevant setting for examining this issue because the province is undergoing rapid socio-spatial transformation associated with peri-urban expansion and the development of Indonesia's new capital city, Ibu Kota Nusantara (IKN). In this transition area, rural and urban food systems increasingly overlap. Traditional food practices, local markets, home-produced food, and social exchange networks coexist with modern retail access, migrant lifestyles, prepared foods, and urbanized consumption patterns. This creates a distinctive context in which food waste may be shaped not only by household behavior, but also by wider territorial changes such as migration, infrastructure development, market restructuring, income shifts, and uneven waste-management capacity. Regional waste data also show that waste generation and waste-management performance remain important issues in East Kalimantan (SIPSN 2023). Thus, East Kalimantan offers an important case for extending household food waste analysis beyond a conventional urban-rural comparison.

This study focuses on Samarinda City as the urban context and Sepaku Sub-district in Penajam Paser Utara District as the rural/peri-urban context. Samarinda represents an urban area in East Kalimantan, with dense population, diverse food markets, and higher municipal waste generation. Sepaku represents a transition area near the IKN development zone, where rural livelihoods are increasingly exposed to urban influences and changing market access. Comparing these two areas is important to understand whether the same household factors influence food waste in both contexts or whether different determinants emerge under different socio-spatial conditions. This comparison is consistent with previous studies showing that household food waste determinants may vary according to income, household characteristics, food access, consumption behavior, and spatial context (Soma 2020; Hermanussen et al. 2022; Kusumawardani et al. 2023; Lybaws et al. 2025).

Accordingly, this study aims to estimate and compare the determinants of household food waste in urban and rural/peri-urban areas of East Kalimantan. Using household survey data and multiple linear regression analysis, the study examines the association between household food waste and income level, number of food portions, household size, food procurement, food processing, and food storage. Previous household food waste studies have also examined the role of economic, sociodemographic, behavioral, and food management factors in explaining food waste generation (Chalak et al. 2016; Fami et al.

2019; Hermanussen et al. 2022; Bilska et al. 2024). By identifying determinants that are common across contexts and those that are context-specific, this study is expected to support more targeted household food waste reduction strategies within a broader food security and sustainability framework (Rolker et al. 2022; Simões et al. 2022; Vittuari et al. 2023).

MATERIALS AND METHODS

Study area

This study was conducted in East Kalimantan Province, Indonesia, focusing on areas surrounding the New Capital City (Ibu Kota Nusantara/IKN), which are currently experiencing rapid socio-economic and spatial transformation. Samarinda City was selected to represent the urban context due to its role as an urban center in East Kalimantan and its relatively high municipal waste generation. Regional waste data indicate that waste generation remains an important issue in East Kalimantan, thereby supporting the relevance of examining household waste-related behavior in this province (SIPSN 2023). Sepaku Sub-district in Penajam Paser Utara (PPU) District, particularly villages located within the IKN delineation area, was selected to represent the rural/peri-urban context characterized by mixed livelihoods and increasing exposure to urban consumption patterns. The distinction between urban and rural/peri-urban settings is relevant because previous studies have shown that household food waste and food consumption behavior may vary according to spatial context, income, retail access, household characteristics, and food management practices (Soma 2020; Mulyo et al. 2022; Lybaws et al. 2025). Figure 1 presents the geographical location of this study, including Delinase Village, within East Kalimantan Province.

Study design

This study employed a cross-sectional quantitative design with an analytical descriptive approach. A cross-sectional design was considered appropriate because the study aimed to assess associations between household socio-economic characteristics, food management behaviors, and household food waste generation at a single point in time. Previous household food waste studies have commonly examined the relationship between food waste and household-level determinants such as income, sociodemographic characteristics, food purchasing behavior, food provisioning, storage practices, and consumer behavior using survey-based quantitative approaches (Stancu et al. 2016; Fami et al. 2019; Hermanussen et al. 2022; Bilska et al. 2024). Importantly, the design supports a structured urban-rural comparative analysis by estimating determinants separately for urban and rural/peri-urban households, enabling the identification of context-specific versus consistent predictors. This approach is consistent with previous studies showing that determinants of household food waste may differ between urban and rural contexts and across different household conditions (Soma 2020; Lybaws et al. 2025).

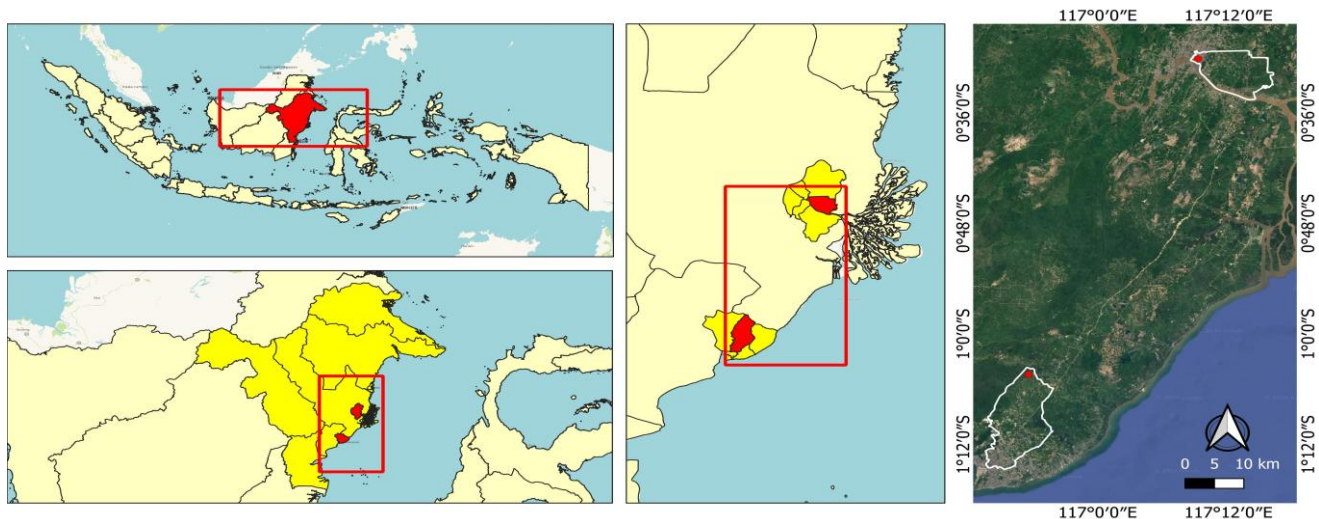


Figure 1. Location of Samarinda City and 2. Sepaku Sub-district (Delinase Village, IKN): point 1 (0°30'08" S, 117°09'13" E), point 2 (1°04'23" S, 116°53'41" E)

Sampling design and sample size

The study population consisted of households residing in selected urban sub-districts of Samarinda City and rural/peri-urban villages of Sepaku Sub-district. A purposive sampling strategy was applied because the study specifically targeted households located in areas directly exposed to socio-economic transformation associated with the IKN development zone. In household food waste studies, the selection of respondents is commonly linked to household-level food management roles because food waste is influenced by food purchasing, meal preparation, storage, and consumption practices (Hebrok and Boks 2017; Schanes et al. 2018; Stancu and Lähteenmäki 2022). Households were included when they met observable criteria: (i) preparing or consuming home-based meals at least four times per week, (ii) having one adult household member responsible for food purchasing or meal preparation, (iii) residing in the selected area for at least one year, and (iv) being willing to participate in the interview. Households that did not routinely prepare food at home or could not identify the person responsible for food management were excluded.

To reduce selection bias, respondents were distributed across different sub-districts/villages and selected to reflect variation in income level, household size, and food-access characteristics. These characteristics were considered relevant because previous studies have shown that household food waste is associated with income, household size, food provisioning, food purchasing behavior, and storage practices (Stancu et al. 2016; Fami et al. 2019; Hermanussen et al. 2022; Klugman 2024; Bilaska et al. 2024). Sample adequacy was assessed using Green's rule of thumb for multiple regression, which recommends $N \geq 50 + 8m$, where m represents the number of predictors (Green 1991). With six predictors, the minimum required sample size is 98 for each subgroup. Therefore, the 100 urban and 100 rural/peri-urban households met this minimum requirement. However, because the sampling

was non-probability based, the findings are interpreted as sample-based associations rather than population-level generalizations.

To strengthen the urban-rural comparison, the two household groups were not assumed to be identical merely because they had equal sample sizes. Comparability was assessed descriptively using income category, household size, number of food portions, and behavioral index scores. These characteristics are reported before the regression results so that readers can evaluate whether the observed differences may reflect contextual food-management behavior or underlying structural differences between urban and rural/peri-urban households. This approach is relevant because previous studies in Indonesia and other contexts indicate that household food waste determinants may differ across urban and rural settings, income groups, food access conditions, and household food consumption patterns (Soma 2020; Mulyo et al. 2022; Lybaws et al. 2025). Because propensity score matching or multilevel modelling was not applied, the regression results are interpreted cautiously and are not presented as causal estimates.

Data collection

Data collection was conducted through structured face-to-face household interviews using a standardized questionnaire. Survey-based household interviews have been widely used in food waste studies to examine household characteristics, consumer behavior, food management practices, and self-reported food waste generation (Stancu et al. 2016; Fami et al. 2019; Hermanussen et al. 2022; Bilaska et al. 2024). This study did not conduct direct physical measurement of food waste in kg/day or kg/week because such measurement requires repeated household waste audits, waste sorting, or food-waste diaries over several days. Previous studies have noted that food waste measurement can be conducted using several approaches, including direct measurement, diaries,

waste composition analysis, and self-reported survey methods, each with different strengths, limitations, and levels of respondent burden (Spang et al. 2019; González-Santana et al. 2022).

Instead, the study used a household food-waste index as a relative measure of food-waste tendency based on self-reported outcome items, such as the frequency and perceived amount of edible food discarded by the household. Self-reported measures are commonly used in household food waste research to capture food waste behavior and related household practices, although they should be interpreted as perceived or reported tendencies rather than exact physical quantities (Stancu et al. 2016; Schanes et al. 2018; Bilska et al. 2024). To minimize conceptual overlap, behavioural factors such as food planning, purchasing, storage, processing, and consumption practices were treated only as explanatory variables and were not included as components of the food-waste index. Thus, the food-waste index represents the outcome variable, while storage and processing variables represent potential determinants that may explain variations in household food waste. This distinction is consistent with previous frameworks that separate food waste outcomes from household food management behaviors and behavioral drivers (Hebrok and Boks 2017; Boulet et al. 2021; Stancu and Lähteenmäki 2022).

Prior to full deployment, the instrument was pre-tested on a small set of households to ensure clarity, logical flow, and separation between outcome and predictor items. Primary data covered household socio-economic characteristics, household food-management practices, and self-reported food waste. Food waste was measured using questions that asked respondents to recall food discarded at the household level during a defined recent recall period, including cooked food left uneaten, edible leftovers after meals, food that spoiled during storage, and food that was discarded because it was no longer considered suitable for consumption. The response options used a five-point Likert format, ranging from very low/never to very high/very often. The questionnaire is recommended to be provided as supplementary material to improve transparency and replicability. Secondary data were obtained from official sources such as SIPSN, BPS, local environmental agencies, and regional government reports to support contextual interpretation. In addition, enumerators recorded brief observational notes and, where permitted, photographic documentation related to food storage facilities, food preparation practices, and disposal behavior to triangulate self-reported information.

Measurement and operationalization of variables

The dependent and independent variables used in this study were operationalized to ensure clarity and consistency in measurement. Their definitions, indicators, and measurement scales are presented in Table 1. The dependent variable, household food waste, was operationalized as a self-reported food-waste index reflecting the frequency and perceived amount of edible

food discarded by households. Previous studies have shown that household food waste can be influenced by several interrelated factors, including income, household size, food provisioning, purchasing behavior, storage, meal planning, preparation practices, and consumer attitudes (Stancu et al. 2016; Hebrok and Boks 2017; Fami et al. 2019; Hermanussen et al. 2022; Bilska et al. 2024). Therefore, the independent variables in this study included Income Level, Number of Food Portions, Household Size, Food Procurement, Food Processing, and Food Storage. These variables were selected because they represent socio-economic characteristics and household food-management practices that have been identified in previous food waste research as potential determinants of household food waste (Boulet et al. 2021; Stancu and Lähteenmäki 2022; Klugman 2024; Lybaws et al. 2025).

Data analysis

Analysis of factors influencing food waste

This study employed multiple linear regression analysis to examine the determinants of household food waste. Multiple regression is appropriate because the study aimed to estimate the association between household food waste and several explanatory variables simultaneously. Similar quantitative approaches have been used in previous household food waste studies to examine the contribution of socio-economic, demographic, behavioral, and food-management factors to household food waste generation (Daulika et al. 2020; Fami et al. 2019; Hermanussen et al. 2022; Bilska et al. 2024). The dependent variable is Food Waste (Y), while the independent variables include Income Level (X1), Number of Food Portions (X2), Household Size (X3), Food Procurement (X4), Food Processing (X5), and Food Storage (X6). Data cleaning, editing, and coding were conducted in MS Excel, and statistical analyses were performed using STATA.

The regression analysis was conducted separately for urban and rural/peri-urban households to identify whether the determinants of household food waste differed between the two contexts. This analytical strategy is supported by previous studies showing that food waste behavior and its determinants may vary across household groups, spatial contexts, income levels, and food access conditions (Soma 2020; Mulyo et al. 2022; Lybaws et al. 2025). The regression model applied in this study is as follows:

$$Y = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + e$$

Where:

Y: Food Waste

X₁: Income Level

X₂: Number of Food Portions

X₃: Household Size

X₄: Food Procurement

X₅: Food Processing

X₆: Food Storage

e: Error (residual)

Table 1. Measurement and operationalization of variables

Variable	Indicator/item composition	Response/coding	Index construction and interpretation
Food waste (Y)	Self-reported discarded food, covering: uneaten cooked food, plate leftovers, spoiled/expired stored food, and edible food discarded after meals.	Five-point Likert scale. Suggested coding: 1 = never/very low, 2 = rarely/low, 3 = sometimes/moderate, 4 = often/high, 5 = very often/very high.	Arithmetic mean/sum of all food-waste items. Higher scores indicate higher self-reported household food waste. No identical item was used in the independent behavioral indices.
Income level (X1)	Monthly household income category.	Ordinal category based on local income grouping used in the questionnaire.	Included as a socio-economic control because income affects purchasing capacity and tolerance toward discarded food.
Number of food portions (X2)	Average number of food portions prepared per main meal.	Numeric count/average reported by respondent.	Included to capture meal preparation scale and potential over-preparation.
Household size (X3)	Number of household members living and eating in the household.	Numeric count.	Included as a demographic control for household consumption scale.
Food procurement (X4)	Food acquisition behavior: purchase frequency, food source, purchase planning, use of shopping lists, market access, and tendency to buy more than needed.	Five-point Likert items coded in the same direction. Items indicating better planning should be reverse-coded where needed.	Composite index. Higher scores indicate greater procurement-related risk of food waste, such as less planned purchasing, overbuying, or constrained/irregular access.
Food processing (X5)	Food preparation behavior: cooking according to household needs, portioning, reuse of leftovers, and avoiding excessive preparation.	Five-point Likert items coded in the same direction.	Composite index. Higher scores indicate better processing and portion-management practices; negative coefficients therefore suggest waste-reducing practices.
Food storage (X6)	Storage behavior and stock condition: amount stored, rotation of food stocks, checking expiry/spoilage, storage facilities, and ability to maintain food quality.	Five-point Likert items coded in the same direction.	Composite index. Higher scores indicate greater storage intensity or stock accumulation. Interpretation therefore distinguishes storage availability from effective stock management.

RESULTS AND DISCUSSION

Factors influencing food waste in rural-urban households in East Kalimantan

Regression analysis

This section represents one of the objectives of this study. The research aims to examine how various factors income level, number of food portions, household size, food procurement, food processing, and food storage influence food waste in rural and urban households in East Kalimantan. These variables were selected because previous studies have shown that household food waste is influenced by socio-economic characteristics, food purchasing and provisioning behavior, household size, food preparation, storage practices, and consumer food-management behavior (Stancu et al. 2016; Hebrok and Boks 2017; Fami et al. 2019; Boulet et al. 2021; Hermanussen et al. 2022; Bilska et al. 2024). The estimated regression coefficients along with the significance values of each variable are presented in Tables 2 and 3.

Based on the estimation results in Tables 2 and 3, the multiple linear regression equations for household food waste in urban and rural/peri-urban households in East Kalimantan can be written as follows. Multiple regression analysis is appropriate in household food waste studies because it allows the simultaneous examination of several socio-economic and behavioral determinants of food waste

(Chalak et al. 2016; Fami et al. 2019; Hermanussen et al. 2022; Bilska et al. 2024).

Urban model:

$$Y = 16.53518 + 0.0016837X1 - 0.0027911X2 + 0.0253172X3 - 0.0007702X4 - 0.2718913X5 + 0.908297X6 + e$$

Rural/peri-urban model:

$$Y = 12.55673 + 0.000514X1 - 0.0001569X2 + 0.821355X3 + 0.0473982X4 - 0.0215377X5 + 0.060953X6 + e$$

Table 2. Urban regression

Variable	Coefficient	Std. Err.
Income level (X1)	.0016837	.0004401
Number of food portions (X2)	-.0027911	.0149569
Household size (X3)	.0253172	.0718551
Food procurement (X4)	-.0007702	.0022191
Food processing (X5)	-.2718913	.0641099
Food storage (X6)	.908297	.1032549
Constant	16.53518	1.062733

Source: Data were processed and analyzed using Stata 17, 2025.

*: Significance level 0.05 (5%)

Table 3. Rural regression

Variable	Coefficient	Std. Err.
Income level (X1)	.000514	.000228
Number of food portions (X2)	-.0001569	.0072416
Household size (X3)	.821355	.5595218
Food procurement (X4)	.0473982	.0235214
Food processing (X5)	-.0215377	.0346142
Food storage (X6)	.060953	.0207927
Constant	12.55673	.2434175

Source: Data were processed and analyzed using Stata 17, 2025.

*: Significance level 0.05 (5%)

Income level (X1)

The coefficient value of Income Level (X1) in this model is 0.0016837 for urban households and 0.000514 for rural households. This means that for every one-unit increase in income level (X1), food waste increases by 0.0016 in urban areas and 0.00051 in rural areas, assuming other variables remain constant.

These findings are consistent with previous studies showing that higher household income is positively associated with food waste generation. Secondi et al. (2015) explained that higher-income households tend to generate more food waste because they have greater purchasing power and may be less sensitive to the economic value of discarded food. Soma (2020), in the Indonesian context, found that income and retail choice influence household food consumption and food waste. Similarly, Kusumawardani et al. (2023) found that income contributes to household food waste generation in Indonesia, while Klugman (2024) reported a positive correlation between household income and food waste quantity. Therefore, the positive effect of income in both urban and rural/peri-urban households in East Kalimantan is consistent with previous evidence that economic capacity can increase the tendency to purchase, store, and discard more food.

Number of food servings (X2)

The coefficient value of Number of Food Portions (X2) is -0.0027911 for urban households and -0.0001569 for rural/peri-urban households. However, the t-test results indicate that this variable is not statistically significant in either model. Therefore, the negative coefficient should not be overinterpreted as evidence that increasing portions reduces food waste. Instead, the result suggests that, after controlling for income, household size, procurement, processing, and storage, portion number alone does not explain meaningful variation in the food waste index in this sample.

Although the coefficient is not statistically significant in this study, the direction remains relevant to portion-management debates in the literature. Previous studies show that excessive preparation, poor meal planning, and mismatch between cooked food and actual consumption can contribute to household food waste (Graham-Rowe et al. 2014; Stancu et al. 2016; Hebrok and Boks 2017; Schanes et al. 2018; Vittuari et al. 2023). However, the present finding indicates that in East Kalimantan, portion

number alone may be insufficient to explain food waste because the effect may be mediated by broader household practices such as food processing, storage, and procurement. Thus, future studies should measure portion management more specifically, including over-preparation, plate leftovers, leftover reuse, and meal-planning accuracy.

Household size (X3)

The coefficient value of Household Size (X3) is 0.0253172 for urban households and 0.821355 for rural/peri-urban households. However, this variable is not statistically significant in either model. This suggests that the total number of household members does not independently explain household food waste once income and food-management behaviors are included. In this context, how households plan, process, and store food appears more important than household size alone.

This finding should be read cautiously because previous studies have reported mixed relationships between household size and food waste. Some studies suggest that larger households may generate greater total food waste because they prepare and consume more food, while others indicate that larger households may produce lower food waste per capita because leftovers can be shared or consumed by more household members (Secondi et al. 2015; Stancu et al. 2016; González-Santana et al. 2022; Bilska et al. 2024). The present finding supports the interpretation that household size alone is not sufficient to explain household food waste. Therefore, household size is retained as a control variable, while the substantive interpretation focuses more strongly on statistically significant behavioral determinants.

Food procurement (X4)

The coefficient value of Food Procurement (X4) is -0.0007702 for urban households and 0.0473982 for rural/peri-urban households. The effect is not statistically significant in urban households but is significant in rural/peri-urban households. Therefore, the urban coefficient is not interpreted substantively. In rural/peri-urban households, the positive and significant coefficient indicates that procurement-related risk such as less planned purchasing, irregular market access, overbuying, or dependence on periodic acquisition is associated with higher food waste.

This finding is consistent with previous studies emphasizing that food purchasing, food provisioning, and planning behavior are important determinants of household food waste (Fami et al. 2019; Boulet et al. 2021; Stancu and Lähteenmäki 2022; Vittuari et al. 2023). Fami et al. (2019) showed that household food waste behavior is closely related to food management and household consumption practices, while Stancu and Lähteenmäki (2022) emphasized that food provisioning behavior can promote waste when households do not manage purchasing and food use effectively. In the rural/peri-urban context of Sepaku/PPU, households may face changing market access due to IKN-related transformation while still relying partly on local markets, own production, informal exchange, and periodic purchasing. Such conditions can increase the risk

of mismatch between food obtained and food actually consumed, particularly when storage or preservation practices are limited. Therefore, the result supports the need for rural/peri-urban interventions that improve procurement planning, purchase scheduling, and coordination of household food needs.

Food processing (X5)

The coefficient value of Food Processing (X5) in this model is -0.2718913 for urban households and -0.0215377 for rural households. This means that for every one-unit increase in food processing (X5), food waste decreases by 0.271 in urban areas and 0.021 in rural areas, assuming other variables remain constant.

The negative effect of food processing, especially in urban households, is consistent with previous studies showing that food preparation, cooking routines, portion estimation, and leftover management are important factors in reducing household food waste (Graham-Rowe et al. 2014; Stancu et al. 2016; Hebrok and Boks 2017; Schanes et al. 2018; Bravi et al. 2020). Graham-Rowe et al. (2014) identified excessive food preparation and cooking more than needed as behavioral causes of household food waste. Similarly, Hebrok and Boks (2017) and Schanes et al. (2018) emphasized that household food waste is closely related to everyday food practices, including meal preparation and leftover use. Therefore, better food processing practices in urban households may reduce the likelihood of uneaten cooked food, over-preparation, and discarded leftovers.

Food storage (X6)

The coefficient value of food storage (X6) is 0.908297 for urban households and 0.060953 for rural/peri-urban households. This variable is statistically significant in both models, indicating that storage-related behavior is a consistent predictor of household food waste across contexts. Because the storage index captures storage intensity and stock accumulation as well as storage management, the positive coefficient should be interpreted as evidence that storing more food without effective stock rotation, monitoring of expiry/spoilage, and meal planning can increase the risk of food being forgotten, spoiled, or discarded.

This result is consistent with previous studies showing that food storage, stock visibility, household food organization, and expiry-date monitoring influence household food waste (Hebrok and Boks 2017; Schanes et al. 2018; Stancu and Lähteenmäki 2022; Vittuari et al. 2023). Hebrok and Boks (2017) identified household storage as an important intervention point for reducing food waste, while Schanes et al. (2018) emphasized that everyday practices such as storing, planning, and managing food at home are central to food waste prevention. In urban households, greater refrigerator/freezer access may encourage overstocking and the “out of sight, out of mind” effect. In rural/peri-urban households, storage risk may emerge from limited preservation capacity for fresh produce, fish, or harvested food. Thus, the policy implication is not merely to increase storage capacity, but

to improve stock management, first-in-first-out practices, preservation skills, and household monitoring of stored food.

R-squared test and F-test

The coefficient of determination (R^2) indicates the proportion of variation in the dependent variable explained by the predictors in the model. The estimated R^2 values are 0.9683 (96.83%) for urban households and 0.9754 (97.54%) for rural/peri-urban households, suggesting very strong explanatory power. Because R^2 values above 0.95 are uncommon in household survey research, these results are interpreted cautiously. The unusually high fit may reflect overfitting, strong correlations among behavioral indices, or an artifact of composite index construction if the food waste index shares conceptual or measurement overlap with some predictors. Previous studies and reviews have noted that household food waste measurement is methodologically challenging because self-reported measures, behavioral indices, and composite variables may capture related aspects of household food management (Spang et al. 2019; González-Santana et al. 2022).

To address this concern, the authors re-examined the construction of the composite indices before final regression estimation. The food waste index was restricted to discarded-food outcomes, whereas food procurement, food processing, and food storage were restricted to household food-management behaviors before disposal. Therefore, no identical questionnaire item was used simultaneously in the dependent and independent variables. In addition, VIF and robustness checks were used to assess whether the results were sensitive to multicollinearity or influential observations. The high R^2 is therefore best understood as indicating a strong within-sample association rather than evidence that the model fully captures all determinants of household food waste in the wider population.

The F-test was used to determine whether the independent variables collectively explain the dependent variable. The statistical test using Stata produced a significance value of 0.000. The calculated F-value for urban households (473.33) was greater than the F-table value (2.31), and the calculated F-value for rural households (615.79) was also greater than the F-table value (2.31). This indicates that the six independent variables used in this study, income level, number of food portions, household size, food procurement, food processing, and food storage, collectively have a significant effect on food waste in both urban and rural households in East Kalimantan.

T-test

The t-test was conducted to examine the significant effect of each independent variable (X) individually. The null hypothesis (H_0) of the t-test states that $\beta_i = 0$, meaning the independent variable has no significant effect on Y. The alternative hypothesis (H_a) states that $\beta_i \neq 0$, meaning the independent variable has a significant effect. H_0 is accepted if the p-value is greater than α , and H_0 is rejected if the p-value is less than α . The partial significance test results for

urban households are presented in Table 4, while the results for rural/peri-urban households are presented in Table 5.

The t-test results for urban households show that income level (X1), food processing (X5), and food storage (X6) each have a significant partial effect on household food waste in urban areas of East Kalimantan. In contrast, number of food portions (X2), household size (X3), and food procurement (X4) do not have a significant partial effect. These results indicate that household food waste in urban households is more strongly associated with economic capacity and food-management practices, particularly food processing and storage behavior. This pattern is consistent with previous studies showing that urban food waste is influenced by income, retail access, food preparation, and household storage practices (Soma 2020; Mulyo et al. 2022; Schanes et al. 2018; Vittuari et al. 2023).

The t-test results for rural/peri-urban households show that income level (X1), food procurement (X4), and food storage (X6) each have a significant partial effect on household food waste in rural areas of East Kalimantan. In contrast, number of food portions (X2), household size (X3), and food processing (X5) do not have a significant partial effect. These results indicate that rural/peri-urban food waste is more closely related to income, food acquisition behavior, and storage practices. This is consistent with previous studies showing that food provisioning, purchasing behavior, storage, and household food-management routines are important determinants of household food waste (Fami et al. 2019; Boulet et al. 2021; Stancu and Lähteenmäki 2022; Lybaws et al. 2025).

A comparison between Tables 4 and 5 indicates that income level and food storage are consistent significant determinants in both urban and rural/peri-urban households. However, food processing is significant only in urban households, while food procurement is significant only in rural/peri-urban households. This difference supports the argument that household food waste determinants are context-specific. Urban households require stronger attention to meal preparation, portion control, leftover use, and stock management, whereas rural/peri-urban households require greater attention to planned food acquisition, storage improvement, and preservation practices. This finding strengthens previous literature by showing that household food waste is shaped not only by individual behavior but also by spatial context and household food-system conditions (Soma 2020; Boulet et al. 2021; Lybaws et al. 2025).

The partial significance test results for urban households are presented in Table 4. The results show that income level (X1), food processing (X5), and food storage (X6) have significant effects on the food waste index among urban households, while number of food portions (X2), household size (X3), and food procurement (X4) are not statistically significant. These results indicate that household food waste in urban areas is more strongly influenced by economic capacity and food-management practices, particularly processing and storage behavior.

The partial significance test results for rural/peri-urban households are presented in Table 5. The results show that

income level (X1), food procurement (X4), and food storage (X6) have significant effects on the food waste index among rural/peri-urban households, whereas number of food portions (X2), household size (X3), and food processing (X5) are not statistically significant. This suggests that food waste in rural/peri-urban households is more closely associated with income, food acquisition practices, and storage behavior.

A comparison between Tables 4 and 5 indicates that income level and food storage are consistent significant determinants in both urban and rural/peri-urban households. However, food processing is significant only in urban households, while food procurement is significant only in rural/peri-urban households. This difference supports the argument that household food waste determinants are context-specific. Urban households require stronger attention to meal preparation, portion control, leftover use, and stock management, whereas rural/peri-urban households require greater attention to planned food acquisition, storage improvement, and preservation practices.

Discussion

Income level and household food waste

The results show that income level has a positive and significant effect on household food waste in both urban and rural/peri-urban households. This finding indicates that higher household income tends to be associated with higher self-reported food waste. The result is consistent with previous studies showing that income is an important socio-economic determinant of household food waste. Soma (2020), in a study on household food consumption and food waste in Indonesia, found that income and retail choice were associated with the amount of food waste generated by households. Similarly, Kusumawardani et al. (2023) found that per capita income was one of the significant determinants of household food waste generation at the provincial level in Indonesia. These studies support the interpretation that households with greater purchasing power may buy more food, maintain larger food stocks, and have a lower economic sensitivity toward discarded food.

However, the present study adds an important urban-rural distinction. Although income is significant in both contexts, the urban coefficient is higher than the rural/peri-urban coefficient. This suggests that income-related food waste may be more pronounced in urban households, where higher purchasing power is combined with easier access to supermarkets, food delivery services, restaurants, and modern retail promotions. In Samarinda City, greater market access may encourage frequent purchasing, bulk buying, and stock accumulation, increasing the possibility that food is left uneaten or spoiled. In rural/peri-urban Sepaku, income also increases food waste, but the effect is relatively smaller, possibly because households still maintain more traditional food-use practices, informal sharing, or stronger economic consideration in food consumption. Thus, the finding confirms previous evidence on the role of income while showing that its influence depends on the spatial and food-system context.

Number of food portions

The number of food portions has a negative but statistically insignificant effect on food waste in both urban and rural/peri-urban households. This means that the number of portions prepared per meal does not independently explain variation in household food waste after income, household size, procurement, processing, and storage are included in the model. This result should not be interpreted as evidence that portion size is unimportant. Rather, it suggests that portion number alone may be insufficient to capture the complexity of food waste behavior.

Previous studies have emphasized that excessive preparation, poor meal planning, and mismatch between cooked food and actual consumption can contribute to household food waste (Hebrok and Boks 2017; Schanes et al. 2018; Vittuari et al. 2023). The present finding partly differs from these studies because the measured variable was the average number of portions, not the accuracy of portion planning, plate leftovers, or household eating consistency. In the East Kalimantan context, portion number may become relevant only when combined with other behavioral factors, such as whether households cook according to actual needs, reuse leftovers, or properly store cooked food. Therefore, the insignificant effect of food portions indicates that future studies should measure portion management more specifically, including over-preparation, plate leftovers, and frequency of uneaten cooked food.

Household size

Household size is not statistically significant in either urban or rural/peri-urban households. This finding indicates that the number of household members does not independently determine food waste once household income and food-management behaviors are considered. The result is consistent with the view that household food waste is not determined only by demographic scale, but also by how food is purchased, prepared, stored, and consumed.

Previous literature reports mixed findings regarding household size. Some studies suggest that larger households may generate more total food waste because they consume and prepare more food, while others argue that larger households may waste less food per capita because leftovers can be consumed by other family members and food can be shared more efficiently (Stancu et al. 2016; González-Santana et al. 2022; Biliska et al. 2024). The present study supports the second interpretation more strongly: household size alone is less important than household food-management practices. In both Samarinda and Sepaku, food waste appears to be more closely related to behavioral and management variables, particularly storage, processing, and procurement, than to the number of people in the household.

Food procurement

Food procurement has different effects across the two study contexts. In urban households, food procurement is not statistically significant, while in rural/peri-urban

households it has a positive and significant effect on food waste. This means that procurement-related risk, such as unplanned purchasing, irregular food acquisition, buying more than needed, or mismatch between food obtained and food consumed, is more relevant in rural/peri-urban households than in urban households.

This finding is consistent with studies that identify food purchasing, planning, and acquisition behavior as important drivers of household food waste. Fami et al. (2019) showed that food consumption management, including purchasing and planning behavior, is closely related to household food waste. Vittuari et al. (2023) also emphasized that food provisioning practices, planning ability, and household routines are important levers for reducing food waste. However, the present study extends this discussion by showing that procurement behavior may be more decisive in rural/peri-urban transition areas.

In Sepaku, households may experience a combination of rural and urban food systems. Some households still depend on local markets, own production, informal exchange, or periodic purchasing, while at the same time they are increasingly exposed to new market access and changing consumption patterns associated with IKN development. This transitional condition may create uncertainty in food acquisition: households may buy in larger quantities when access is available, obtain food from multiple sources, or experience mismatch between purchased food and actual household needs. Unlike urban households, where food can be purchased more frequently and in smaller quantities, rural/peri-urban households may face stronger procurement-related risks. Therefore, the significant effect of procurement in rural/peri-urban households strengthens the argument that food waste prevention in transition areas should begin at the acquisition stage, not only at the disposal stage.

Food processing

Food processing has a negative and significant effect on food waste in urban households, but it is not significant in rural/peri-urban households. The negative coefficient indicates that better food processing practices, such as cooking according to household needs, managing portions, reusing leftovers, and avoiding excessive preparation, are associated with lower food waste in urban households. This finding is consistent with previous studies showing that meal preparation, cooking routines, leftover reuse, and food management skills play an important role in reducing household food waste (Stancu et al. 2016; Hebrok and Boks 2017; Schanes et al. 2018; Bravi et al. 2020).

The significance of food processing in urban households may reflect the characteristics of urban consumption. Urban households in Samarinda have easier access to diverse food options, prepared foods, restaurants, and delivery services. These conditions may create more flexible but less predictable eating patterns, making cooking accuracy and leftover management more important. When food is prepared without considering actual household consumption, the risk of uneaten cooked food increases. Therefore, better processing and portion-

management practices can directly reduce food waste in urban households.

In contrast, food processing is not significant in rural/peri-urban households. This does not mean that processing behavior is irrelevant, but rather that other factors, particularly procurement and storage, play a stronger role in explaining food waste in this context. Rural/peri-urban households may still have more habitual cooking routines, stronger leftover use, or more direct use of local food sources. As a result, variation in food processing practices may be smaller and less influential than variation in food procurement and storage. This finding supports the need for differentiated intervention strategies: urban households require stronger education on meal planning, portion control, and leftover processing, while rural/peri-urban households require greater attention to procurement efficiency and storage improvement.

Food storage

Food storage has a positive and significant effect on household food waste in both urban and rural/peri-urban households. This result shows that storage-related behavior is a consistent predictor of food waste across contexts. However, the meaning of storage should be interpreted carefully. In this study, the storage variable does not only represent the availability of storage facilities, but also storage intensity, stock accumulation, stock rotation, checking of spoilage, and the ability to maintain food quality. Therefore, the positive coefficient indicates that greater storage intensity without effective stock management may increase the risk of food being forgotten, spoiled, or discarded.

This finding is consistent with previous studies showing that food storage, stock visibility, expiry-date monitoring, and household food organization influence food waste. Schanes et al. (2018) emphasized that household food waste is strongly related to everyday practices, including storing, planning, and managing food at home. Vittuari et al. (2023) also identified storage management and household routines as important levers for reducing consumer food waste. The present study confirms these findings in the East Kalimantan context but also reveals different mechanisms between urban and rural/peri-urban households.

In urban households, better access to refrigerators, freezers, and modern retail may encourage overstocking. Food kept in storage may be forgotten, hidden behind newer products, or discarded after spoilage or expiry. This supports the “out of sight, out of mind” explanation often discussed in household food waste studies. In rural/peri-urban households, the storage problem may be different. The risk may come from limited preservation facilities, irregular electricity access in some areas, limited cold storage, or seasonal availability of fresh produce and fish. Thus, storage-related food waste in rural/peri-urban areas may be caused not only by overstocking, but also by limited capacity to maintain food quality. These contextual differences show that storage intervention should not only provide more storage facilities, but also improve stock

rotation, first-in-first-out practices, preservation skills, and household monitoring of stored food.

Overall comparison with previous studies

Overall, the findings of this study are consistent with previous research showing that household food waste is influenced by socio-economic capacity and household food-management behavior. The significant effect of income supports Soma (2020) and Kusumawardani et al. (2023), who found that economic factors contribute to food waste in Indonesia. The importance of food storage and food processing is consistent with broader international literature emphasizing that household routines, planning, cooking, and storage practices are central drivers of food waste (Stancu et al. 2016; Hebrok and Boks 2017; Schanes et al. 2018; Vittuari et al. 2023). The significance of procurement in rural/peri-urban households also supports studies that highlight the role of purchasing and food provisioning behavior in shaping food waste outcomes (Fami et al. 2019; Stancu and Lähteenmäki 2022).

The main contribution of the present study lies in showing that these determinants do not operate uniformly across spatial contexts. Unlike studies that analyze household food waste at the national or urban level, this study compares urban and rural/peri-urban households in East Kalimantan, a non-Java region undergoing socio-spatial transformation related to IKN development. The results show that income and storage are consistent predictors in both areas, while processing is more important in urban households and procurement is more important in rural/peri-urban households. This pattern supports the argument that food waste reduction strategies should be context-specific. Urban interventions should focus on consumption planning, portion control, leftover processing, and stock management, while rural/peri-urban interventions should focus on efficient food acquisition, preservation practices, improved storage, and local food utilization. In this way, the study strengthens existing food waste literature by providing comparative evidence from a transition region where urban and rural food systems increasingly overlap.

Recommendations for household food waste prevention efforts for the government and other stakeholders

Regarding the differences in food waste between urban and rural households and the factors influencing them, preventive efforts must involve the roles of local governments, community organizations, businesses, and other stakeholders. Policy recommendations and strategies that can be developed in the Table 6.

Implications for food security

Recommendations for preventing household food waste are proposed to local governments and other stakeholders, with direct application to household food security. In urban areas, local governments can strengthen food security primarily through the demand side by promoting “smart consumption” education campaigns that encourage high-income families to purchase only what they need, avoid impulse buying, and effectively manage household food

stocks. Portion guide initiatives such as portion size labeling in restaurants and food delivery services and regulations or incentives for modern retailers to limit “buy more, save more” promotions can help reduce overpurchasing and excess food availability at home, thereby reducing the risk of waste while maintaining stable and adequate food access. In rural areas, food security can

be enhanced by improving access and stability through education on planned shopping, providing basic storage infrastructure (communal cold storage, village silos, shared food warehouses), and integrating food waste reduction interventions into PKK programs and village outreach programs that focus on stock management and post-harvest processing.

Table 4. Significance test results of explanatory variables affecting the food waste index among urban households

Variable	Coefficient	Sig.	T statistic	T table	Information
Income level (X1)	.0016837	0.000***	3.83	1.98	significant
Number of food portions (X2)	-.0027911	0.852	-0.19	1.98	not significant
Household size (X3)	.0253172	0.725	0.35	1.98	not significant
Food procurement (X4)	-.0007702	0.729	-0.35	1.98	not significant
Food processing (X5)	-.2718913	0.000***	-4.24	1.98	significant
Food storage (X6)	.908297	0.000***	8.80	1.98	significant

Note: ***: Significant 1%, **: Significant 5%, *: Significant 10%. Source: Data were processed and analyzed using Stata 17 in 2025

Table 5. Significance test results of explanatory variables affecting the food waste index among rural households

Variable	Coefficient	Sig.	T statistic	T table	Information
Income level (X1)	.000514	0.026**	2.25	1.98	significant
Number of food portions (X2)	-.0001569	0.983	-0.02	1.98	not significant
Household size (X3)	.821355	0.145	1.47	1.98	not significant
Food procurement (X4)	.0473982	0.047**	2.02	1.98	significant
Food processing (X5)	-.0215377	0.535	-0.62	1.98	not significant
Food storage (X6)	.060953	0.004***	2.93	1.98	significant

Note: ***: Significant 1%, **: Significant 5%, *: Significant 10%. Source: Data were processed and analyzed using Stata 17 in 2025

Table 6. Recommended strategies for reducing household food waste based on urban-rural household characteristics

Stakeholder	Household context	Recommended strategies for reducing household food waste
Local government	Urban	“Smart Consumption” education campaigns: educating high-income families to buy only what is necessary, avoid impulsive purchases, and manage household food stocks effectively. Promoting “portion guide” labeling and portion-size awareness campaigns in restaurants and food delivery services. Regulations or incentives for modern retailers to reduce “buy more, save more” promotional practices that encourage over-purchasing.
	Rural	Planned shopping education programs: promoting the use of shopping lists, understanding household preferences, and scheduling purchases. Provision of basic storage infrastructure (e.g., communal cold storage, village silos, or shared food warehouses) to extend the shelf life of harvests. Integration of food waste reduction into PKK programs and village extension activities, with a focus on stock management and post-harvest processing.
Other stakeholders (modern retail, communities, village cooperatives, BUMDes, NGOs, and academics)	Urban	Supermarkets to promote packaging innovations such as smaller-size or portion packs tailored to the needs of urban households. Food processing education programs: workshops or cooking classes focused on balanced portions to prevent over-preparation.
	Rural	Community and university initiatives to develop digital household stock management applications (e.g., reminders for food storage and expiration in refrigerators/freezers). Cooperatives or village-owned enterprises (BUMDes) can provide collective market day services to minimize impulsive shopping and optimize food distribution. NGOs and universities may initiate post-harvest processing training (e.g., drying, fermentation, simple canning) to extend the shelf life of agricultural products. Encouraging the use of food waste for animal feed or compost through simple local technologies (e.g., biopores, drum composters).

In addition to the government, other stakeholders also play an important role in strengthening the link between food waste and food security. In urban areas, modern retailers can support food security by offering smaller packages or portion sizes more suited to household needs, while community groups and universities develop digital tools for household stock management and provide food processing education to prevent excessive and threatening vigilance. In rural areas, cooperatives and Village-Owned Enterprises (BUMDes) can coordinate collective markets and food distribution, NGOs and universities can provide post-harvest processing training (e.g., drying, fermentation, simple canning) to reduce quantitative and qualitative losses, and local initiatives can optimize the use of inevitable food waste as animal feed or compost. Together, these context-specific interventions are expected to reduce food waste, ensure food availability at the household and community levels, and ultimately support more resilient and sustainable food security in both urban and rural areas of East Kalimantan.

In conclusion, the determinants of household food waste differ across urban and rural/peri-urban contexts in East Kalimantan. In urban households, food waste is significantly associated with income level, food processing practices, and food storage, whereas in rural/peri-urban households the significant determinants include income level, food acquisition behavior, and food storage. Importantly, income and food storage emerge as consistent predictors in both settings, indicating that economic capacity and household storage capability are central leverage points for reducing food waste across contexts. These findings support the need for context-specific interventions urban strategies emphasizing consumer education and improved food management practices, and rural/peri-urban strategies emphasizing more efficient food acquisition and strengthened storage and preservation practices so that food waste reduction can contribute to stronger food security outcomes. This study has several methodological limitations that should be considered when interpreting the results. First, the use of purposive (non-random) sampling may limit representativeness and external validity; therefore, the findings should be interpreted as associations within the sampled communities rather than population-wide estimates. Second, key measures rely on self-reported responses, which may be affected by recall error or social desirability bias. Third, the cross-sectional design restricts causal inference and does not capture seasonal or temporal changes in food purchasing, storage, and waste behavior particularly relevant in areas undergoing rapid transformation near the IKN development zone. Future research should address these limitations by: (i) applying probability-based or stratified sampling across multiple Sub-districts to improve generalizability; (ii) incorporating objective or diary-based measures (e.g., short-term waste weighing, food waste logs, or photo-assisted recording) to validate self-reports; (iii) using longitudinal or repeated-survey designs to capture seasonal dynamics and behavioral change over time; and (iv) testing targeted interventions (e.g., storage improvement, meal-planning education, or procurement

optimization) through quasi-experimental or pilot program evaluations to identify the most effective strategies for different contexts in East Kalimantan.

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