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Study of Household Willingness to Pay Waste Retribution Fees at Kapuk Village, Cengkareng, West Jakarta

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Abstract. Kapuk Village faces significant challenges in effective waste management. High population numbers and the lack of waste facilities have resulted in high waste generation and diverse waste compositions. In an effort to overcome this problem, community participation in the form of WTP is very important. WTP in Kapuk Village reflects the extent to which the community is willing to pay to improve waste management services. **Objectives:** Estimate the WTP value, analyze the factors that influence it, and determine the total generation and composition of the waste produced. **Method and Results:** Using a quantitative approach supported by primary data obtained from the results of questionnaires, as well as observations and measurements of waste generation and composition. **Conclusion:** Waste generation for one day per person in Kapuk Village was 0.38 kg and 2.44 L, consisting of 61% food waste, 9% wrappers of food/drinks, snacks, instant and noodles, 3% plastic bags, 2% bottles of mineral water and soda, 1% Styrofoam, 3% cardboard/cartons, 1% tissue, 7% HVS, books, newspapers, and magazines, 2% cloth, and 11% diapers. According to the t-Test results, the factors partially associated with WTP are perception (sig. value = 0.000), attitude (0.001), and knowledge (0.000). These three variables also simultaneously influence the value of WTP, with a sig. value of 0.000. In addition, the WTP for waste retribution fees in Kapuk Village is Rp 20,633/month/family. The budget from the WTP can be used to hold seminars or campaigns, as well as provide additional facilities for waste management.

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1 Introduction

1.1 Background

Kapuk Village has a population of 167,900 people, consisting of 55,258 families [1]. The village is one of the villages in the Cengkareng Sub-District, which is one of the biggest waste producers in West Jakarta [2]. According to statistical data from 2022, West Jakarta has the third smallest number of temporary landfills in Jakarta, with only 198 landfills [3]. The small number of temporary landfills will certainly increase the amount of unserved waste, cause waste to pile up, and pollute the surrounding environment. Not only that, West Jakarta has the second-highest waste generation rate after East Jakarta. In 2021, the waste generation rate was 729,092.61 tons/year, which is an increment from the earlier year's pace of 719,768 tons/year [4]. This data shows that the waste generation rate in West Jakarta is likely to continue to increase along with population growth.

Kapuk Village faces significant challenges in effective waste management due to high population numbers and a lack of waste facilities. This has resulted in high waste generation and diverse waste compositions, which are a major concern for maintaining environmental cleanliness and public health. In an effort to overcome this problem, community participation in the form of Willingness to Pay (WTP) is very important. WTP reflects the extent to which the community is willing to pay to improve waste management services. Individuals' eagerness to pay (WTP) for this village can be impacted by various elements, such as income, perceptions, viewpoints, level of education, and environmental knowledge. Understanding WTP is important for designing sustainable and effective waste management strategies. Information about the value that communities place on improving waste management services assists local governments in allocating resources efficiently and prioritizing efforts that are most relevant to community needs and preferences.

A comprehensive understanding of waste generation and composition is essential for effective waste management planning. By analyzing waste generation patterns and trends, the government can identify the main sources of waste, such as households, the commercial sector, or the industrial sector. Similarly, by knowing the dominant types of waste, such as organic, plastic, paper, metal, or hazardous materials, the government can design appropriate methods and infrastructure for processing and recycling this waste. This information can be used to develop an effective and sustainable waste management system. By understanding the Willingness to Pay (WTP), waste generation, and waste composition in Kapuk Village, the local government can design a waste management program that focuses on community participation, waste reduction, and resource utilization. Collaboration between the government, community, and other stakeholders is essential to creating a clean, healthy, and sustainable environment in Kapuk Village.

2 Method

This study used a quantitative approach, which involves collecting and analyzing numerical data, and also primary data obtained from questionnaires, such as data on perceptions, attitudes, knowledge, and willingness to pay of residents of Kapuk Village, as well as observations and measurements on the composition and generation of waste. In compliance with SNI, waste generation and composition will be sampled and measured for eight days in a row, beginning at 10:30 AM and finishing at 02:30 PM.

2.1 Study Variables

2.1.1 Dependent Variable

The willingness to pay for household waste management in Kapuk Village is the dependent variable in this study. A person's willingness to pay is the maximum quantity of money they are prepared to spend on an item or service [5]. WTP is defined as an individual's willingness to pay for waste retribution fees in the context of waste management. The more diligent the people are in paying the waste retribution fees, the better the waste management system in that place will be.

2.1.2 Independent Variable

1. Perception

   Perception is the process of interpreting sensory impressions to give meaning to the environment. In waste management, community perception can be interpreted as a community's opinion, assessment, or view of waste management activities. The more positive the community's view of waste management, the more successful waste management activities will be in that area [6].

2. Attitude

   Attitude refers to a person's actions or responses to something. The way a person behaves will vary depending on their experience, judgment, and understanding. In waste management, attitude can be interpreted as a person's actions when they see, hear, or feel how waste management activities are running. A better attitude shows that a person has a high level of concern for the environment.

3. Perception

   Knowledge is the understanding of a topic that a person has acquired through experience, education, or research. The greater the community's knowledge or understanding of waste management, the higher their willingness to participate in activities that will improve waste management quality [7].

The study variables will be assessed using a 5-point Likert scale where respondents will be required to evaluate the extent to which they agree with statements related to perceptions, attitudes, knowledge, and willingness to pay for waste disposal fees.

2.2 Population and Sample

The populations in this study are drawn from 55,258 households at Kapuk Village [1]. The sample was taken using purposive sampling technique, which is based on who lived near the study site. The sample size was determined using the Slovin formula, which is written in the following form:

$$n = \frac{N}{1+N(e^2)} \quad (1)$$

N is the entire population, e is the 10% margin of error, and n is the overall sample size [8]. Using the above formula, this study will use a sample of 150 households for the questionnaire and 25 households to calculate waste generation and composition.

2.3 Research Instruments

The following image shows the materials that will be used to calculate waste generation and composition.

(a) (b) (c)

(d) (e) (f)

Fig. 1. (a) scale max. 50 kg (b) ruler (c) gloves (d) masks (e) plastic bags (f) box 25 x 28 x 57 cm

In addition to the above, other instruments were used to support the research, namely questionnaires. The questionnaire was created using a Google form and will be shared online via social media platforms such as WhatsApp, Line, and Instagram, or shared directly. Before distributing the questionnaire to all respondents, validity and reliability tests were conducted to measure whether or not the questionnaire was valid. In this case, the questionnaire will be distributed to the first 20 people as a sample to test its validity and reliability. Validity and reliability testing will use data from the first 20 samples, processed using the Pearson method (Pearson product moment) and Cronbach's alpha [9]. The test will be analyzed using SPSS 16.0, the statistical software for the social sciences. The survey will be given to each responder once more when it has been determined to be valid and reliable.

2.4 Data Analysis

2.4.1 Weight and Volume of Waste

$$\text{Weight of Waste (/person)} = \frac{Average\ Total\ Weight\ (kg)}{Number\ of\ Waste\ Generating\ Units} \quad (2)$$

$$\text{Volume of Waste (/person)} = \frac{Average\ Total\ Volume\ (liter)}{Number\ of\ Waste\ Generating\ Units} \quad (3)$$

Average Total Weight/Volume = Average total waste weight/volume in 8 days from each household

Number of Waste Generating Units = Number of family members

2.4.2 Waste Composition Percentage

$$\%\ \text{Waste Type} = \frac{Weight\ of\ Waste\ (kg)}{Total\ Weight\ of\ Waste\ (kg)}\ \text{x}\ 100\% \quad (4)$$

Weight of Waste = Total weight of each waste composition from 25 households

Total Weight of Waste = Total weight of waste from 25 households

2.4.3 Regression Model

The independent and dependent variables are assumed to have a linear relationship by the regression model. The regression model is obtained using linear regression analysis in SPSS, and can be written like the following:

$$Y = \alpha + \beta_1 X_1 + \beta_2 X_2 + \ldots. + \beta_n X_n + e \quad (5)$$

Y = Dependent Variable

α = Constant

$\beta_1, \beta_2, \beta_n$ = Independent Variable Regression Coefficient

X_1, X_2, X_n = Independent Variable

e = error

Referring to the preceding equation, if Xn increases by one unit, Y will grow by βn units [10].

2.4.4 Classical Assumption Test

To ensure the legitimacy and accuracy of a regression model in predicting the dependent variable, it is imperative to test the classical assumptions after the model has been fitted The following are the classical assumptions that will be tested:

1. Normality Test

   Used to ascertain if the remaining variables in the model of regression have a normal distribution. Plotted data (dots) that conform to a diagonal line are deemed to be regularly distributed in the regression model [11].

2. Multicollinearity Test

   For determining if the independent variables in the model of regression have a high degree of correlation, apply the multicollinearity test. Highly connected independent variables might produce erroneous results

in a regression model, hence it is best to avoid using them in regression models. There doesn't exist multicollinearity among the independent variables if the tolerance value is more than 0.1 and the VIF is smaller than 10.

3. Heteroscedasticity Test

   In order to assess if the variance associated with the residuals in a model of regression is the same for every observation, the heteroscedasticity test is employed. Heteroscedasticity is a flaw in a regression model that can produce unreliable findings. If the plotted data (dots) are evenly distributed around the zero line and do not show any patterns, such as waves or widening and narrowing, then it can be concluded that there is no heteroscedasticity [12].

2.4.5 Multiple Linear Regression Test

Using MLR, one may determine whether independent factors have a meaningful influence on the dependent variable as well as the direction and intensity of those associations. MLR consists of two main tests: F-test and t-test.

1. F-Test (Simultaneous)

   When determining whether each of the independent variables in a regression equation concurrently affects the dependent variable at a significance level of 0.05 (α = 5%), the F-test is utilized. The independent factors do not jointly or concurrently impact the dependent variable if the significance value is greater than 0.05, and vice versa.

2. t-Test (Partial)

   When assessing if an independent variable significantly affects a dependent variable while considering other independent factors, the partial test is utilized. This test also relies on a significance level of 0.05 (α = 5%), and if the value is greater than 0.05, it indicates neither of the variables that are independent impact the variable that is the dependent one [13].

2.4.6 The Coefficient of Determination (CD)

The CD's findings were utilized to calculate the proportion of the dependent variable's fluctuation that may be attributed to the independent variables. The coefficient of determination, which has a range of 0 to 1, indicates how strongly the three different types of variables are related [14].

Table 1. Interpretation of R^2

Coefficient Interval	Correlation
1 – 0.8	Very Strong
0.6 – 0.79	Strong
0.4 – 0.59	Quite Strong
0.2 – 0.39	Weak

0 – 0.19	Very Weak

3 Results and Discussion

3.1 Result of Waste Generation and Composition

3.1.1 Weight and Volume of Waste in Kapuk Village

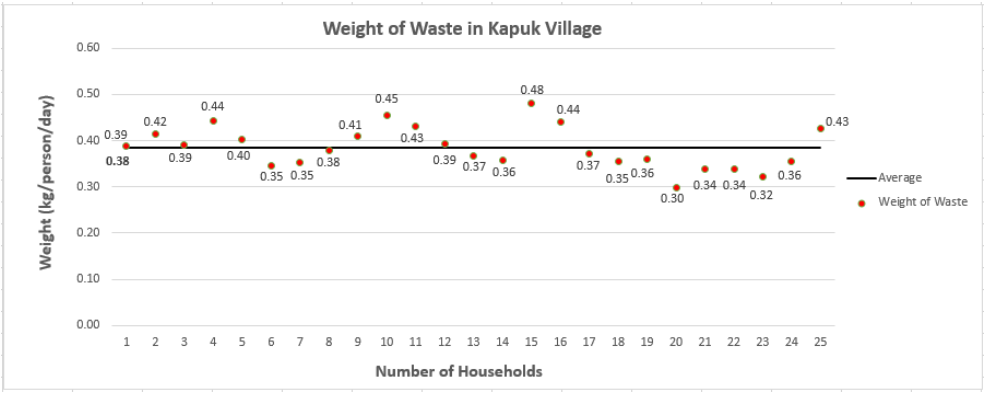

Fig. 2. Weight of Waste in *Kapuk* Village

Kapuk Village's average daily waste weight is 0.38 kg/person, which is in line with SNI-19-3983-1995's waste generation criteria for permanent houses. The allowed range for waste output per person per day in permanent houses is between 0.35 and 0.4 kg/person/day [15].

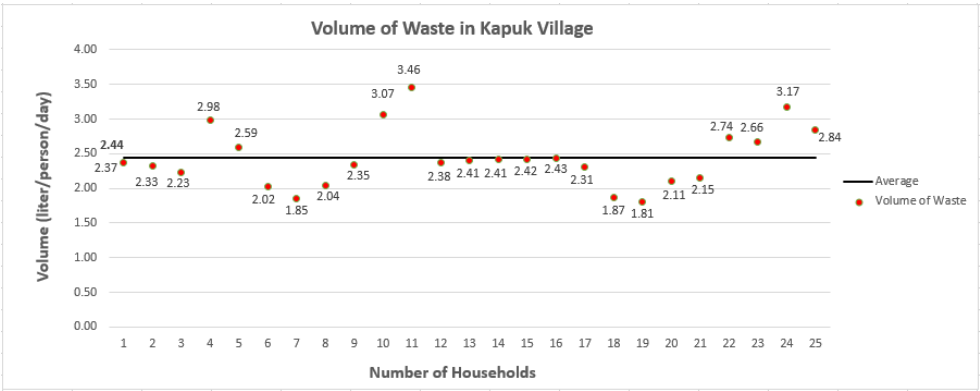

Fig. 3. Volume of Waste in *Kapuk* Village

The average waste volume generated in Kapuk Village stands at 2.44 L/person/day. This figure aligns with the SNI standard for the average daily waste volume produced by individuals, which ranges from 2.25 to 2.5 L/person/day [15].

3.1.2 Composition of Waste in Kapuk Village

Table 2. Total Composition of Waste in Kapuk Village

No.	Composition of Waste	Total Weight (Kg)	Percentage (%)
1	Food waste	223.17	60.74

2	Wrap sachets of food/drinks, snacks, instant noodles, etc.	32.86	8.94
3	Plastic bags	9.73	2.65
4	Bottles of mineral water, soda, etc.	6.75	1.84
5	Styrofoam	3.71	1.01
6	Cardboard/cartons	12.19	3.32
7	Tissue	3.82	1.04
8	Other papers (HVS, books, newspapers, magazines)	25.97	7.07
9	Excess material from clothing, trousers, etc.	6.87	1.87
10	Diapers	42.34	11.52
	Total	367.41	100

The table above provides information about the total waste generated by 25 households in an 8-day period, which amounts to 367.41 kg. Among the different types of waste, food waste is the most significant, making up 60.74% of the total, which is equivalent to 223.17 kg. There were no other types of waste observed during the 8-day research period. The following pie chart shows the breakdown of waste composition percentages in Kapuk Village.

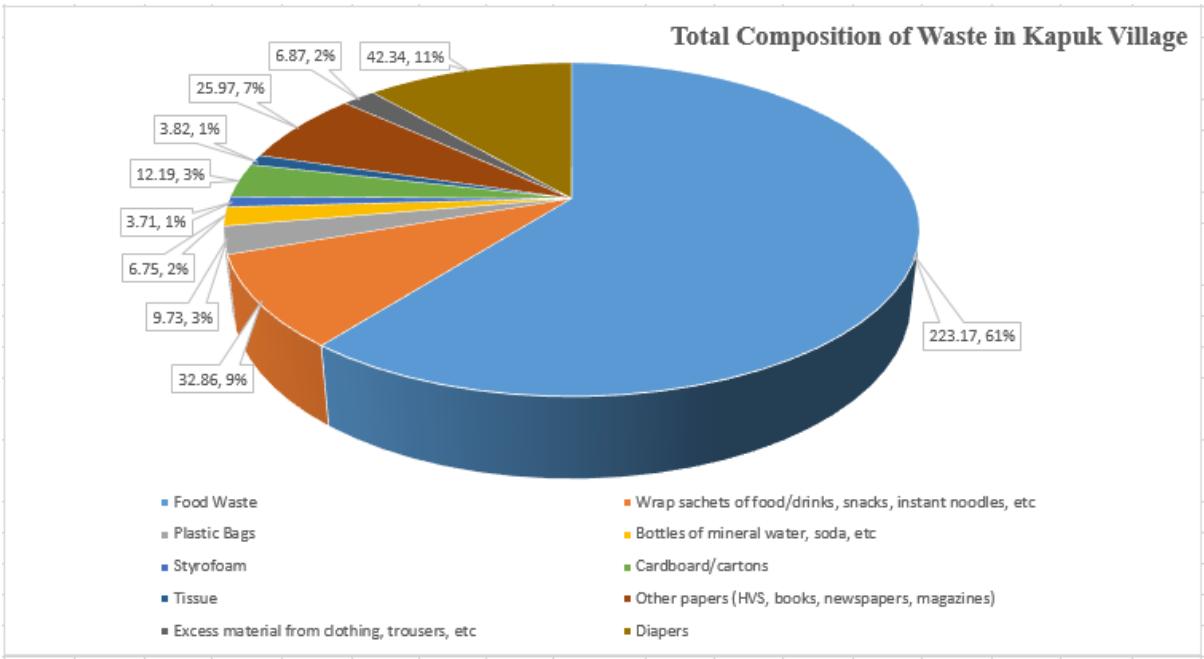

Fig. 4. Total Composition of Waste in *Kapuk* Village

In the pie chart above, the percentages of the ten waste compositions have been rounded to the nearest whole number. Food waste has a percentage of 61%, Wrap sachets of food/drinks, snacks, instant noodles, etc. 9%, Plastic bags 3%, Bottles of mineral water, soda, etc. 2%, Styrofoam 1%, Cardboard/cartons 3%,

Tissue 1%, Other papers (HVS, books, newspapers, magazines) 7%, Excess material from clothing, trousers, etc. 2%, and Diapers 11%.

3.2 Willingness to Pay

3.2.1 Regression Model

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients
		B	Std. Error	Beta
1	(Constant)	3.702	1.074	
	Total_Perception	.396	.058	.420
	Total_Attitude	.147	.041	.217
	Total_Knowledge	.288	.055	.329

a. Dependent Variable: Total_WTP

Fig. 5. Regression Model Result

Based on outcomes from the analysis of multiple linear regression conducted using SPSS as shown above, the following equation, or regression model, is WTP = 3.702 + 0.396P + 0.147A + 0.288K.

3.2.2 Classical Assumption Test

1. Normality Test

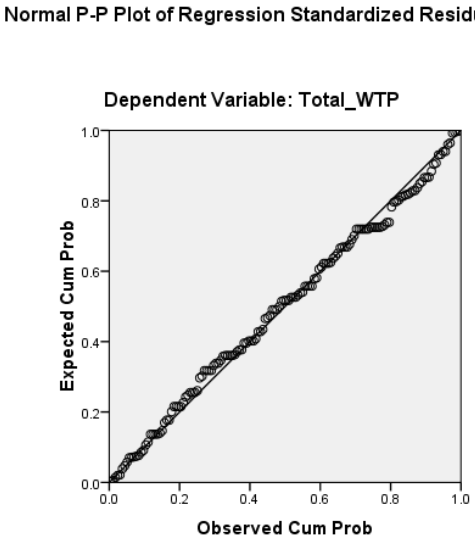

Fig. 6. Normality Test Result

It is clear from the following results that the model of regression has a normal distribution.

2. Multicollinearity Test

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients			Collinearity Statistics	
		B	Std. Error	Beta	t	Sig.	Tolerance	VIF
1	(Constant)	3.702	1.074		3.447	.001		
	Total_Perception	.396	.058	.420	6.844	.000	.581	1.722
	Total_Attitude	.147	.041	.217	3.555	.001	.587	1.702
	Total_Knowledge	.288	.055	.329	5.250	.000	.559	1.790

a. Dependent Variable: Total_WTP

Fig. 7. Multicollinearity Test Result

It is acceptable to conclude that a regression model does not exhibit multicollinearity based on the preceding results.

3. Heteroscedasticity Test

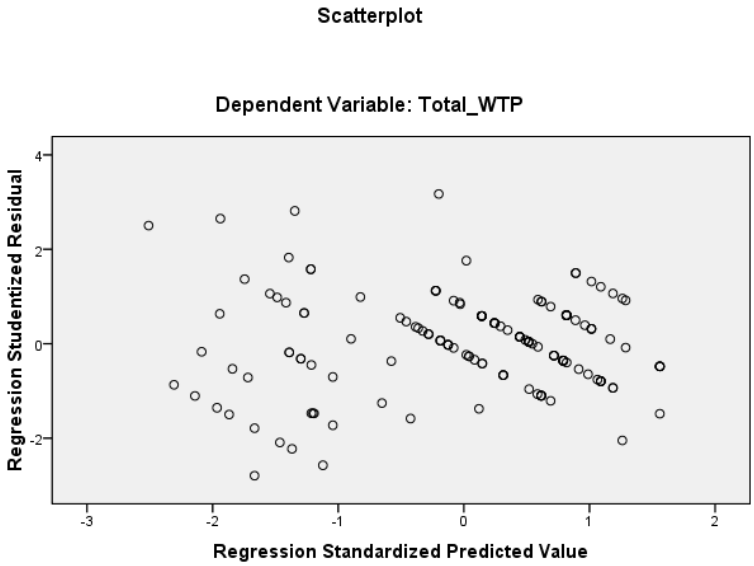

Fig. 1. Heteroscedasticity Test Results

Fig.8. indicates that the model for regression lacks any heteroscedasticity symptoms.

3.2.3 Multiple Regression Linear Test

1. F-Test

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	316.067	3	105.356	103.564	.000[a]
	Residual	148.526	146	1.017		
	Total	464.593	149			

a. Predictors: (Constant), Total_Knowledge, Total_Attitude, Total_Perception

b. Dependent Variable: Total_WTP

Fig. 9. F-Test Results

Based on the table above, it can be concluded that Perception (X1), Attitude (X2), and Knowledge (X3) simultaneously affect Willingness to Pay (Y).

2. t-Test

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	3.702	1.074		3.447	.001		
	Total_Perception	.396	.058	.420	6.844	.000	.581	1.722
	Total_Attitude	.147	.041	.217	3.555	.001	.587	1.702
	Total_Knowledge	.288	.055	.329	5.250	.000	.559	1.790

a. Dependent Variable: Total_WTP

Fig. 10. t-Test Results

It is clear from the following figure that:

- Perception (X1) influences Willingness to Pay (Y)
- Attitude (X2) influences Willingness to Pay (Y)
- Knowledge (X3) influences Willingness to Pay (Y)

3.2.4 The Coefficient of Determination (CD)

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.825[a]	.680	.674	1.00861

a. Predictors: (Constant), Total_Knowledge, Total_Attitude, Total_Perception

b. Dependent Variable: Total_WTP

Fig. 11. CD Test Results

The significant association between the two groups of variables in the model of regression is indicated by **Fig. 11**. with a value of 0.68, or 68%.

3.3 Discussion

3.3.1 Waste Generation and Composition

Several other research findings in Indonesia are consistent with the waste production and composition results in Kapuk Village. As an example, research conducted in Selamat Village with the amount of waste generated per person per day was 0.3 kg and the volume was 2.45 liters [16]. Study in Kedamaian Village, where the most frequent type of waste produced was organic waste, making up 67% of the total waste generated**,** which included vegetable and fruit scraps and food ingredients, and the other waste consisted of 18% plastic waste, 13% waste paper, and 1% cloth and other waste [17].

3.3.2 Willingness to Pay in Kapuk Village

According to the questionnaire result, the WTP of households in Kapuk Village is Rp 20,633/month/family. Therefore, it can be concluded that households in Kapuk Village are willing to pay a waste retribution fee of Rp 20,633/month/family, or rounded up, around Rp 21,000/month/family. This amount is slightly higher than the current fee of Rp 20,000/month/family. This result is consistent with findings from other studies. For example, a study in Cileunyi District, Indonesia, found that the average WTP for waste retribution fees was Rp 20,572, which is higher than the current fee of Rp 10,208 [5]. Similarly, a study in Rajabasa District, Indonesia, found that the average WTP was Rp 23,529, which is higher than the minimum WTP of Rp 20,000 in that district [18].

3.3.3 The Influence of Perception, Attitude, and Knowledge partially toward WTP

Based on the t-test results presented in Fig. 10. regarding the perception, attitude, and knowledge variables, the significance value is less than the predefined alpha value of 5% (0.05), specifically 0.000, 0.001, and 0.000. These findings indicate that the variables of perception, attitude, and knowledge have a partial influence on the WTP. These results align with previous research conducted in Aceh Regency, Indonesia, which observed that public perceptions positively affect how waste is managed and the WTP of waste retribution [19]. Research conducted in Binjai Village, Indonesia, which demonstrated that attitudes and knowledge affect the management of waste and also raise people's WTP [20].

3.3.4 The Influence of Perception, Attitude, and Knowledge Simultaneously toward WTP

Factors like perception, attitude, and knowledge are significant in determining how much someone is prepared to spend when it comes to paying waste retribution costs. The combination of these three variables shapes individual beliefs and intentions to pay waste retribution fees, which in turn can influence community participation and support for effective waste management. A significant result of 0.000 was found based on the F-test results, which is less than the alpha value of 5% (0.05). it can be concluded that the combination of perception, attitude, and knowledge, simultaneously impacts the willingness of households in Kapuk Village to pay waste retribution fees.

4 Conclusions and Recommendations

4.1 Conclusions

1. Kapuk Village generates 0.38 kg and 2.44 L of waste per person for one day, with a composition of 61% food waste, 9% wrappers of food/drinks, snacks, instant noodles, etc., 3% plastic bags, 2% bottles of mineral water, soda, etc., 1% Styrofoam, 3% cardboard/cartons, 1% tissue, 7% other papers (HVS, books, newspapers, magazines), 2% excess material from clothing, trousers, etc., and 11% diapers.
2. There is a relationship between people’s perceptions toward Willingness to Pay in Kapuk Village.
3. There is a relationship between people’s attitudes toward Willingness to Pay in Kapuk Village.
4. There is a relationship between people’s knowledge toward Willingness to Pay in Kapuk Village.
5. The willingness to pay for waste management in Kapuk Village is Rp 20,633/month/family.

4.2 Recommendations

1. Activities or programs can be carried out to raise the level of Kapuk Village's management of waste by utilizing the waste retribution fees from willingness to pay, such as holding seminars, counselling, and providing additional facilities for waste.

2. Organizing seminars or counseling sessions can help to discuss waste management topics, such as waste sorting and the 3Rs, as well as explain to the public the importance of contributing to waste retribution fees.
3. Additional facilities for waste management can include waste containers, general garbage cans, inorganic and organic garbage cans, and transportation for waste collection
4. For further research, increasing the number of samples and adding variables such as income or education can be done to obtain more accurate results.

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