

## RESEARCH ARTICLE



## Behavioral Intention of Domestic Organic Waste Segregation in Urban Communities (Case Study: Depok City, Indonesia)

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### ABSTRACT



Waste management is a significant and widespread issue that challenges many countries, particularly developing countries. Organic waste is a primary contributor to greenhouse gas (GHG) emissions in waste management, making it a crucial problem to address. Proper waste management practices, including decentralized organic waste management, are necessary to address this issue. However, this decentralization requires the support of the community's waste segregation behavior. Therefore, this study was conducted in Sukmajaya and Cilodong Districts to analyze the intention of organic waste sorting behavior utilizing Theory of Planned Behavior (TPB) analysis. The results showed that only two constructs, attitude and perceived behavioral control, positively impacted the intention to sort organic waste. In this study, norm construction does not serve as a supporting construction for the waste sorting intention. Additionally, knowledge of waste sorting programs and activities significantly affects perceived behavioral control.

## Introduction

The increase in global population has a direct impact on the amount of waste generated worldwide. According to the United Nations in 2022 the current world population stands as November 2022 to reach 8 billion, resulting in an annual domestic waste generation of approximately 1.3 billion tonnes [1]. The surge in waste production due to population growth, urbanization, and industrialization poses a significant challenge for developing countries [2]. Despite its significance, the waste management sector has received less attention than it deserves, with several studies pointing out that it is the third-largest contributor to global non-carbon dioxide (non-CO<sub>2</sub>) greenhouse gas (GHG) emissions [3].

Urbanization is primarily centered on Java [4]. According to 2020 census data, Indonesia's population has surpassed 270.20 million, with Java Island having the highest concentration, accounting for 56.10% [5]. As urbanization continues to increase, it poses various challenges, including the fact that over 50% of the world's population resides in urban areas. These activities can have both positive and negative influences on the environment both locally and globally [6].

In 2021, Indonesia generated a total of 30,881,713 tons of waste, of which 64.56%, 15.62%, and 48.95% were managed, handled at the source, and sent to landfill, respectively [7]. The characteristics of waste can vary depending on its geographical location and economic status [8]. Organic waste accounts for the largest percentage of the waste composition, with a projected rate of 54.62% in 2022, consisting of 41.45% food waste and 13.17% wood or twigs. This trend was also observed in Depok City, which has a similar percentage of organic waste at 63.52%, composed of 62.95% food waste and 0.57% wood or twigs [9]. The high percentage of organic waste generated is of great concern in developing countries because it contributes significantly to GHG emissions [10].

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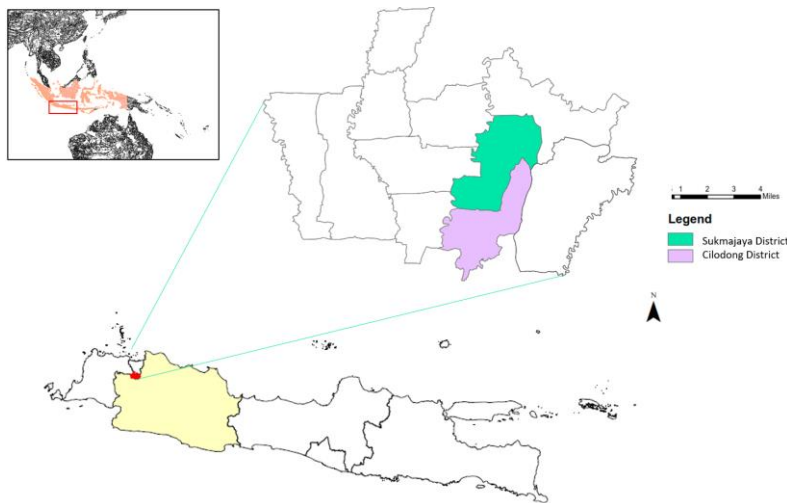
Active participation from the community, government, and other stakeholders is critical to the success of waste management initiatives [11–12]. Sustainable waste management practices can satisfy environmental, economic, and social aspects [13]. The importance of segregating inorganic and organic wastes as an effective method for achieving sustainable waste management at the community level [14]. Decentralized or regional-scale governance produces policies that are closer and more accountable to the local community [15]. This decentralization is a favorable approach to waste management, as shown by Depok City’s program called “Partai Ember.” The program involves communal collection of organic waste from residents’ homes and its transport to composting facilities for processing [16]. In domestic waste management, household behavior plays an essential role in supporting recycling programs and reducing waste generation [17]. Therefore, this study aimed to investigate the intention of households to sort organic waste in Depok City, specifically in the Cilodong and Sukmajaya Districts. This study proposes the following four hypotheses:

- H1: Attitude positively influences sorting behavior.
- H2: Subjective norms play a significant role in sorting behavior.
- H3: Perceived behavioral control positively influences sorting behavior.
- H4: Knowledge has a significant relationship with perceived behavioral control.

## Method

### Study Area

In the Sukmajaya District, there are two composting facilities, Hanggar Merdeka 1 and 2. Both composting facilities treated waste from two districts: Sukmajaya and Cilodong. Therefore, this study collected data from residents living in areas served by these composting facilities. Data were collected between February and March 2023. Location of the study area can be seen in figure 1.



**Figure 1.** Research location.

### Data Collection Method

This study utilized a quantitative approach and methods. This study involved 100 respondents who met the criteria of residing in either Sukmajaya or Cilodong District, whether they are served or not with organic waste transportation and living in a household with at least two people. Determination of the number of respondents is determined through a formula based on the slovin formula. Based on this formula, the number of respondents was 100 people. The details of the calculation are as follows:

$$n = \frac{N}{1 + Ne^2} \tag{1}$$

$$n = \frac{426,360}{1 + 4,263.6} \tag{2}$$

$$n = 100 \tag{3}$$

Where: n = Number of samples; N = Total population; e = Error tolerance (level).

The total population was obtained from the percentage of the population of Sukmajaya District and Cilodong District, and the population of these sub-districts in 2022 is 253,810 people and 172,550 people, respectively. The selected error limit is set to 10%. Data were collected using an online questionnaire distributed via social media or message applications by community leaders or members. The online questionnaire was not in physical form, but the respondent was given a link to fill out the question. Community leaders or members help spread the link on message applications or other social media platforms.

### Data Analysis

Sorting behavior plays an important role in supporting domestic waste management. The behavior itself is formed by the intention of sorting behavior. In this study, Theory of Planned Behavior (TPB) analysis was used to analyze the behavioral intention of sorting organic waste. Intention is formed from several constructs, namely, attitudes, subjective norms, and perceived behavioral control. In addition to construction, knowledge construction has been added as an aspect of influence on perceived behavioral control.

The prepared questions were subjected to a reliability test using Cronbach's alpha for each construct. The questionnaire was considered reliable or consistent when the Cronbach's alpha value was > 0.60. Conversely, when the alpha value was below this threshold, the questionnaire was considered unreliable. A validity test tends to be carried out to ensure whether the questionnaire is valid. This test can be conducted using a Bivariate Pearson correlation and can also be processed using the SPSS program. To carry out reliability and validity tests, 40 test samples were taken. A discriminant validity test was carried out using the Fornell-Lacker's criterion.

To ensure the reproducibility of this study, it is necessary to provide detailed information on the methods used to address the issues highlighted. This included specifying the study location and time, describing the population and sample, identifying the variables, and detailing the data-collection process. To achieve this, a clear and concise outline of the basic procedures employed in the study was provided. This included the selection of respondents, as well as the observational and analytical methods. The variables examined were knowledge (KNW), attitude (ATTD), subjective norm (SN), perceived behavioral control (PBC), and intention (INT). Research analysis framework can be seen in figure 2 below.

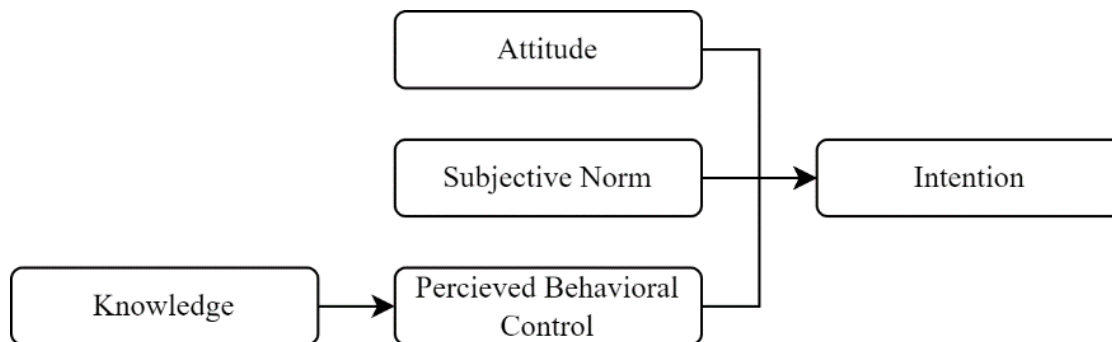


Figure 2. Research analysis framework.

## Result and Discussion

### Respondent Profile

In this study, the respondents who participated exhibited a significant level of diversity across various demographic factors, including age, gender, income, and education. It is essential to clarify that these profiles were not utilized as inclusion criteria but rather as a means of providing a comprehensive portrayal of the respondent population. The following are the profiles of the respondents who completed the questionnaire can be seen in Table 1.

Based on the collected data, 42% of the respondents used compost houses. Most participants fell within the age range of 20 to 30 years, followed by those aged 40 to 50 years, 30 to 40 years, more than 50 years, and less than 20 years. In terms of gender, the respondents were predominantly women, comprising 78% of the sample, while men accounted for 22%. The highest income for respondents fell within the IDR 5,000,000 to 10,000,000 range. Furthermore, most (89%) had tertiary education. In this study, we did not examine the relationship between the respondent's profiles and behavioral intentions.

**Table 1.** Respondent profile.

Questions		Number of respondents	Percentage (%)
Served by compost house	Yes	42	42
	No	58	58
Ages	< 20 years old	1	1
	20 – 30 years old	41	41
	30 – 40 years old	21	21
	40 – 50 years old	23	23
	> 50 years old	14	14
Gender	Women	78	78
	Men	22	22
Salary	< IDR 1.000.000	26	26
	IDR 1.000.000 – 5.000.000	22	22
	IDR 5.000.000 – 10.000.000	28	28
	IDR 10.000.000 – 20.000.000	14	14
	> IDR 20.000.000	10	10
Education	Elementary/Junior High School	0	0
	Senior High/Vocational School	11	11
	Diploma/Bachelor/Master/Doctor	89	89

## Result

To assess the validity, a review of the Critical Value Table was conducted. When examining the validity of a questionnaire, which variable can be seen in Table 2 with 40 samples, the Pearson correlation coefficient value for each variable must be greater than 0.312 to be considered valid. A reliability test on Table 3 was conducted using Cronbach's alpha (CA), and all the variables were scored above 0.6. According to Hair et al. [18], CA values greater than 0.6 were required to ensure the reliability of the questionnaire results. This shows that the results obtained were reliable. The questionnaire results were considered valid because all validity tests exceeded the threshold of 0.312. Distribution of research variable scores can be seen in Table 4.

**Table 2.** Variable from TPB theory and questionnaire items.

Knowledge	
KNW <sub>1</sub>	I know that Depok City has an organic waste segregation program
KNW <sub>2</sub>	I know that a special trash can is provided to accommodate organic waste
KNW <sub>3</sub>	I know the types of organic waste that can be disposed of in the trash
KNW <sub>4</sub>	I know the purpose of sorting organic waste
KNW <sub>5</sub>	I know the bad effects of unmanaged organic waste
KNW <sub>6</sub>	I know that organic waste can contribute to greenhouse gas (GHG) emissions, which can trigger global warming
Attitude	
ATTD <sub>1</sub>	I generate organic waste every day
ATTD <sub>2</sub>	I throw organic waste into the trash (not buried in the ground)
ATTD <sub>3</sub>	I throw organic waste into a special organic waste bin
ATTD <sub>4</sub>	When I throw garbage in the organic trash, it will avoid environmental pollution
Subjective Norms	
SN <sub>1</sub>	Disposing of trash in its place is a common view or attitude where I live
SN <sub>2</sub>	If I throw organic waste in the regular trash, I am afraid my neighbors will scold me
SN <sub>3</sub>	I dispose of organic waste in a special organic waste bin because I do not want to look different from my neighbors
SN <sub>4</sub>	I throw my organic waste in the special trash because my role models do the same
SN <sub>5</sub>	My family or people who live with me dispose of organic waste in a special organic waste bin
Perceived Behavioral Control	

PBC <sub>1</sub>	Sorting organic waste is not difficult for me
PBC <sub>2</sub>	My house has a special (temporary) organic bin, before being dumped into the organic bin provided by the composting house
PBC <sub>3</sub>	I am willing to set up a special (temporary) organic bin, before throwing it into the organic bin provided by the compost house
PBC <sub>4</sub>	Disposing of organic waste in a special place for organic waste does not take much time
PBC <sub>5</sub>	My household and I remind each other to dispose of organic waste in the organic waste bin
PBC <sub>6</sub>	My concern for the environment encourages me to dispose of organic waste in a special organic waste bin
Intention	
INT <sub>1</sub>	I want to sort organic waste
INT <sub>2</sub>	I want to provide a special trash can temporarily at home
INT <sub>3</sub>	I want to throw garbage in the organic waste bin

**Table 3.** Reliability and validity test results.

Variable	Reliability test	Validity test
Knowledge	0.7980	0.413 – 0.806
Attitude	0.6900	0.706 – 0.759
Subjective norm	0.7580	0.341 – 0.854
Perceived behavioral control	0.8860	0.811 – 0.911
Intention	0.8840	0.895 – 0.940

**Table 4.** Distribution of research variable scores.

Variable	Mean	SD	Min	Max
Knowledge	3.69	1.01	1.00	5.00
Attitude	3.94	0.84	1.00	5.00
Subjective norm	2.95	0.91	1.00	5.00
Perceived behavioral control	3.60	1.10	1.00	5.00
Intention	4.20	0.95	1.00	5.00

Based on the collected data, it can be observed that the existing variables with average values from low to high are the subjective norm, perceived control behavior, knowledge, attitude, and intention. The average range for these variables falls between 2.95 and 4.2, with standard deviations ranging from 0.84 to 1.10. These data suggest that the overall average value for each variable is quite good, with values mostly above 3, except for the subjective norm which has an average value of 2.95.

To evaluate the internal consistency and reliability of the variables, both Composite Reliability (CR) and Average Variance Extracted (AVE) were calculated (Table 5). The CR measures internal consistency reliability and ranges from 0 to 1, with values between 0.7 to 0.9, which is considered acceptable. AVE measures the latent variance captured by each variable, and a value above 0.5 is considered desirable [19–20]. The AVE value was squared to determine the diagonal value of the Fornell-Lacker's criterion.

**Table 5.** Assessment of convergence validity.

Latent Variable	$\lambda$	$\lambda^2$	$\epsilon$	CR	AVE
KNW <sub>1</sub>	0.721	0.521	0.479		
KNW <sub>2</sub>	0.861	0.742	0.258		
KNW <sub>3</sub>	0.820	0.673	0.327		
KNW <sub>4</sub>	0.607	0.369	0.631	0.907	0.586
KNW <sub>5</sub>	0.621	0.385	0.615		
KNW <sub>6</sub>	0.839	0.704	0.296		
KNW <sub>7</sub>	0.841	0.707	0.293		
ATTD <sub>1</sub>	0.650	0.422	0.578	0.751	0.431

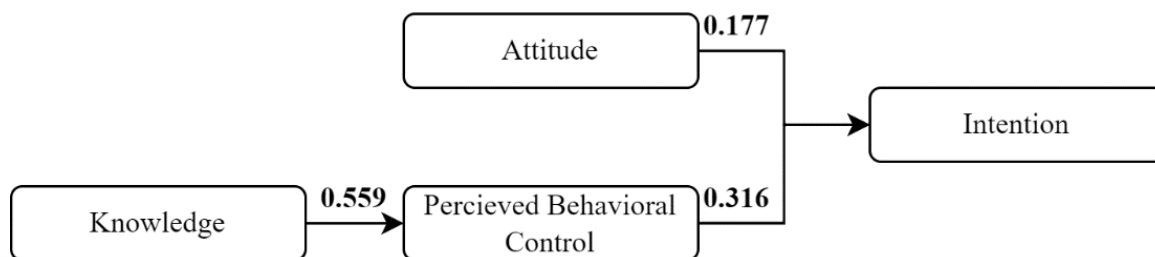
Latent Variable	$\lambda$	$\lambda^2$	$\epsilon$	CR	AVE
ATTD <sub>2</sub>	0.673	0.453	0.547		
ATTD <sub>3</sub>	0.591	0.350	0.650		
ATTD <sub>4</sub>	0.705	0.497	0.503		
SN <sub>1</sub>	0.655	0.430	0.570		
SN <sub>2</sub>	0.737	0.543	0.457		
SN <sub>3</sub>	0.855	0.731	0.269	0.867	0.568
SN <sub>4</sub>	0.811	0.658	0.342		
SN <sub>5</sub>	0.692	0.479	0.521		
PBC <sub>1</sub>	0.740	0.548	0.452		
PBC <sub>2</sub>	0.691	0.477	0.523		
PBC <sub>3</sub>	0.771	0.595	0.405		
PBC <sub>4</sub>	0.758	0.575	0.425	0.889	0.573
PBC <sub>5</sub>	0.772	0.595	0.405		
PBC <sub>6</sub>	0.806	0.650	0.350		
INT <sub>1</sub>	0.695	0.482	0.518		
INT <sub>2</sub>	0.823	0.678	0.322	0.825	0.613
INT <sub>3</sub>	0.824	0.679	0.321		

The Fornell-Lacker's method for path coefficient analysis is widely used to evaluate the construct validity of measurement models. The diagonal variable must be greater than the others [21]. The analysis showed that the AVE square root value of perceived behavioral control over intention was smaller than the other variables, which raises concerns. This is because of other factors that affect the relationship between the two variables. Therefore, it is difficult to confirm whether the hypothesis results are genuine or are caused by statistical differences. The Fornell-Lacker's result can be seen in Table 6.

**Table 6.** Fornell-Lacker's criteria.

	KNW	ATTD	SN	PBC	INT
KNW	0.765				
ATTD	0.563	0.656			
SN	0.470	0.458	0.754		
PBC	0.560	0.570	0.644	0.757	
INT	0.485	0.608	0.523	0.826	0.783

Figure 3 shows the path analysis, which is a method used to determine the significance of causal relationships among a set of variables [22]. The results indicate that knowledge has a significant influence on perceived behavioral control, with a path coefficient of 0.559. Furthermore, the relationship between attitude and intention is 0.177, and that of perceived behavioral control and intention is 0.316. Table 7 shows the path coefficient and a p-value less than 0.05, indicating a significant impact on the hypothesis. The relationship between subjective norms and intention is not significant, leading to the rejection of the hypothesis. However, the other hypotheses were accepted.



**Figure 3.** Path analysis.

**Table 7.** Path coefficient.

	$\beta$	<i>t-value</i>	<i>p-value</i>	Hypothesis test result
ATTD → INT	0.177	3.109	0.002	H <sub>1</sub> : Supported
SN → INT	-0.030	-0.664	0.508	H <sub>2</sub> : Rejected
PBC → INT	0.316	9.409	0.000	H <sub>3</sub> : Supported
KNW → PCB	0.559	6.671	0.000	H <sub>4</sub> : Supported

## Discussion

The results showed that constructs such as attitude, perceived behavioral control, and knowledge are significant factors in shaping the intention to sort organic waste. Based on the analysis, perceived behavioral control emerged as the strongest predictor of intention, followed by attitude, which is in line with the findings of previous studies. It was also discovered that individuals with a high level of perceived behavioral control were better equipped to identify waste management needs and increase their potential to engage in desired behavior [23].

In terms of the construction of attitudes, there were noticeable differences among respondents based on their attitudes toward sorting organic waste. Some respondents expressed skepticism regarding the effectiveness of sorting programs, believing that their sorted waste would ultimately be mixed by the waste transport operator. Despite this, the overall results indicated that attitudes toward sorting organic waste were quite high. This was consistent towards other research, who noted the importance of attitude in influencing waste-sorting intentions [24].

During the review of the study, it was observed that knowledge had a positive influence on perceived behavioral control. This suggests that having knowledge about waste sorting can lead to an increase in perceived behavioral control and ultimately influence waste sorting intention [19]. Furthermore, [25] showed that the availability of time and energy plays a role in shaping the intention to sort organic waste.

Path analysis showed that subjective norms did not have a significant effect on the intention to sort organic waste. This is consistent with the results of previous studies, such as those by [19]. The weak influence of subjective norms could be attributed to the focus of the questionnaire on instrumental attitudes, with only a few questions related to experiential attitudes. Wan et al. [26] investigated the effects of instrumental attitude, subjective norm, and experimental attitude on recycling intention. The results showed that experimental attitude positively affected recycling intention, whereas instrumental attitude negatively influenced sorting intention.

In the questionnaire, respondents expressed their aspirations regarding the compost house program, with many expecting more extensive outreach and education regarding the benefits of the program and its technical implementation. These findings are in line [26], who suggested that providing information about the program could be effective in increasing sorting intention, specifically when the subjective norm is low. Additionally, some respondents expressed a desire for the distribution of composted fertilizers to residents, highlighting the need for maximal socialization related to this program. The results also show a lack of communal trash bins, suggesting an increase in their provision. This would enable residents to combine their disposal time with waste management, thereby promoting the sorting of organic wastes. Respondents showed enthusiasm and intention to sort organic waste but emphasized the need for improved socialization and the provision of facilities to increase participation. These findings were consistent with [27] who highlighted the importance of socialization and education, and with [28], who emphasized the need for facilities.

## Conclusion

In conclusion, according to the TPB, three main constructs contribute to behavior formation. Of the four hypotheses presented in this study, only three are accepted. Therefore, the results indicate that subjective norms had no significant effect on the intention to sort organic waste. The constructs that shaped the intention to sort organic waste included attitude and perceived behavioral control, while knowledge positively influenced perceived behavioral control. It was suggested that the weak influence of subjective norms on intentions could be due to the instrumental nature of the attitudes studied. To promote groups with low subjective norms, it is recommended to provide education and socialization related to organic waste

segregation programs. Additionally, the community expressed the need for support facilities for sorting, such as buckets or communal organic waste bins.

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