

Impact of Waste Picker and Recycling Applications as Dimension of Perceived Behavioural Control on Recycling Intention

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Abstract

Separating household waste is a crucial step in the recycling process that relies on personal motivation. Enhancing recycling intentions is particularly important in underdeveloped nations where the role of waste pickers significantly influences the separation efforts. A relevant area for study is the availability of recycling applications which can support and simplify waste separation efforts. The presence of waste pickers and the availability of recycling applications should be considered critical factors when assessing Perceived Behavioural Control (PBC), along with factors such as infrastructure availability and recycling costs. These factors are integrated into the extended Theory of Planned Behavior (TPB) model which includes key components such as attitude toward recycling, subjective and moral norms, PBC, as well as economic incentives. Therefore, this study aimed to show that PBC functioned as a second-order variable influencing the intention to recycle. Data were collected from 122 respondents in the Greater Jakarta area of Indonesia and analyzed using Partial Least Squares Structural Equation Modelling (PLS-SEM). The results showed that moral norms and attitudes toward recycling were the primary motivators for households to engage in waste management and recycling. However, PBC tended to discourage recycling intentions due to variables such as waste pickers, recycling applications, costs, and infrastructure availability. These results suggested that policymakers should reconsider the role of waste pickers in fostering citizen's ability to develop recycling habits. Further publications were recommended to explore additional factors such as public perceptions of government enforcement and the effectiveness of industry and appeals to better understand recycling and waste management practices in Indonesia.

Keywords: household, perceived behaviour control, recycling, waste management

1. Introduction

Waste is a major contributor to the environmental problems of Indonesia. Household waste needs to be separated into categories such as organic, plastic, metal, glass, and paper to support the recycling process. In other words, waste separation is a crucial stage in the recycling process. However, a significant challenge to effective recycling in Indonesia is the limited participation of households in waste segregation. The Indonesian government has enacted legislation to address waste and environmental management including Law Number 18 (2008) for waste management and Law Number 32 (2009) for environmental protection. Both regulations outline how citizens should manage waste to ensure environmental sustainability. The laws further emphasize the collective responsibility of individuals to engage actively in waste management and environmental protection.

Ideally, waste separation should include active participation from all individuals. In Indonesia, waste segregation is predominantly handled by informal labourers, particularly waste pickers and garbage collectors rather than individual households. Neighbourhoods also hire these workers who are paid collectively by the residents. When neighbourhood management does not show a readiness to commence this practice, individual households often take the initiative to hire waste pickers. Although some households may engage in waste separation, others also depend on pickers to transfer recyclable materials to the final phases of waste management. Problems frequently arise when waste pickers do not follow a fixed schedule, raising the question of whether increased awareness of garbage collectors in local areas could stimulate household participation in recycling. This situation has led to the development of platforms and applications such as Mallsampah Recycling Network and eRecycle which streamline recycling efforts by offering convenient waste collection services at individuals homes.

Zaikova et al. (2022) found that individual's intentions significantly influence waste separation behaviour. This

suggests that reliance on waste pickers for waste separation is influenced by recycling intentions. As a developing nation, Indonesia has not established a widespread culture of waste sorting. The situation worsens as individuals often dispose of waste carelessly, and many remain unaware of recycling applications that could facilitate the efforts.

Previous publications on recycling intention have often overlooked the impact of waste pickers and the applications both as independent variables and as potential moderators or mediators, particularly in studies using the Theory of Planned Behaviour (TPB). This study addresses that gap by incorporating and investigating these aspects as second-order variables within Perceived Behavioural Control (PBC). Concori et al. (2022) further showed that the TPB model was widely used to analyze behaviour in studies related to recycling and waste management. However, previous publications showed that the explanatory factors within the TPB model were insufficient in accurately predicting recycling behaviour in specific nations. For example, Soomro et al. (2022) expanded the TPB model by including moral norms as a factor influencing subjective norms, and convenience as elements affecting PBC. Similarly, Juliana et al. (2022) and Kalil et al. (2022) incorporated moral or personal norms as an explanatory variable into the TPB model. Zaikova et al. (2022) used Economic Incentives as an additional explanatory variable in the expanded TPB model.

This study incorporates environmental awareness as a factor influencing attitudes towards recycling, alongside the direct impacts of moral standards and economic incentives into the conventional TPB model to better explain recycling intentions. Additionally, the analysis expands PBC by including the availability of waste pickers, recycling applications, infrastructure, and the cost as secondary variables. The study aimed to evaluate the role of waste pickers and recycling applications in shaping households' recycling intentions which is a topic that has not been explored in previous publications, particularly in the Indonesian context. Since PBC evaluates an individual's perceived ability to act, investigating the role of waste pickers and recycling applications will help identify the barriers to recycling behaviour.

2. Literature Review

2.1 Theory of Planned Behaviour (TPB)

Concori et al. (2022) found that TPB was a widely recognized method in numerous studies related to recycling, sustainability, and environmental issues across various nations. It was shown to be a strong model for studying recycling behaviour. This model used psychological methods to predict individuals' conduct and was considered highly effective in explaining the internal motivations that influenced an individual's behavioural intentions in recycling. According to TPB, individuals were inclined to engage in specific activities when intended to perform the activity which was influenced by several factors including.

2.1.1 Attitude Towards Recycling

Khalil et al. (2017) defined attitude as a general evaluation of the individual perception of the gains and losses that could result from performing a specific action or activity. Borrello et al. (2020) offered a different definition, describing attitude as a belief held by an individual about a specific activity. Additionally, Juliana et al. (2022) and Zaikova et al. (2022) explained that attitude toward a behaviour was based on how positive or negative an individual's opinion was regarding a specific activity within a given context. In summary, the attitude was established through a series of procedures where the individual weighed the potential gains expected from an action against the potential losses. This evaluation shaped the beliefs and opinions about the activity as the more favourable the perceived gains compared to the losses, the more positive the individual's attitude would be toward the action. In the context of recycling, attitude toward recycling was viewed as a belief that the activities would have a positive impact on the environment.

2.1.2 Subjective Norms

Khalil et al. (2017) defined subjective norms as an individual's perception of social pressure which could be influenced by significant leaders in the environment to perform a particular action. Zaikova et al. (2022) similarly described subjective norms as an individual's perception of social pressure compelling or motivating the individual to engage in a specific behaviour. This correlated with Juliana et al. (2022) who defined subjective norms as an individual's understanding of the social elements in the community and the willingness to face the consequences of social pressure when not conforming. Therefore, individuals typically behave according to the prevailing social norms. Regarding household recycling, it was observed that individuals could experience social pressure from neighbours when the residents failed to manage the waste properly as improper disposal could lead to pollution affecting the entire neighbourhood. The decision to recycle was influenced by social pressure, particularly when the neighbourhood leader insisted on a specific course of action.

2.1.3 Perceived Behavioural Control (PBC)

Khalil et al. (2017) defined PBC as an individual's perception of the ability to carry out a particular action or task. According to Juliana et al. (2022) and Zaikova et al. (2022), PBC referred to an individual's perception of the level of difficulty associated with performing a certain task. Although both studies shared a common perspective on PBC, the methods differed in terms of methodology. Juliana et al. included the convenience of available recycling infrastructure and the cost of recycling, emphasizing individual awareness and ability to access recycling facilities, as well as the capacity to allocate time and space for waste sorting. In contrast, Zaikova et al. (2022) excluded the convenience aspect from the consideration of PBC.

In this study, PBC was defined as the level of convenience derived from the availability of recycling facilities and the corresponding cost as described by Juliana et al. (2022). The development of recycling infrastructure comprised not only physical facilities but also the existence of waste pickers engaged in the recycling procedure. In the Indonesian context, Sembiring et al. (2010) defined waste pickers or scavengers as individuals engaged in the recycling of solid waste and classified as part of the informal sector. The recycling process included the segregation of waste by type which was a task ideally performed by the households. The publication categorized waste pickers into groups including street waste pickers, temporary storage site scavengers, and landfill site scavengers. This study argued that trash transportation services, typically provided by communities rather than local governments could also be classified as waste pickers. Furthermore, the evolution of recycling applications contributed to increased convenience. Borello et al. (2020) stated that consumer convenience referred to the perception of how easily technology, platforms, or applications could be used to accomplish specific tasks.

2.2 *Extended TPB*

Previous publications incorporated several additional factors into the extended TPB model to predict recycling intentions or behaviours which included the following.

2.2.1 Moral Norms

Moral and subjective norms exhibited distinct differences in the origins. Subjective norms were influenced by external social factors while moral norms originated from within the individual. Khalil et al. (2017) and Juliana et al. (2022) both perceived moral norms as moral obligations or personal duties to perform specific actions. Adhering to moral norms could elicit a sense of pride while a lack of adherence would lead to guilt or discomfort.

2.2.2 Environmental Awareness

Environmental knowledge referred to an individual's understanding and awareness of environmental challenges as well as the knowledge of strategies and concepts to address the issues. Dewi et al. (2022) examined the knowledge component of individuals regarding circular economy activities and the comprehension of the economic and environmental consequences of the implementation. Szilagyi et al. (2022) further emphasized that the primary environmental concern included both the individual's awareness and contribution to addressing environmental problems. Although these concepts could appear to be connected, recognizing that the ideas should be perceived as distinct entities. This was because an individual who possessed a strong concern for the environment did not necessarily have a comprehensive understanding of sustainable concepts. Additionally, Juliana et al. (2022) combined environmental knowledge and concern into a single construct called environmental awareness. This concept comprised not only information and concern but also comprehension of environmental challenges, the identification of solutions, and the implementation of essential measures to improve environmental quality.

2.2.3 Economic Incentives

Zaikova et al. (2022) included economic incentives as factors influencing individuals' intention to engage in recycling and waste management. This factor assumed that individuals would be more willing to recycle when received material benefits such as payments for returning products to recycling hubs or discounts from waste collection services for sorting recyclable and non-recyclable waste.

2.3 *Hypothesis Development*

This study extended the TPB model by adding the environmental awareness factor as an antecedent of attitude, moral norms, and economic incentives while subjective norms remained unchanged. However, PBC was treated as a second-order variable with the availability of waste pickers, the convenience of recycling applications, infrastructure availability, and the cost (Juliana et al., 2022) as first-order variables. The PBC construct was further modelled in a reflective-reflective model.

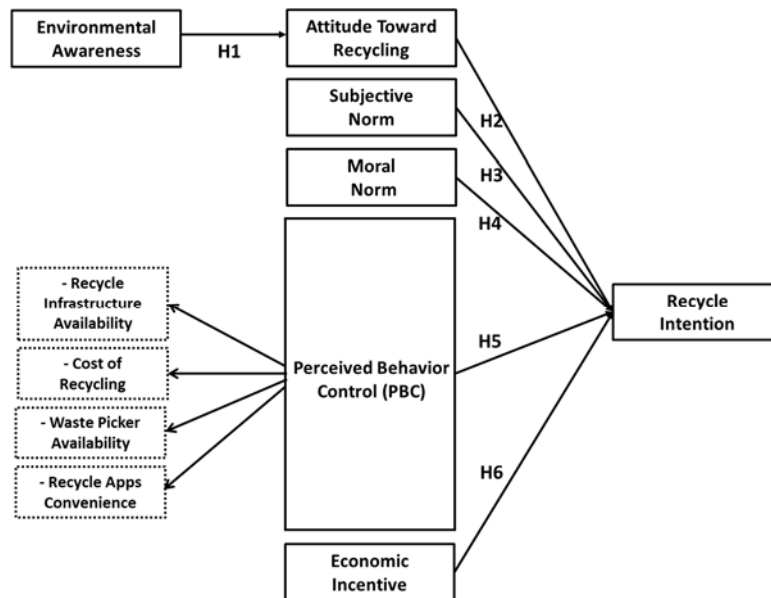


Figure 1. Theoretical framework

Juliana et al. (2022) further identified a direct relationship and statistically significant impact between environmental awareness and attitude toward recycling. Dewi et al. (2022) in the study on circular consumer behaviour found a strong positive correlation and significant impact between circular knowledge, a component of awareness, and circular attitude. The study showed that consumers who were more familiar with the circular concept exhibited a more positive attitude. Therefore, hypothesis 1 could be derived from the given information as follows.

H1: Environmental Awareness had a positive effect on Attitude Towards Recycling.

Khalil et al. (2017) found significant positive associations among the four dependent variables in the TPB model namely attitude, subjective norms, PBC, and personal norms. The publications also showed that these factors predicted 52% of the intention to recycle. Zaikova et al. (2022) discovered that in Russia both attitude and subjective norms had a substantial and beneficial impact on waste management intention while in Finland, only attitude showed a significant and positive effect. Zheng et al. (2020) also found that attitude, subjective norms, and PBC had significant impacts on the intention to engage in garbage sorting. Furthermore, Juliana et al. (2022) stated that although intention was not considered a mediating variable, subjective norms, moral/personal norms, recycling costs, and infrastructure availability (components of PBC) all showed significant positive correlations with recycling behaviour, and attitude did not. Despite the mixed results in previous studies, the following hypotheses were proposed:

H2: Attitude Towards Recycling had a positive effect on Recycling Intentions.

H3: Subjective Norms had a positive effect on Recycling Intentions.

H4: Moral Norms had a positive effect on Recycling Intentions.

H5: Perceived Behavioural Control had a positive effect on Recycling Intentions.

As PBC was treated as a second-order variable, this study introduced a reflective model for the first-order variable. The inclusion of recycling applications could potentially strengthen the positive influence of PBC on recycling intention. Liu et al. (2022) found that the perceived usefulness of smart recycling significantly impacted individuals' intention to use the technologies. Similarly, De Wildt et al. (2023) showed that perceived usefulness had a significant positive effect on the intention to use applications. Although neither study used TPB as the underlying model, and both focused on smart recycling applications, the concept remained relevant for this study. However, the effect of waste picker availability on the relationship between PBC and recycling intention remained unclear. Hayami et al. (2007) further observed that waste pickers contributed to the cost-saving efforts of the city government by reducing waste disposal expenses. However, the informal role in Indonesia could lead to a lack of participation from the public and society in recycling activities including waste separation.

Zaikova et al. (2022) found that economic incentives had no substantial impact on waste management intention in both Russia and Finland. However, there was a slight positive connection between the two variables. Some respondents confirmed that having a motivation to assist waste management was important. Based on this background, the hypothesis was determined as follows.

H6: Economic Incentives had a positive effect on Recycling Intentions.

3. Method

3.1 Operationalization of Variables

The measurement items for each variable were adapted from several sources. Recycling Intentions (RI) consisted of six items sourced from Zaikova et al. (2022), Hameed et al. (2021), and Zheng et al. (2020). Environmental Awareness (EA) comprised seven items as referred to by Szilagyi et al. (2022) and Juliana et al. (2022). Attitude Towards Recycling (AR) included six items adapted from Juliana et al. (2022), Zaikova et al. (2022), and Khalil et al. (2021). Subjective Norms (SN) were measured using six items taken from Juliana et al. (2022) and Zaikova et al. (2022). Moral Norms (MN) consisted of seven items from Juliana et al. (2022), Khalil et al. (2021), and Zheng et al. (2020). Cost of Recycling (CR) included four items adapted from Juliana et al. (2022), Khalil et al. (2017), and Ahmad et al. (2014). Infrastructure Availability (IA) was measured using three items from Juliana et al. (2022), Khalil et al. (2017), and Ahmad et al. (2014). Waste Pickers Availability (WP) and Recycling Applications Convenience (RA) each consisted of four from Juliana et al. (2022). Lastly, Economic Incentives (EI) included four items adapted from Zaikova et al. (2022). In total, there were 51 measurement items all rated on a 6-point Likert scale to avoid neutral responses.

3.2 Sample Size

This study focused on married women residing in Greater Jakarta, Indonesia. Married women were selected due to the primary role as household managers, a position that was assumed to reflect household behaviour toward recycling and waste management. Non-probability sampling techniques were used to select the sample which was determined using the sample-variable ratio method as described by Suhr (2006) and cited by Memon et al. (2020) with a recommended ratio of 10:1. Considering that the study included 10 variables comprising the second-order variable PBC, the minimum required sample size was 100 respondents.

3.3 Data Analysis

The data were analyzed using Partial Least Squares Structural Equation Modelling (PLS-SEM) version 4. A two-stage technique was also implemented due to the inclusion of a higher-order model, specifically the second-order PBC. In this methodology, PBC used the latent variables obtained from the dimensions before proceeding with the bootstrapping procedure.

Table 1. Measurement Items

Variable	Measurement Item	
Recycle Intention (RI)	RI1	I would follow the guidelines introduced for sorting waste in the future
	RI2	I would like to sort my waste in the future.
	RI3	I would like to actively participate in recycling activities in the future.
	RI4	I intend to recycle my recyclable waste in the next four weeks.
	RI5	I plan to separate my plastic waste in the future.
	RI6	I plan to deliver my plastic waste to the recycling hub in the future.
Environmental Awareness (EA)	EA1	Resource waste is a severe issue
	EA2	I am concerned about the rising use of natural resources.
	EA3	I am concerned about the impact of the current natural resources use on our future generations.
	EA4	Recycling is a major way to reduce pollution.
	EA5	Recycling is a major way to conserve natural resources.
	EA6	Recycling saves energy
	EA7	Doing recycling practices can provide a better environment for the next generation.
Attitude Towards Recycling (AR)	AR1	I believe that my recycling behaviour will help reduce the wasteful use of landfills.
	AR2	I feel good about myself when I recycle.
	AR3	I feel good about myself when I separate my domestic waste (into recyclable and non-recyclable).
	AR4	I feel responsible when I recycle.
	AR5	I am interested in recycling my household waste.
	AR6	I am interested in separating my household waste.
Subjective Norm (SN)	SN1	My family expects me to engage in recycling behaviour
	SN2	Most individuals who are important to me think I should engage in recycling behaviour.
	SN3	Most individuals who are important to me would approve of my engaging in recycling behaviour.
	SN4	I think my closest families expect me to separate my waste.
	SN5	I think my neighbour expects me to separate my waste.
	SN6	I think the community expect me to separate my waste.
Moral Norm (MN)	MN1	It would be wrong with me not to recycle my recyclable materials
	MN2	I would feel guilty when I did not recycle my recyclable materials.
	MN3	I would feel guilty when I did not sort my household waste.
	MN4	Recycling goes in line with my principles.
	MN5	I feel I should not waste anything when it could be used again.
	MN6	Waste separation activity is in line with my principle.
	MN7	I think I have a responsibility to sort my domestic waste.
Cost of Recycle (CR)	CR1	Household recycling is an easy task for me.
	CR2	I have enough space to store the materials for recycling.
	CR3	I have enough time to sort the recycling materials.
	CR4	It is easy for me to distinguish between recyclable items with non-recyclable items.
Infrastructure Availability (IA)	IA1	I am familiar with the recycling facilities in my area.
	IA2	I am familiar with the materials accepted for recycling in the recycling facilities in my area.
	IA3	I know where to take my household waste for recycling.
Waste Picker Availability (WP)	WP1	I am familiar with the waste picker service in my area.
	WP2	I know where to find waste pickers in my area.
	WP3	I am familiar with the timing when waste pickers come to my area.
	WP4	I am familiar with the materials that waste pickers in my area usually collect.
Recycle Apps Convenience (RA)	RA1	I am familiar with the existence of recycling applications that could collect recyclable waste.
	RA2	I am familiar with the materials accepted for recycling by the recycling application provider.
	RA3	I know where to download recycling applications.
	RA4	I believe recycling applications help me in waste separation.
Economic Incentive (EI)	EI1	Monetary benefit in waste sorting is important.
	EI2	The monetary benefits of recycling are important.
	EI3	Reducing waste collection fees when I sort the waste is important.
	EI4	A refund of the cost of packaging (for example plastic bottles) when I recycle is important.

4. Results and Discussion

4.1 Respondents Profile

Among 122 respondents, 35% lived in central urban areas while the remaining respondents resided in suburban regions. The type of residence was evenly distributed across all categories. A gated residential complex which was defined as a residential area with controlled access was common among the respondents. Approximately 93% of

the respondents were between 27 and 58 years old with 83% having no children under the age of two. The number of household members was predominantly between three and five individuals (81%). Furthermore, 92% of the respondents disposed of waste using government services or services arranged by community members.

Table 2. Respondents Profile

Criteria	No. of Respondent	Percentage
City of Residence		
Jakarta	43	35.2
Bogor	17	13.9
Depok	6	4.9
Tangerang	30	24.6
Bekasi	26	21.3
Type of Residence		
Outside gated residential complex	44	36.1
Large gated residential complex	46	37.7
Small gated residential complex/townhouse	32	26.2
Age Range		
19–26 years old	5	4.1
27–42 years old	69	56.6
43–58 years old	44	36.1
59 years old or above	4	3.3
Occupation		
Housewife	60	49.2
Employee	45	36.9
Entrepreneur	10	8.2
Others	7	5.7
Educational Level		
High school or equivalent	23	18.9
Diploma	23	18.9
Bachelor	59	48.4
Postgraduate	15	12.3
Others	2	1.6
No. of Family Member		
2 persons	11	9.0
3 persons	23	18.9
4 persons	56	45.9
5 persons	20	16.4
6 persons	8	6.6
7 persons	3	2.6
8 persons	1	0.8
Have Children Under 2 Years Old		
Yes	21	17.2
No	101	82.8
Estimated Expenditures Per Month (excl. school and transportation cost)		
<IDR 2,000,000	18	14.8
IDR 2,000,000–5,000,000	20	16.4
IDR 5,000,001–10,000,000	54	44.3
>IDR 10,000,000	30	24.6
Residential waste transportation services		
Provided by local government	20	16.4
Organized by members of the community	93	76.2
Waste picker	2	1.6
Others	7	5.7

4.2 Outer Model Analysis – Stage 1

The analysis of the outer model showed that all measurement items except for RA1 (“I am familiar with the existence of recycling applications that could collect recyclable waste”) and RA4 (“I believe recycling applications help me in waste separation”) within the PBC construct had outer loadings greater than 0.7. Since the study used

a two-stage method PBC incorporated all measurement items from the dimensions (IA, CR, WP, RA). Despite the initial concerns about RA1 and RA4, the positive results from the assessments of construct validity, reliability, and discriminant validity justified the retention of these items.

Table 3. Construct Validity and Reliability Results

	Cronbach's Alpha	Composite Reliability (rho_a)	Composite Reliability (rho_c)	Average Variance Extracted (AVE)
Environmental Awareness (EA)	0.932	0.936	0.945	0.714
Attitude Towards Recycling (AR)	0.919	0.923	0.937	0.713
Moral Norms (MN)	0.949	0.950	0.958	0.767
Subjective Norms (SN)	0.944	0.947	0.956	0.782
Economic Incentives (EI)	0.834	0.846	0.890	0.671
PBC	0.953	0.957	0.959	0.609
Infrastructure Availability (IA)	0.952	0.953	0.969	0.913
Cost of Recycling (CR)	0.875	0.879	0.915	0.728
Waste Pickers Availability (WP)	0.933	0.936	0.953	0.834
Recycling Applications Convenience (RA)	0.861	0.890	0.907	0.713
Recycling Intentions (RI)	0.905	0.911	0.927	0.681

Table 4. Discriminant Validity (HTMT)

	AR	CR	EI	EA	IA	MN	PBC	RA	RI	SN
Attitude Towards Recycling (AR)										
Cost of Recycling (CR)	0.518									
Economic Incentives (EI)	0.773	0.598								
Environmental Awareness (EA)	0.784	0.318	0.786							
Infrastructure Availability (IA)	0.393	0.877	0.579	0.277						
Moral Norms (MN)	0.827	0.701	0.689	0.687	0.586					
PBC	0.470	0.993	0.606	0.289	0.928	0.636				
Recycling Applications Convenience (RA)	0.499	0.890	0.631	0.310	0.825	0.618	0.990			
Recycling Intentions (RI)	0.801	0.546	0.691	0.782	0.426	0.832	0.462	0.4988		
Subjective Norms (SN)	0.645	0.771	0.698	0.474	0.751	0.738	0.755	0.7656	0.632	
Waste Picker Availability (WP)	0.295	0.689	0.397	0.150	0.638	0.408	0.876	0.7082	0.220	0.466

4.3 Outer Model Analysis – Stage 2

At this stage, the latent variables of PBC's dimensions were used as measurement items for PBC as shown in Figure 2. The same outer model analysis was conducted and the loading factors for all items exceeded 0.7 except for EA1 ("Resource waste is a severe issue"). However, EA1 was retained in the analysis due to satisfactory outcomes in terms of construct validity, reliability, and discriminant validity.

Table 5. Construct Validity and Reliability Results Stage 2

	Cronbach's Alpha	Composite Reliability (rho_a)	Composite Reliability (rho_c)	Average Variance Extracted (AVE)
Attitude Towards Recycling (AR)	0.919	0.923	0.937	0.713
Economic Incentives (EI)	0.834	0.846	0.890	0.671
Environmental Awareness (EA)	0.932	0.936	0.945	0.714
Moral Norms (MN)	0.949	0.950	0.958	0.767
Subjective Norms (SN)	0.944	0.947	0.956	0.782
PBC	0.904	0.955	0.931	0.772
Recycling Intentions (RI)	0.905	0.911	0.927	0.681

Table 6. Discriminant Validity (HTMT) Stage 2

	AR	EI	EA	MN	PBC	RI
Attitude Towards Recycling (AR)						
Economic Incentives (EI)	0.773					
Environmental Awareness (EA)	0.784	0.786				
Moral Norms (MN)	0.827	0.689	0.687			
PBC	0.472	0.619	0.287	0.648		
Recycling Intentions (RI)	0.801	0.691	0.782	0.832	0.472	
Subjective Norms (SN)	0.645	0.698	0.474	0.738	0.778	0.632

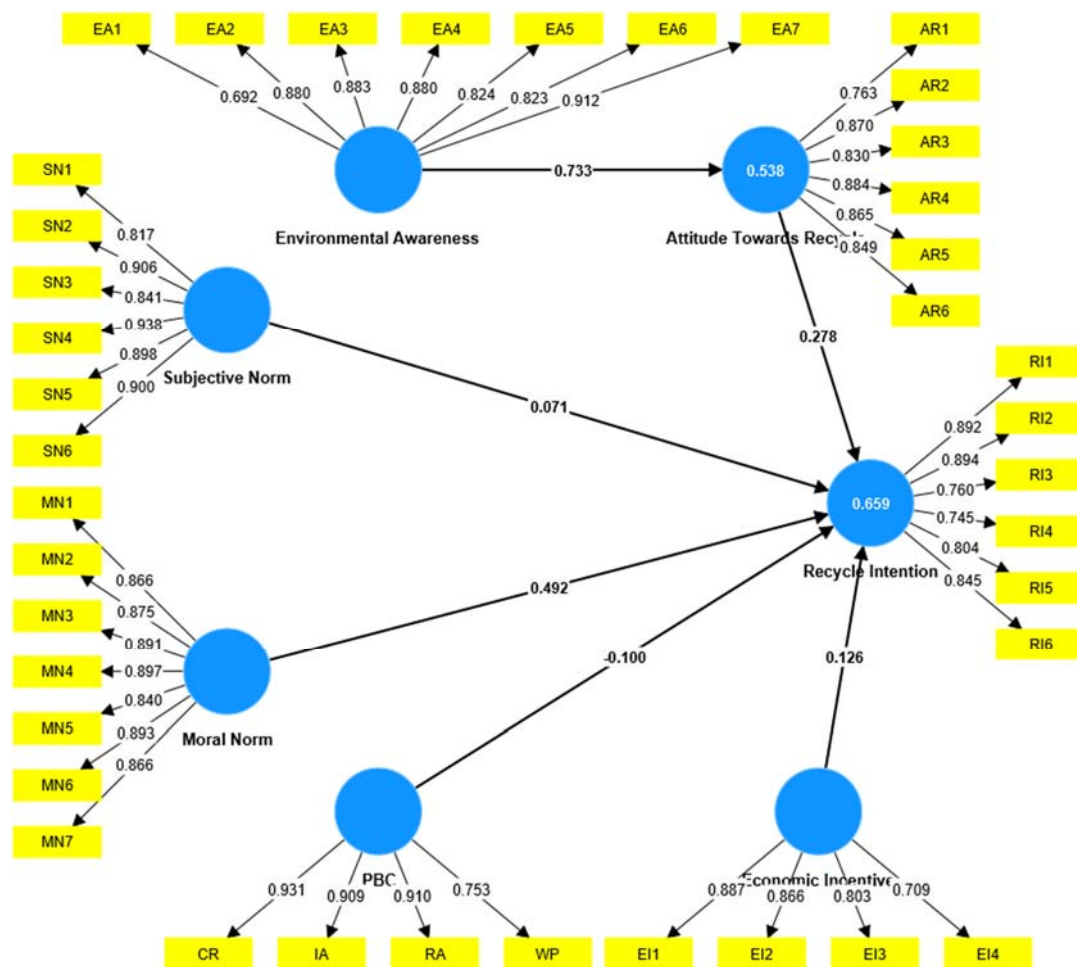


Figure 2. Second Stage Model Using Latent Variables

4.4 Internal Model Analysis

The internal model analysis was conducted to test the hypotheses and the results showed that several hypotheses were rejected including the positive impact of Subjective Norms, PBC, and Economic Incentives on Recycling Intentions. However, the model supported the hypotheses concerning the positive impact of Environmental Awareness on Attitude Towards Recycling, as well as the impact of Attitude and Moral Norms on Recycling Intentions.

Table 7. Hypothesis Testing

		Original Sample (O)	Standard Deviation (STDEV)	T statistics (O/STDEV)	P Values	Results
H1:	Environmental Awareness → Attitude Towards Recycling	0.733	0.058	12.554	0.000	Supported
H2:	Attitude Towards Recycling → Recycling Intentions	0.278	0.118	2.349	0.019	Supported
H3:	Subjective Norms → Recycling Intentions	0.071	0.123	0.576	0.565	Rejected
H4:	Moral Norms → Recycling Intentions	0.492	0.131	3.763	0.000	Supported
H5:	PBC → Recycling Intentions	-0.100	0.098	1.016	0.310	Rejected
H6:	Economic Incentives → Recycling Intentions	0.126	0.097	1.300	0.194	Rejected

The supported hypotheses showed that recycling intentions were strongly connected to intrinsic motivation as reflected in awareness, attitude, and moral norms. These internal factors drove recycling behaviour more effectively than external influences such as subjective norms, economic incentives, and PBC. The results correlated with the Norm Activation Theory (NAT) introduced by Schwartz (1977). Personal norms occupied a central position in NAT and were distinct from social norms. Although expectations and possible sanctions originating from social norms were customized in the social environment, those arising from personal norms originated from the individual self (cf. Kerr, Garst, Lewandowski, & Harris, 1997). These personal expectations manifested as feelings of moral obligation to engage in specific behaviours while acting against the action could lead to feelings of guilt and self-deprecation (Schwartz, 1977).

NAT further identified various activators for personal norms. Among the four activators, awareness of need and situational responsibility were shown to support the promotion of pro-environmental behaviour according to Harland et al. (2007). Awareness of need referred to how strongly an individual's attention was focused on the presence of an abstract entity (e.g., the environment) in need. Situational responsibility referred to how strongly an individual feels responsible for the consequences of that need. For example, when others caused the need, the possibility that potential actors felt responsible in that situation decreased (Schwartz, 1977, p. 246). These activators of personal norms helped explain the influence of environmental awareness on attitudes toward recycling.

The result showed that external factors such as subjective norms and economic incentives did not significantly influence recycling intention. Subjective Norms referred to the perceived social pressure to engage in or refrain from a specific behaviour (Ajzen, 1991). In this study, the subjective norms were measured by expectations from family, significant individuals, neighbours, the community, and the approval of important figures regarding recycling. Subjective norms were influenced by normative beliefs concerning the probability that key referent individuals or groups would approve or disapprove of performing a given behaviour (Ajzen, 1991). It could be interpreted that when significant individuals solely expected a change in behaviour without expressing approval, those beliefs were not as strong as those originating from actual approval. Among the items measuring subjective norms, the statement "Most individuals who are important to me would approve of my engaging in recycling behaviour" (SN3) received the highest average score (4.63) compared to other items reflecting expectations.

Table 8. Subjective Norms Descriptive Statistics

Items	Description	Average
SN1	My family expects me to engage in recycling behaviour	4.434
SN2	Most individuals who are important to me think I should engage in recycling behaviour	4.262
SN3	Most individuals who are important to me would approve of me engaging in recycling behaviour	4.631
SN4	I think my closest ones expect me to separate my waste	4.426
SN5	I think my neighbour expects me to separate my waste	4.320
SN6	I think the community expect me to separate my waste	4.377
	Subjective Norms	4.408

Ajzen (1991) asserted that the results for subjective norms were mixed with no discernible pattern. The results suggested that for the behaviours considered, personal considerations tended to overshadow the influence of perceived social pressure.

An interesting result evolved regarding PBC showing that PBC had a negative and not significant influence on

recycling intentions which could be explained as follows. First, the concept of PBC included the belief that one could control the performance of a behaviour (Ajzen, 1991) i.e., individuals may feel motivated when the individual believed “can do it.” Whether a measure of PBC could substitute for actual control depends on the accuracy of those perceptions. PBC could not be particularly realistic when an individual had relatively little information about the behaviour when requirements or available resources had changed or when new and unfamiliar elements entered the situation. Under these conditions, a measure of PBC could contribute little to the accuracy of behavioural predictions. PBC was measured by factors such as the cost of recycling, infrastructure availability, waste pickers availability, and convenience of recycling applications. The interpretation was that these items were new and unfamiliar to respondents, prompting the individuals to be unable to predict behaviour accurately. Familiarity with these items could also take some time to develop.

Second, the negative sign showed that besides unfamiliarity, the existence of these measures weakened the recycling intentions. The need to allocate space and other resources for recycling could delay the recycling intentions as respondents could perceive the associated costs as unnecessary. Although the availability of infrastructure, waste pickers, and applications provided services to facilitate recycling, this did not motivate respondents to engage in recycling independently. Despite the outcome appearing counterintuitive, it possibly occurred because as individuals became more aware of the waste pickers in the area, the individuals tended to prefer delegating waste management and recycling responsibilities rather than undertaking the activities. Furthermore, waste transportation services whether provided by local governments or self-sustaining community initiatives often did not require households to separate the waste before transport. All waste at the Final Disposal Site (TPA) was mixed before sorting by the waste pickers.

4.5 Model Fit

Apart from the rejection of PBC, Subjective Norms, and Economic Incentives in influencing Recycling Intentions, the model overall moderately explained the factors influencing the dependent variable with the R-squared value for recycling intentions showing 0.659. At the 95% confidence level, this showed that recycling intentions could be explained by Attitude Towards Recycling and Moral Norms. These results showed that internal motivation played a significant role in recycling intentions. Attitude toward recycling with an R-squared value of 0.598 was influenced by Environmental Awareness. Greater individual environmental awareness and knowledge motivated a more positive attitude toward recycling and waste management, eventually fostering a stronger intention to engage in these activities.

Table 9. R-Square

	R-square	R-square adjusted
AR	0,598	0,595
RI	0,656	0,641

5. Conclusion

In conclusion, this study showed that internal motivation was more important than external for fostering recycling intentions. Attitude Toward Recycling which was driven by Environmental Awareness and Moral Norms was also found to significantly influence recycling intentions. In contrast, the influence of Subjective Norms along with the availability of support to enhance PBC and Economic Incentives was not significant. The effects of Waste Pickers' Availability and Recycling Applications' Convenience on recycling intentions were indirect. Specifically, PBC had a negative influence on recycling intentions when PBC was determined by factors such as the cost of recycling, infrastructure availability, waste pickers' availability, and convenience of recycling applications, the presence of these factors weakened the intention to recycle. Although the existence of waste pickers simplified the recycling and waste management process, it made households reluctant to undertake the activities independently and led to relying more on waste pickers' services. Respondents' unfamiliarity with recycling applications also hindered accurate predictions of the behaviours.

Questions arose regarding what factors could influence Subjective Norms and PBC which was the participation of government. In this context, the government's function as a policymaker appears essential in motivating households to participate in recycling and waste management activities. The lack of enforcement regarding the proper disposal of waste prevented the formation of societal norms concerning the consequences of careless waste disposal. This lack of enforcement contributed to Subjective Norm's inability to influence recycling intentions in the study. Regional governments could formalize provisions requiring waste transportation service providers to

only collect waste that has been sorted, reducing household dependence on waste picker services for sorting and recycling. Additionally, the role of industries such as the plastics as well as food and beverage sectors in shaping environmental awareness and attitudes was crucial for promoting recycling and waste management. Through various advisory activities, industries could assist the government in fostering societal norms regarding the importance of these activities. The government could also create suitable incentive schemes and provide recycling infrastructure in residential areas to stimulate broader participation in recycling and waste management.

For the development of future publications, similar studies should further include variables such as perceptions regarding the effectiveness of enforcing government regulations and the impact of appeals made by both government and industry regarding recycling and waste management. This method would provide a better understanding for government and industry stakeholders on how to improve the strategies for promoting recycling and waste management in Indonesia.

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