



Original Research

Assessment of factors influencing Indonesian residents' intention to use a deposit–refund scheme for PET bottle waste

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ABSTRACT

The collection rate is a difficult and important issue in the management of polyethylene terephthalate (PET) bottle waste, as it is related to the behavior of the community to participate and comply with the system established by the government. One system that has been shown to increase the collection rate of PET bottle waste is the deposit–refund scheme (DRS). We tested residents' intention to participate in the DRS using the theory of planned behavior and complemented it with several important variables that could influence the model. The method used is partial least square-structural equation modeling. The result of the study is that all the variables studied were positively influenced according to their respective paths. Nevertheless, environmental awareness is the latent variable with the strongest positive effect on attitude, and attitude has the strongest positive effect on intention. Public information is the latent variable that positively influences all variables related to intention. The proposed model can be applied globally to identify factors that influence recycling participation, particularly for DRS, and help achieve sustainable development goals while initiating a circular economy by recycling plastic bottle waste.

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1. Introduction

The low participation of the Indonesian population in waste separation is a barrier to finding appropriate waste management solutions (Rousta et al., 2020). Various technology options for managing plastic bottle waste have been implemented, but require that the quality of polyethylene terephthalate (PET) bottle waste must be strictly separated and maintained from contamination (Amirudin et al., 2022). In this study, PET bottle waste was selected as a primary target for separation by residents. PET waste or plastic waste is the focus of this study due to its prevalence as one of the most common types of waste generated in Indonesia, with PET bottles being the main contributor. These bottles are frequently used for beverages like water and soft drinks, and their improper disposal has resulted in environmental pollution. The difficulty in decomposing PET bottles is also a concern, as they can take hundreds of years to break down, leaving long-lasting environmental impacts. However, PET bottle waste has many advantages if

residents can perform the sorting process properly on their own, as pure PET waste has economic value and is easy to handle. Thus, in various developing countries, there are still deficiencies in shaping residents' behavior in waste management (PET bottle waste management) (Khan et al., 2019).

Assessing the efficacy of Indonesia's legal framework for the management of plastic bottle waste necessitates a multifaceted approach that combines both supportive and coercive measures to encourage community participation in implementing tailored systems and mechanisms aimed at enhancing the quality of waste recycling (Amirudin et al., 2023). In the context of reducing PET waste in Indonesia, one solution that can be implemented is to implement a deposit–refund (DRS) system for PET bottles. DRS is a mechanism where the purchaser pays an additional fee on the original cost of a product packaged in a PET bottle as a deposit, which is reimbursed after returning the bottle to a designated collection point. By implementing DRS, it is expected to encourage residents to return bottles for recycling, thus increasing the quality and quantity of waste, reducing waste in the environment, preventing contamination of recycled materials, and saving natural resources (Xevgenos et al., 2015). In Europe, DRS has shown success in achieving collection rates of between 30% and 90% for plastic

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waste (Xevgenos et al., 2015). It has been shown to increase resident collection rates and waste quality for PET bottle waste in Germany (Snell et al., 2017). Policy simulations on the introduction of DRS for PET bottles in China also showed that DRS could improve the collection rate by 3.5% per year (Wang et al., 2020). Not only for PET bottle waste, but also for electric vehicle batteries, DRS could improve the collection rate by 0.3% per year in China (Li et al., 2020), and a simulation of DRS for battery recycling in the Netherlands showed that the collection rate could be improved by 2.8% per year (Linderhof et al., 2019). Currently, the collection rate for all types of plastic waste in Indonesia is 39% (Global Plastic Action Partnership, 2020), and without changes to the scenario and system, the negative impact on people and the environment would increase. Therefore, it is important to consider DRS as a precondition to increase the collection rate and improve the recycling mechanism.

Several studies have been conducted on the possibility of introducing DRS in Asian countries. Wang et al. (2020) applied mathematical simulations to determine the increase of PET bottle waste collection rate in China. Balwada et al. (2021) proposed DRS as a solution to increase PET bottle waste collection rate in India using Analytical Hierarchy Process. However, the resident is not yet considered when evaluating the success of DRS, although it plays a central role.

The scheme requires behavior change, and the most important step in changing behavior is enhancing intent. It would be important to identify resident's view about DRS. In this study, the theory of planned behavior (TPB) is elaborated to evaluate the determinants of Indonesian residents. This theory is the most widely used in environmental behavior research and has been applied to many research topics, such as electric car customer intentions, waste reduction behaviors, and energy conservation behaviors (Aboelmaged, 2021; Pierini et al., 2021; Yan et al., 2019; Zhang et al., 2019), as well as other fields of study such as management, marketing, and social sciences.

TPB has three primary variables: attitude, subjective norm, and perceived behavioral control. These variables influence the intention that can lead to behavior (Ajzen, 1991; Khan et al., 2019). Some other variables that can change behavior are moral norms, awareness of consequences, convenience (Khan et al., 2019), economic incentives, facilities, and regulation (Mak et al., 2021).

Another variable that affects intention is religious norm. Since religion plays a special role for followers and has a robust social structure in society, there are also implications for waste management (Fatimah Mohamad et al., 2011). A study by Mohamad et al. (2012) found that religious communities in Malaysia play an important role in supporting waste management because they have an institutional structure, their own motivating factors, and a collective movement for recycling. In other studies, religious norms were found to have a direct influence on lifestyle in religious-based countries such as Malaysia (Mohamad et al., 2012), Egypt (Abdelradi, 2018), and India (Fergusson et al., 2018). The results show that religion has a positive effect on individual intention to make choices and shape waste management behavior.

DRS has been classified as an economic tool for waste management because DRS asks resident to pay extra money as a deposit (Xevgenos et al., 2015). Therefore, economic consequences play an important role in residents' intention. Some studies also concluded that economic consequences have significant impacts on waste behavior (Fami et al., 2019; Koshta et al., 2022).

Environmental awareness affects the attitude of residents towards the treatment of waste and other factors causing environmental damage. It represents consciousness of environmental

protection and stewardship, and is associated with recycling intentions, as there is a positive correlation between environmental awareness and attitude. As a movement, it influences business models, product designs, and elections. Aikowe and Mazancová (2021) observed students' intention to recycle plastic. They concluded that students' environmental awareness has a positive impact on their waste sorting intentions and promotes students' interest in environmental issues and plastic recycling initiatives.

Residents need the support of facilities, convenience, and sincerity to recycle. By considering the convenience factor in the recycling system, a strong intention to recycle and a strong inclination to the essential characteristics of the behavioral object can be generated. Therefore, it is important to understand how convenience is related to DRS. Wang et al. (2021) found that convenience is positively correlated with perceived behavior control in TPB, as it induces customers to sort packaging waste.

Residents should be well informed about recycling, how to manage their waste, and the benefits of waste management. When residents are fully informed about proper behavior, they are more likely to follow that behavior. Intuitively, public information can motivate residents to adapt proper recycling behaviors (Wang et al., 2019). Several studies found that public information can have a positive impact on recycling intention and become an important determinant of residents' behavior (Aikowe & Mazancová, 2021; Noh, 2021; Papaoikonomou et al., 2020).

This study investigated the factors that can enhance residents' intention to participate in the DRS for PET bottle waste in Indonesia. To achieve this, several factors such as religious norms, economic consequences, environmental awareness, convenience, and public information were used as latent variables. Additionally, three baseline variables of the TPB were employed to establish the relationship between latent variables and intention. Given the lack of innovative schemes to improve PET bottle waste management, this study proposed a DRS for PET bottles as a solution and evaluates residents' behavior towards this scheme. The innovative point of this study is the proposal and evaluation of a DRS for PET bottles as a solution to address the low participation of residents in the PET bottle waste recycling system in Indonesia. The study investigated the factors that may enhance people's intention to participate in DRS. By proposing a new scheme and evaluating residents' behavior towards it, the study aims to contribute to the development of effective waste management policies and practices in Indonesia. Therefore, the innovative point lies in its proposal of a new solution and its evaluation of its effectiveness in addressing the problem at hand.

2. Literature review

2.1. PET bottle waste

PET bottles have become one of the most common forms of packaging in the world due to their convenience and low cost. However, the extensive use of PET bottles has led to a significant increase in plastic waste generation, particularly in developing countries like Indonesia. To address this issue, various initiatives have been implemented to promote proper disposal and recycling of PET bottles, including the DRS (Xevgenos et al., 2015).

DRS (Fig. 1) is a system where the consumer pays a surcharge on the basic price of a product in a PET bottle for the deposit, which is refunded upon return of the bottle to a collection point. This scheme encourages residents to return the containers for recycling, which increases the quality and quantity of waste, reduces littering,

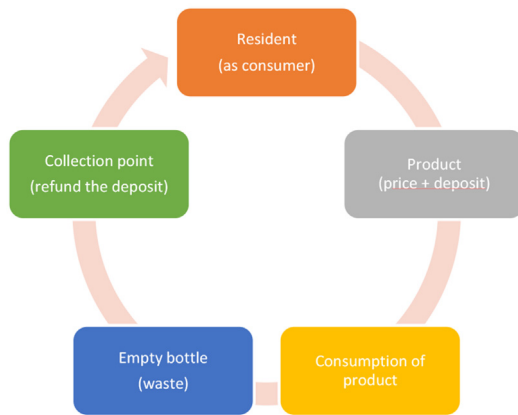


Fig. 1. DRS for PET bottle waste.

prevents contamination of recyclable material, and conserves natural resources (Xevgenos et al., 2015).

2.2. Theoretical model and hypothesis

To tease out the determinants of residents' intention to manage waste, many researchers have used TPB frameworks (Fami et al., 2019; Sun et al., 2017; Vassanadumrongdee & Kittipongvises, 2018; Zhang et al., 2021). The framework (Fig. 2) helps to identify the influencing factors that can improve the intention of individuals in a society to thereby induce behavior change. TPB considers three main variables that influence intention and behavior. These main variables have varying degrees of impact depending on the situation. In addition, latent variables may influence the main variables as well.

Besides the three main factors in the TPB that could influence the intention, several factors having a positive effect on the intention were taken into account, such as religious norm, economic consequence, environmental awareness, convenience, and public information (Table 1). These were used to form hypotheses about their relationship to each other.

2.2.1. Environmental awareness has a positive effect on attitude (H1) and subjective norm (H2)

Environmental awareness of residents should be improved to avoid environmental damage and destruction. Environmental awareness is exceptionally important for the behavior of residents in dealing with waste, because residents must be fully aware of the consequences of the negative impacts of waste. Mohd Suki and Mohd Suki (2019) emphasized that perceived environmental

responsibility has an important influence on people's decision intention.

In particular, the correlation between environmental awareness and attitude has been studied by several researchers (Amit Kumar, 2021; Barba-Sánchez et al., 2022; Van et al., 2021; Yaghoubi Farani et al., 2019). It can be seen that environmental awareness has a direct, significant, and positive impact on attitude. Environmental awareness has become a lifestyle that influences various aspects of life. Due to the numerous environmental damages that have occurred and can be perceived by everyone, it is an important aspect in policy making, so it is normal that environmental awareness influences people's attitude towards the management of plastic bottle waste. Plastic bottle waste may not have a direct impact on the environment, but the manufacturing process and management after use still contribute to environmental damage. Therefore, it is important to recognize the relevance of the relationship between environmental awareness and attitude to support the intentions of residents in the DRS system, as there are different situations that affect the production and management of plastic bottle waste. Environmental awareness has become an important consideration in society and has developed into a moral norm that could influence subjective norms. In addition, Yi (2019) proved that environmental awareness positively influences subjective norms.

2.2.2. Public information has a positive effect on attitude (H3), subjective norm (H4), and perceived behavioral control (H5)

Public information could inform residents about plastic bottle disposal and encourage them to participate in plastic waste collection. Public information was also found to have a significant influence on attitude, social norm, and perceived behavioral control in TPB (Tian et al., 2019). Residents need information to determine their recycling behavior. In this regard, public information is one way to change culture (Danchin et al., 2004). In addition, information strengthens residents' motivation to support waste management programs. However, the government sometimes does not prioritize public information to change people's behavior (Zhang et al., 2021). Huang (2016) concluded that people with strong pro-environmental intentions will try to find public information available through various media. It is shown that the availability of public information promotes residents' recycling intentions. Zhang et al. (2021) and Wang et al. (2019) reported that public information plays a positive role in intention. Since attitude is also assumed to have a positive effect on intention (H10), it is important to decipher the relationship between public information and attitude. To the authors' knowledge, this has not yet been investigated.

Subjective norms result from the pressure created on the individual by society's judgment, and fear of social misconduct results from the evaluation of one's behavior in relation to public information (Ajzen, 1991). Thus, public information does not only affect attitudes. It is also predicted to have a positive effect on subjective norms because public information turns into social values and becomes the standard for judging the reasonable and good behavior of other people (Danchin et al., 2004). Noh (2021) investigated the influence of information on college students' recycling behavior for clothing and textiles. The result was that information had a positive effect on subjective norm and thus strongly influenced recycling intention compared to other factors. A person's willingness and ability must receive an informational stimulus that makes them confident. The ability and desire are represented by perceived behavioral control. Therefore, the role of public information should be important to improve perceived behavioral control and can also be tested in DRS applications.

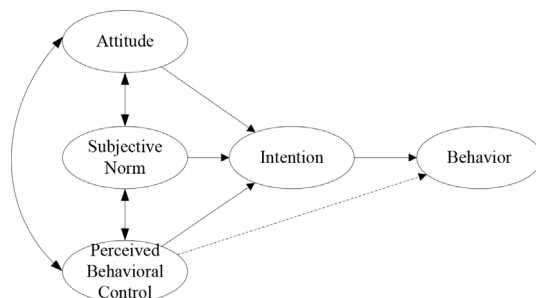


Fig. 2. Theory of planned behavior (reproduced with permission from Ajzen (1991) © Elsevier 1991).

Table 1
List of variables and questionnaire item related to intention for DRS in PET bottle waste.

Variable	Definition	Item	Reference
Environmental awareness (EAW)	Understanding the consequences of waste or pollution	EAW1	(Abdelradi, 2018; Khan et al., 2019; Koshta et al., 2022)
		EAW2	
		EAW3	
		EAW4	
Public information (PI)	Information about PET bottle waste separation, handling, and scheme	PI1	(Chen, 2020; Si et al., 2022; Zhang et al., 2021)
		PI2	
		PI3	
Religion norm (RN)	Religion is a certain system of belief and worship	RN1	(Abdelradi, 2018; Graafland, 2017; Mohamad et al., 2012)
		RN2	
Economic consequence (EC)	Value of benefit or loss from activities	EC1	(Juliana et al., 2022; Wang et al., 2021)
Convenience (CON)	Perceived support or hindrance to perform certain activities	EC2	
		CON1	
		CON2	(Soomro et al., 2022; Wang et al., 2021)
		CON3	
Attitude (ATT)	The extent to which the performance of the behavior is evaluated positively or negatively	ATT1	(Bošnjak et al., 2020; Kan & Fabrigar, 2017; Khan et al., 2019)
		ATT2	
		ATT3	
Subjective norms (SN)	The perceived social pressure to participate or not in a behavior	SN1	(Bošnjak et al., 2020; Zhang et al., 2015)
		SN2	
		SN3	
		SN4	
Perceived behavioural control (PBC)	A person's perception of their ability to perform a particular behavior	PBC1	(Bošnjak et al., 2020; Strydom, 2018)
		PBC2	
Intention (INT)	The willingness of a person to perform a particular behavior	INT1	(Aboelmaged, 2021; Bošnjak et al., 2020)
		INT2	
		INT3	

2.2.3. Religious norm has a positive effect on attitude (H6) and subjective norm (H7)

Residents of Indonesia must belong to one of the religions recognized by the government, so religion affects various values in society, including waste management. All religions urge their followers to protect and not harm the environment (Mohamad et al., 2012). Therefore, religion will certainly affect the attitude and subjective norms in society, and it is of interest to investigate the relationship between religion and attitudes as well as subjective norms in management of waste PET bottles.

2.2.4. Convenience has a positive effect on perceived behavioral control (H8)

Convenience is important in support residents' behavior and helping them follow regulations. Khan et al. (2019) concluded that convenience is an important predictor variable that can support residents' intention to return or recycle plastic waste. Previous research has shown a strong relationship between perceived behavioral control and intention (Aboelmaged, 2021; Amit Kumar, 2021; Khan et al., 2020), but the next question is what factors may increase perceived behavioral control. We link convenience to perceived behavioral control because, according to Ajzen (1991), the resources and opportunities available to residents result in better perceived behavioral control in TPB. The resources and opportunities are represented by the convenience provided to residents to support their intentions in dealing with plastic bottle waste.

2.2.5. Economic consequences have a positive effect on perceived behavioral control (H9)

The deciding factor in DRS is the amount of money that is set as a deposit, with the risk of being lost if the item of interest is not returned. Research by Zhou et al. (2020) showed that the higher the deposit amount, the higher the collection rate, but this result is not only based on a large amount of money, but also needs to include the ability of residents to afford the deposit. Oke et al. (2020) pointed out that the cost implication is what customers most concern about when adopting DRS for plastic packaging. In this study, we define this as the economic consequences. This will certainly have an impact on perceived behavioral control, as economic capabilities will certainly be considered in decision making.

2.2.6. Attitude has a positive effect on intention (H10)

Attitude is the extent to which the performance of the behavior is evaluated, both positively or negatively (Bošnjak et al., 2020; Kan & Fabrigar, 2017; Khan et al., 2019). Tian et al. (2019) found that attitude has a positive influence on residents' waste separation intention. In another study, attitude was found to have a weak correlation with recycling intention (Strydom, 2018). Subjective norms are the perceived social pressure to engage in a behavior (Bošnjak et al., 2020; Zhang et al., 2015). Perceived behavioral control refers to a person's perception of their ability to perform a particular behavior. The intention to participate in a deposit refund scheme is an indication of a person's willingness to perform a certain behavior (Aboelmaged, 2021; Bošnjak et al., 2020). Attitude,

subjective norm, and perceived behavioral control have been shown to be correlated with intention in many researches, leading to the question of which of these has the greatest influence on intention and should be considered by policy makers.

2.2.7. Subjective norm has a positive effect on intention (H11)

Subjective norm normally has a positive effect on intention. However, it is still important to evaluate the correlation between subjective norms and intention because subjective norms explain human recycling behavior (Khan et al., 2019). The impact on intention would depend on the content and context of society, culture, and type of waste in each country (Khan et al., 2020).

2.2.8. Perceived behavioral control has a positive effect on intention (H12)

Perceived behavioral control is a TPB variable that can directly affect behavior without affecting intention (Fig. 2). Since DRS has not yet been implemented, perceived behavioral control is only linked to intention. Furthermore, Khan et al. (2019) found that perceived behavioral control positively affects intention to recycle plastic waste, and stated that perceived behavioral control is important for evaluation because it shows the degree of individual dependence in decision making.

Previous studies have shown that the correlation between variables is positive towards intention, though these studies have investigated different schemes and waste types. This study focuses on evaluating the determinant factor that could support DRS for PET bottle waste and the hypothesis compilation can be seen in Fig. 3.

2.3. Methodology data collection

In this study non-probability sampling was used to collect data from the ten most populous cities in Indonesia (Brotosusilo & Handayani, 2020; Qonitan et al., 2021). These are: Surabaya, Manokwari, DKI Jakarta, Semarang, Pekanbaru, Makassar, Medan, Denpasar, Samarinda, and Manado. A non-probability sample was chosen because the population is very large and difficult to represent. The questionnaire was provided via Google form in Indonesian to facilitate respondents' completion and dissemination via social media such as Instagram, Facebook, Line, Twitter, and WhatsApp from June to December 2021. The target group was residents who generate PET bottle waste regularly. Since DRS does not yet exist, it would be impossible to obtain correct samples (Uprichard, 2013). The possible answers to the questions in the questionnaire ranged from "strongly disagree" to "strongly agree" (Likert scale) and were provided as an online questionnaire

(questionnaire design see Table 1). The number of respondents was 1,147, from different demographic groups (Table 2).

2.4. Data analysis

Structural equation modelling has been introduced to investigate the theoretical construct and latent variables of a research problem. In particular, partial least square-structural equation modelling (PLS-SEM) is applied because PLS-SEM has the advantage of analyzing measurement theory and structural path models (Astrachan et al., 2014). PLS-SEM became popular in environmental science research since 2017. More than 400 publications have examined case studies on green human resource management and green supply chain management (Nejati et al., 2017), green building technology promotion strategies (Darko et al., 2018), consumer acceptance of smart products (Lu et al., 2019), and food waste recycling behavior (Mak et al., 2021). The main advantage of PLS-SEM is the ability to produce consistent results with a limited data sample and anomalous data distribution (Hair Jr et al., 2013).

2.5. Reliability and validity

Data from the online survey with 1147 respondents were analyzed by the partial least square (PLS) using SmartPLS (v.3.3.3). The PLS-SEM results were obtained in two steps as described in the literature (Chin, 2010; Hair Jr et al., 2013). First, the PLS algorithm was to evaluate the measurement model for 300 iterations. Second, the path analysis was estimated by bootstrapping 5000 subsamples to determine the structural model and significance level.

2.5.1. Measurement model

The assessment of the measurement model is composed of convergent validity, discriminant validity, and reliability, and reflects the overall suitability of the measurement model. The first measurement is convergent validity, which is the positive correlation measurement for each construct indicator (question) to the variable, and it is convergent valid if the average variance extracted (AVE) value is more than 0.5 and the outer loading value is more than 0.7 (Hair Jr et al., 2019). This is true for all variables in this work (see Table S1 which is in the Electronic Supplementary Material (ESM) in the online version of this paper).

The second is discriminant validity, which is determined by comparing the square root of the AVE values with the correlations of the latent variables. Specifically, the square root of the AVE of each construct should be greater than any correlation with other constructs, which is referred to as the Fornell–Larcker criterion (Table S2 in the ESM) (Hair Jr et al., 2021). Based on Table S2 in the ESM, the Fornell–Larcker criterion was fulfilled, which implies that a construct variable is unique and captures phenomena not represented by other constructs in the model.

The last measurement model is reliability. To evaluate the reliability of the variables, Cronbach's alpha and the composite reliability must be calculated, which are shown in Table S1 in the ESM. Chin (2010) stated that an indicator is reliable if the value of Cronbach's alpha is bigger than 0.6 and the composite reliability is bigger than 0.7. This is true for all variables examined in this work (Table S1 in the ESM).

2.5.2. Structural model and significance level

Structural models and significance levels were estimated by bootstrapping 5000 subsamples, and the coefficients of determination (R^2) value were generated from this mechanism. R^2 measures the predictive power of the model and is calculated as the squared correlation between the actual and predicted values of a given endogenous construct (Hair Jr et al., 2021). They were used to

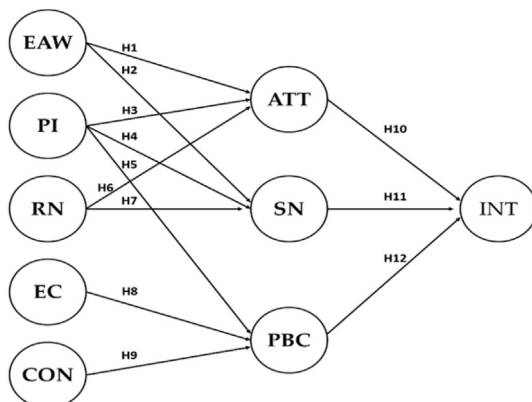


Fig. 3. Research hypotheses (abbreviations can be found in Table 1).

Table 2
Respondents' socio-economic profile.

Variable	Description		Frequency	Percentage
Number of respondents			1147	100%
Age (year)	17–20		264	23%
	21–30		682	59%
	31–40		98	9%
	41–50		73	6%
	Older than 51		31	3%
Gender	Male		639	56%
	Female		508	44%
Education level	School		514	45%
	Bachelor		564	49%
	Graduate		69	6%
Experience	Experience with DRS	Yes	217	19%
		No	930	81%
	Curiosity about DRS	Yes	1084	95%
		No	63	5%
	Member of waste bank	Yes	287	25%
		No	860	75%
	PET bottle consumption (items/week)	0	120	10%
		<3	470	41%
		<5	276	24%
		<7	130	11%
		<9	64	6%
		<11	20	2%
		<13	67	6%
Monthly income (Indonesian Rupiah (IDR))	<1 million		155	14%
	>1 million		671	59%
	>5 million		234	20%
	>10 million		66	6%
	>20 million		8	1%
	>30 million		3	0%
Acceptable range of deposit (Indonesian Rupiah (IDR))	>40 million		10	1%
	0 IDR		167	15%
	<1.500 IDR		366	32%
	<2.500 IDR		208	18%
	<3.500 IDR		106	9%
	<4.500 IDR		56	5%
	<5.500 IDR		112	10%
Marital status	<6.500 IDR		132	12%
	Single		865	75%
Origin/city	Married/Widow/Divorce		276	24%
	Denpasar		93	8%
	DKI Jakarta		446	39%
	Makasar		60	5%
	Manado		44	4%
	Manokwari		25	2%
	Medan		58	5%
	Pekan Baru		51	4%
	Samarinda		89	8%
	Semarang		113	10%
Surabaya		168	15%	

measure the deviation of the change in the independent variable from the dependent variable.

PLS-SEM is assessed using R^2 of each of the latent constructs that used to describe the overall goodness of fit of an estimated model with one or more independent variables. R^2 ranges from 0 to 1. If it implies that there exists a perfect fit, that is $\hat{Y}_i = Y_i$. If $R^2 = 0$, it implies that there is no relationship between the estimator and the estimate, i.e., $\hat{Y}_i = Y_i$. Similarly, if $R^2 > 0.5$, it implies that there is a good fit of the model to the given data, and if $R^2 < 0.5$, it implies that there is no good fit of the model to the given data (Hair Jr et al., 2021). Alternatively, it can be evaluated as the square of the coefficient of correlation.

$$R^2 = \frac{ESS}{TSS} = \frac{\sum(\hat{Y}_i - \bar{Y})^2}{\sum(Y_i - \bar{Y})^2} \quad (1)$$

$$Q^2 = 1 - \frac{RSS}{TSS} = 1 - \frac{\sum(Y_i - \hat{Y})^2}{\sum(Y_i - \bar{Y})^2} \quad (2)$$

where ESS is the explained sum of squares; RSS is the residual sum of squares; TSS is the total sum of squares; Y_i is the actual value; \bar{Y} is the mean of actual value and \hat{Y} is the estimated value.

3. Results

3.1. Descriptive statistical analysis

Table 2 shows the descriptive statistical analysis of a total of 1147 male (56%) and female (44%) respondents, most of whom were younger than 30 years old (82%) and had a bachelor's degree (49%). Most of the respondents were adults aged 21 years old and older, independent in their decisions, and well educated. Respondents

were from Denpasar (8%), DKI Jakarta (39%), Makassar (5%), Manado (4%), Manokwari (2%), Medan (5%), Pekanbaru (4%), Samarinda (8%), Semarang (10%), and Surabaya (15%). Although the distribution is not even, the survey is appropriate because these cities vary greatly in size. Most respondents had incomes in the IDR 1–5 million ranges (59%). Most respondents had never participated in DRS before (81%), but 91% were interested in receiving information about DRS. Most respondents were not members of the waste bank (75%), and 41% had PET bottle consumption of less than 3 bottles per week.

Based on the survey data collected, it was found that 15% of the respondents were not willing to pay a deposit for the PET bottle waste. However, 32% of the respondents were willing to pay a deposit of less than IDR 1,500, which is a price range similar to that of drinking water (IDR 600–3500). On the other hand, 54% of the respondents preferred a deposit price of more than IDR 1500. These findings suggest that the use of DRS in Indonesia would be acceptable to most respondents in the range of IDR 1500 to 6500 (85%). This range provides valuable insight for policymakers and waste management practitioners in determining an optimal deposit price that will encourage participation in the DRS program.

3.2. Model structure

Before the model construction is elaborated, the values of R^2 and Q^2 must be determined. The value of R^2 can vary widely across research disciplines. The R^2 value for intention (INT) in this study was 0.385 (Table S1 in the ESM). In addition, R^2 of 0.638, 0.554, and 0.237 were found for attitude, subjective norm, and perceived behavioral control, respectively, which were within the range of other works. In other studies, the R^2 of behavioral intention to treat plastic waste ranged from 0.339 to 0.506 when PLS-SEM was used (Khan et al., 2019; Luu & Baker, 2021). Chin (1998) classified R^2 as strong, moderate, and weak when values exceeded 0.67, 0.33, and 0.19, respectively. Accordingly, the R^2 values found in this study are considered moderate and acceptable, with the exception of the behavioral control value, which must be considered weak.

Given the complexity of the residents' behavior regarding PET bottle waste and DRS, and the lack of a general theoretical framework covering all factors that determine the intention to dispose of PET bottle waste (Oke et al., 2020), the R^2 value was considered to be acceptable in this work. Hair Jr et al. (2019) also used the cross-validated redundancy measure Q^2 to assess the predictive ability of the structural model. The value of Q^2 must be greater than zero. Using the blind folding method, the omission distance is set to 7, and the Q^2 value of the intention is 0.440 (Table S1 in the ESM). Model fit was evaluated using the standardized root mean square residual (SRMR) recommended by Hair Jr et al. (2021), which has become the standard for model fit in Smartpls applications. The value of SRMR in this paper was 0.076, which is less than the value of 0.08, thus satisfying the model fit requirements.

3.3. Hypothesis testing

The structural model presents the influence between variables by presenting the direct influence path coefficient and p -value. The value of the path coefficient illustrates the degree of strong or weak influence between variables. The greater the value of the path coefficient is, the stronger the influence of a variable on other variables is. The positive sign on the path coefficient indicates the direction of influence in the same direction. Conversely, the negative sign on the path coefficient indicates the opposite direction of influence, i.e., the greater the value of a variable, the weaker the influence of the other variables affected.

The p -value is used to see the result of the hypothesis testing, i.e., whether or not there is a significant influence of a variable on other variables. If the p -value < 0.05 (alpha 5%), it can be said to be significant, which means there is a significant influence of one variable on other variables. All hypotheses were accepted because the p values of all hypotheses were well below 0.05 (Table 3). The values of the T statistic were higher than 2.33 for all variables (Table 3), as required by the one-sided test to conclude a positive and significant correlation (Hair Jr et al., 2021). The correlation between religion and attitude showed the lowest correlation.

The structure of the model is shown in Fig. 4. Attitude, subjective norm, and perceived behavioral control positively and significantly influence intention, with attitude have the largest positive impact. Latent variables that influence TPB are environmental awareness, public information, and religious norms. These strongly influence attitude and subjective norms, with the exception of the religious norm, which has a lesser influence compared to the others. Public information, economic consequence, and convenience have a positive and significant influence on perceived behavioral control. The structure of this model explains how the latent variables affect the construct variables, which in turn affect intention for the DRS.

4. Discussions

TPB explains what needs to be done to influence and change a person's behavior and what aspects determine behavior change. In this research, residents' intention to implement a DRS for PET bottle waste is described as a guideline for increasing residents' participation in solving PET bottle waste problems. Various variables have been suggested as critical factors in influencing resident intentions. An explanation of the influence of each variable is described on a variable-by-variable basis in the TPB. In this section, the discussion is based on Table 3, especially the results of the path coefficients and T statistics to show the relationship and positive effect on each variable.

It is assumed that residents who have environmental awareness understand the consequences of uncontrolled waste that affects environmental quality and other aspects such as health and beauty. Environmental awareness (path coefficient: 0.667; T statistic: 28.058) was shown to positively influence attitude. The same result was also found by Juliana et al. (2022) and Wang et al. (2021). When residents' environmental awareness increases, their attitude toward sustainable disposal of plastic bottles also increases, so there is a greater chance that residents will dispose of waste properly. This finding has implications for forming a clearer attitude about the consequences of waste management that result from a lack of environmental awareness. For example, the residents' guidelines for handling plastic bottle waste also convey awareness of environmental damage by highlighting the consequences of improper waste handling.

Environmental awareness (path coefficient: 0.163; T statistic: 5.993) also has a positive effect on subjective norms. Studies by Liao and Xing (2023) also show the same result: since environmental awareness is also the basis for community justification of a person's actions, environmental awareness can increase social pressure if it has been transformed into social regulation. This can increase sanctions that accelerate internalization of environmental awareness in the community and reinforce subjective norms. Environmental awareness has a much stronger effect on attitude than on subjective norms because PET bottles are household products that make waste more individual. Therefore, the pressure on a personal decision is influenced more by the attitude than by the subjective norm originated from the surrounding community. Moreover, subjective norms take time to assimilate because the majority of

Table 3
Hypothesis result.

Hypothesis	Path coefficient	Standard deviation (STDEV)	T statistics (O/STDEV)	P values
H1 Environmental awareness → Attitude	0.667	0.024	28.058	0.000
H2 Environmental awareness → Subjective norm	0.163	0.027	5.993	0.000
H3 Public information → Attitude	0.204	0.023	8.708	0.000
H4 Public information → Subjective norm	0.374	0.032	11.815	0.000
H5 Public information → Perceived behavioral control	0.111	0.030	3.672	0.000
H6 Religious norm → Attitude	0.056	0.020	2.842	0.004
H7 Religious norm → Subjective norm	0.265	0.030	8.694	0.000
H8 Economic consequence → Perceived behavioral control	0.214	0.036	5.922	0.000
H9 Convenience → Perceived behavioral control	0.295	0.037	8.042	0.000
H10 Attitude → Intention	0.511	0.032	15.946	0.000
H11 Subjective norm → Intention	0.175	0.025	6.986	0.000
H12 Perceived behavioral control → Intention	0.214	0.029	7.325	0.000

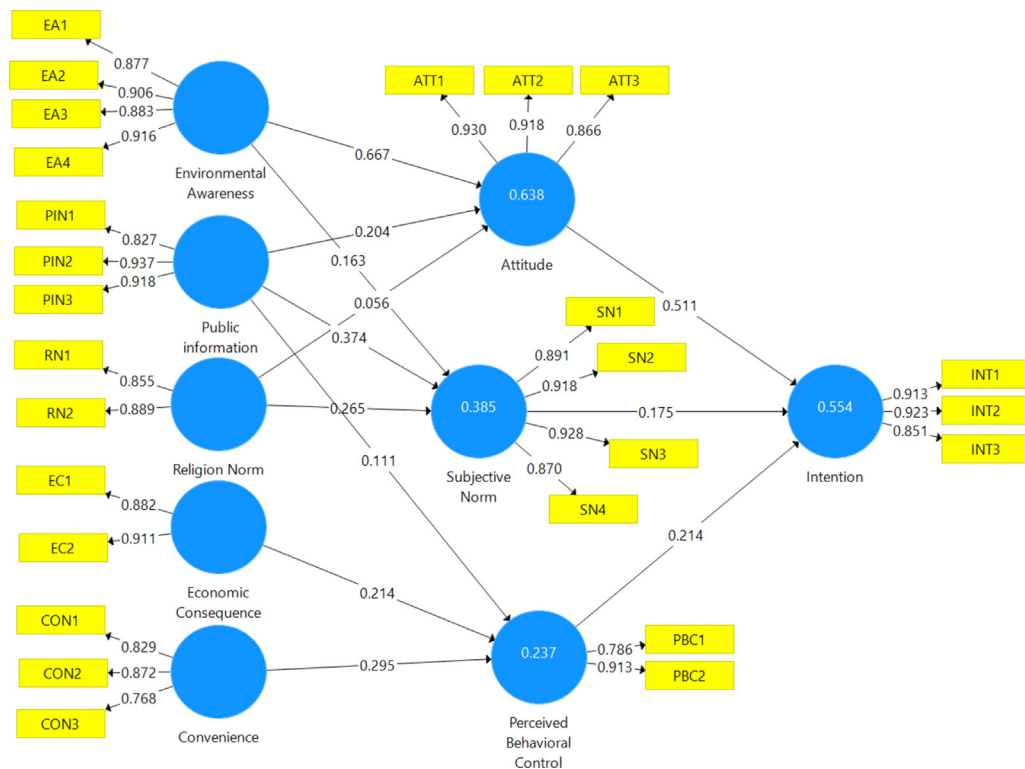


Fig. 4. Model structure.

the community must accept the content of a new norm. In contrast, attitudes can change more quickly because they depend on one's positive or negative view of the context. Thus, environmental awareness is incorporated into a formal regulation and affects residents more quickly.

Public information positively affects attitude, subjective norms, and perceived behavioral control, with subject norms being more highly influenced relative to others. Public information is a precursor to attitude change because the information is processed by the human mind and determines attitude decisions. Research by Si et al. (2022) also shows that public information has a positive effect on attitude (path coefficient: 0.204; T statistic: 8.708) because information provides an idea of correct behavior. Research by Guo et al. (2022) shows that information positively affects subjective

norms and perceived behavioral control, provided that residents pay attention to the information. This suggests that public information is a precursor to attitude change because it is processed by the human mind and influences personal decisions. Furthermore, Wang et al. (2019) concluded that information quality positively influences households' intention to perform waste separation. Therefore, the quality of information disseminated through appropriate media is crucial to effectively reach and motivate residents to participate in waste separation. This is particularly important in areas where the DRS is not yet implemented, as public information can help to raise awareness and promote the benefits of waste separation.

In some countries, religion is enshrined in law as a source of norms and regulations, so a person's religion influences their

actions, including waste separation. Religious norm (path coefficient: 0.056; *T* statistic 2.842) has a positive effect on attitude. Although the effect is small, it can still be considered as an influential variable. A study by Graafland (2017) examined the relationship between religiosity, attitude, and subjective norm. The result was that religiosity has a positive effect on both, but that on attitude is lower. The religious norm (path coefficient: 0.265; *T* statistic: 8.694) has a greater positive influence on the subjective norm. The same result was also reached by Osei-Marfo et al. (2022). Although religious norm has a positive effect, its value is the lowest compared to others, which shows that intervention through religious norm in waste management is not very effective. Furthermore, the comparison between the influence of religious norm on attitude and subjective norm also shows that religious norm is weaker as a source of positive and negative determination in waste management attitudes. On the other hand, religious norm is stronger as social pressure in society to form the subjective norm.

The application of DRS at the individual and household level requires the willingness to pay more money as a deposit. It is very important to check this because it is a variable that is a direct consequence of the DRS implementation. In some studies (Liu et al., 2017; Nduneseokwu et al., 2017; Singh et al., 2018), it is associated with economic incentives, but we define it as an economic consequence because it represents expenditures and income that can occur in the DRS process; expenditures mean that residents lose their deposits if they do not return the bottles, and income because residents collect discarded bottles to earn the deposit. Existing research demonstrates that incentives positively influence perceived behavioral control (Singh et al., 2018). In this study, the term economic consequence is used, which is more general and includes the meaning of benefits. This work shows that losses and economic consequences (path coefficient: 0.214; *T* statistic 5.922) positively influence perceived behavioral control because they can compel residents to exert effort in DRS.

Convenience (path coefficient: 0.295; *T* statistic: 8.042) has a positive effect on perceived behavior control because convenience includes various external support factors that can provide self-efficacy to residents, such as infrastructure, facilities, and support systems. The same conclusion was also drawn by Somroo et al. (2022). Convenience can be achieved by meeting community expectations for various supporting infrastructures and considering the cost, time, and distance of DRS. To further enhance the management of PET bottle waste, it is important to consider the role of convenience as a contributing factor to the success of DRS implementation. This can be achieved by providing various supporting infrastructures that meet community expectations and by considering the cost, time, and distance of the DRS. Furthermore, it is also essential to address the negative factors that may arise during the sorting process and how they may affect the overall success of the DRS. Measures such as education and awareness campaigns can be implemented to inform residents of the negative impacts of improper waste disposal and encourage them to properly sort and dispose of their waste.

Attitude (0.511; 15.946) has a significant and positive influence on intention, which is even stronger than that of subjective norms and perceived behavioral control, as also shown by Khan et al. (2020). It can be seen that residents have the intention to perform DRS when there is an attitude to deal with PET bottle waste. It follows the attitude that DRS is a positive thing that must be disseminated as widely as possible so that all residents are aware of it. The path to shaping the attitude value involves three variables: environmental awareness, public information, and religious norms.

The effect of subjective norm (0.175; 6.950) on intention is smaller than that of attitude and perceived behavioral control. Subjective norm is the pressure that society puts on individuals.

Because of the increasing privacy and individuality in modern society, it is not necessarily likely to influence changes in residents' attitude. DRS itself is more of a private matter, as it does not directly affect other residents. In addition, the weak effect of subjective norms on intention can also be attributed to the fact that residents may prioritize personal convenience over social norms. For instance, if DRS collection points are too far from their residence or require additional effort to use, residents may not participate in the program even if they feel the pressure from their social network to do so. Therefore, it is crucial to consider the convenience and accessibility of the DRS system in order to encourage participation and behavior change among residents.

Perceived behavioral control is the only variable that can directly affect behavior (Bošnjak et al., 2020). Most researches show that the effect on intention is significant with a path coefficient of 0.214. Other research comes to a similar conclusion (Aboelmaged, 2021; Tian et al., 2019; Zhang et al., 2021). Perceived behavioral control has a significant and positive effect by increasing self-efficacy and confidence to perform the DRS.

The model shows that residents' intention to adopt DRS for PET bottle waste recycling can be increased by paying attention to variables that have a positive influence on attitude, subjective norm, and perceived behavioral control. Based on the value, the most significant positive influence is attitude, which shows that Indonesian residents need determination in identifying positive and negative aspects of the application of DRS to strengthen their attitude toward environmental awareness and public information. Perceived behavioral control will increase intention through economic consequences and convenience. The influence of subjective norm mediated by public information, religious norm, and environmental awareness on intention was found to be rather low.

5. Conclusions

The implementation of a DRS can increase the collection rate of PET bottle waste in Indonesia. However, it is necessary to investigate the factors that positively influence residents' intentions to use the DRS since it has not been implemented yet. A structural equation modelling was used to build a model that identifies the factors that determine residents' intentions. It turned out that attitude has the strongest positive effect, followed by perceived behavioral control and subjective norm.

Attitude itself is strongly influenced by environmental awareness. Policies to increase environmental awareness should be implemented by promoting environmental education in communities through formal and informal educational institutions. The impact of public information is less pronounced, but is mediated by attitude, subjective norm, and perceived behavioral control. The media, including the social media platforms widely used in Indonesia, should be encouraged to raise environmental awareness by providing reliable information about the plastic waste issue. Other variables such as religious norms, economic consequences, and convenience have a less pronounced effect, but should be kept in mind in order to avoid discouraging residents.

The model can be applied in other countries or regions since the variables used represent different aspects that are also important in different social conditions. Policymakers can use the proposed model to identify important factors that influence residents' intention to participate in recycling programs, particularly for DRS. Strengthening residents' intention towards recycling plastic waste will have a significant impact on the achievement of sustainable development goals in developing countries, where plastic bottle waste pollutes the oceans and requires immediate intervention by specific policies. Recycling plastic bottle waste can also be an initiation for implementing circular economy because plastic bottle

waste can be recycled into making new products or derivatives due to homogeneity, availability, waste quality, and technology readiness.

Declaration of competing interest

The authors state that they do not have any recognizable conflicting financial interests or personal connections that may have seemed to affect the research presented in this paper.

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References

- Abdelradi, F. (2018). Food waste behaviour at the household level: A conceptual framework. *Waste Management*, 71, 485–493.
- Abolmaged, M. (2021). E-waste recycling behaviour: An integration of recycling habits into the theory of planned behaviour. *Journal of Cleaner Production*, 278, 124182.
- Aikowe, L., & Mazancová, J. (2021). Plastic waste sorting intentions among university students. *Sustainability*, 13, 7526.
- Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, 50, 179–211.
- Amirudin, A., Inoue, C., & Grause, G. (2022). Analyzing polyethylene terephthalate bottle waste technology using an analytic hierarchy process for developing countries: A case study from Indonesia. *Recycling*, 7, 58.
- Amirudin, A., Inoue, C., & Grause, G. (2023). Rethinking waste management in Indonesia using public-private partnership framework: A case study of akhmad amirudin PET bottle waste management. *Nature Environment and Pollution Technology*, 22, 29–38.
- Amit Kumar, G. (2021). Framing a model for green buying behavior of Indian consumers: From the lenses of the theory of planned behavior. *Journal of Cleaner Production*, 295, 126487.
- Astrachan, C. B., Patel, V. K., & Wanzenried, G. (2014). A comparative study of CB-SEM and PLS-SEM for theory development in family firm research. *Journal of Family Business Strategy*, 5, 116–128.
- Balwada, J., Samaiya, S., & Mishra, R. P. (2021). Packaging plastic waste management for a circular economy and identifying a better waste collection system using analytical hierarchy process (AHP). *Procedia CIRP*, 98, 270–275.
- Barba-Sánchez, V., Mitre-Aranda, M., & del Brío-González, J. (2022). The entrepreneurial intention of university students: An environmental perspective. *European Research on Management and Business Economics*, 28, 100184.
- Bošnjak, M., Ajzen, I., & Schmidt, P. (2020). The theory of planned behavior: Selected recent advances and applications. *Europe's Journal of Psychology*, 16, 352–356.
- Brotsusilo, A., & Handayani, D. (2020). Dataset on waste management behaviors of urban citizens in large cities of Indonesia. *Data in Brief*, 32, 106053.
- Chen, Y. (2020). An investigation of the influencing factors of Chinese WeChat users' environmental information-sharing behavior based on an integrated model of UGT, NAM, and TPB. *Sustainability*, 12, 2710.
- Chin, W. W. (1998). The partial least squares approach to structural equation modeling. In *Modern method for bussiness research* (1st ed., p. 488). Psychology Press.
- Chin, W. W. (2010). How to write up and report PLS analyses. In V. Esposito Vinzi, W. W. Chin, J. Henseler, & H. Wang (Eds.), *Berlin&HeidelbergHandbook of partial least squares* (pp. 655–690). Springer Berlin Heidelberg.
- Danchin, E., Giraldeau, L., Valone, T., & Wagner, R. (2004). Public information: From nosy neighbors to cultural evolution. *Science*, 305, 487–491.
- Darko, A., Chan, A. P. C., Yang, Y., Shan, M., He, B.-J., & Gou, Z. (2018). Influences of barriers, drivers, and promotion strategies on green building technologies adoption in developing countries: The Ghanaian case. *Journal of Cleaner Production*, 200, 687–703.
- Fami, H. S., Aramyan, L., Sijtsema, S., & Alambaigi, A. (2019). Determinants of household food waste behavior in tehran city: A structural model. *Resources, Conservation and Recycling*, 143, 154–166.
- Fatimah Mohamad, Z., Idris, N., & Baharuddin, A. (2011). Religion and waste. *Waste Management*, 31, 1905–1906.
- Fergusson, L., Wells, G., & Kettle, D. (2018). The personal, social and environmental sustainability of Jainism in light of Maharishi Vedic Science. *Environment, Development and Sustainability*, 20, 1627–1649.
- Global Plastic Action Partnership. (2020). *Radically reducing plastic pollution in Indonesia: A multistakeholder action plan national plastic action partnership*.
- Graafland, J. (2017). Religiosity, attitude, and the demand for socially responsible products. *Journal of Business Ethics*, 144, 121–138.
- Guo, X., Fan, Z., Zhu, H., Chen, X., Wang, M., & Fu, H. (2022). Willingness to pay for healthy housing during the COVID-19 pandemic in China: Evidence from eye-tracking experiment. *Frontiers in Public Health*, 10, 855671.
- Hair, J. F., Jr., Hult, G. T. M., Ringle, C. M., & Sarstedt, M. (2021). *A primer on partial least squares structural equation modeling (PLS-SEM)*. New York: Sage Publications, 390.
- Hair, J. F., Jr., Ringle, C., & Sarstedt, M. (2013). Partial least squares structural equation modeling: Rigorous applications, better results and higher acceptance. *Long Range Planning*, 46, 1–12.
- Hair, J. F., Jr., Risher, J. J., Sarstedt, M., & Ringle, C. M. (2019). When to use and how to report the results of PLS-SEM. *European Business Review*, 31, 2–24.
- Huang, H. (2016). Media use, environmental beliefs, self-efficacy, and pro-environmental behavior. *Journal of Business Research*, 69, 2206–2212.
- Juliana, N., Lada, S., Chekima, B., & Abdul Adis, A. A. (2022). Exploring determinants shaping recycling behavior using an extended theory of planned behavior model: An empirical study of households in Sabah, Malaysia. *Sustainability*, 14, 4628.
- Kan, M. P. H., & Fabrigar, L. R. (2017). Theory of planned behavior. In V. Zeigler-Hill, & T. K. Shackelford (Eds.), *Encyclopedia of Personality and individual differences* (pp. 1–8). Cham, Switzerland: Springer International Publishing.
- Khan, F., Ahmed, W., & Najmi, A. (2019). Understanding consumers' behavior intentions towards dealing with the plastic waste: Perspective of a developing country. *Resources, Conservation and Recycling*, 142, 49–58.
- Khan, O., Daddi, T., Slabbinck, H., Kleinhans, K., Vazquez-Brust, D., & De Meester, S. (2020). Assessing the determinants of intentions and behaviors of organizations towards a circular economy for plastics. *Resources, Conservation and Recycling*, 163, 105069.
- Koshta, N., Patra, S., & Singh, S. P. (2022). Sharing economic responsibility: Assessing end user's willingness to support E-waste reverse logistics for circular economy. *Journal of Cleaner Production*, 332, 130057.
- Liao, Y., & Xing, Y. (2023). Social capital and residents' plastic recycling behaviors in China. *Journal of Environmental Planning and Management*, 66, 955–976.
- Li, X., Mu, D., Du, J. B., Cao, J. J., & Zhao, F. (2020). Game-based system dynamics simulation of deposit-refund scheme for electric vehicle battery recycling in China. *Journal of Cleaner Production*, 157, 104788.
- Linderhof, V., Oosterhuis, F. H., van Beukering, P. J. H., & Bartelings, H. (2019). Effectiveness of deposit-refund systems for household waste in The Netherlands: Applying a partial equilibrium model. *Journal of Environmental Management*, 232, 842–850.
- Liu, J., Li, G., Li, H., & Wang, Z. (2017). Planned behavior theory-based study on the influencing factors in construction waste reducing willingness—with construction workers as an example. *Ekoloji*, 26, 13–28.
- Lu, D., Lai, I., & Liu, Y. D. (2019). The consumer acceptance of smart product-service systems in sharing economy: The effects of perceived interactivity and participation. *Sustainability*, 11, 928.
- Luu, T. T. N., & Baker, J. R. (2021). Exploring consumers' purchase intention of rPET bottle-based apparel in an emerging economy. *Journal of Open Innovation: Technology, Market, and Complexity*, 7, 22.
- Mak, T. M. W., Yu, I. K. M., Xiong, X. N., Zaman, N. Q., Yaacof, N., Hsu, S. C., Poon, C. S., & Tsang, D. C. W. (2021). A cross-region analysis of commercial food waste recycling behaviour. *Chemosphere*, 274, 129750.
- Mohamad, Z. F., Idris, N., Baharuddin, A., Muhammad, A., & Nik Sulaiman, N. M. (2012). The role of religious community in recycling: Empirical insights from Malaysia. *Resources, Conservation and Recycling*, 58, 143–151.
- Mohd Suki, N., & Mohd Suki, N. (2019). Examination of peer influence as a moderator and predictor in explaining green purchase behaviour in a developing country. *Journal of Cleaner Production*, 228, 833–844.
- Nduneseokwu, C., Qu, Y., & Appolloni, A. (2017). Factors influencing consumers' intentions to participate in a formal E-waste collection system: A case study of onitsha, Nigeria. *Sustainability*, 9, 881.
- Nejati, M., Rabiei, S., & Chiappetta Jabbour, C. J. (2017). Envisioning the invisible: Understanding the synergy between green human resource management and green supply chain management in manufacturing firms in Iran in light of the moderating effect of employees' resistance to change. *Journal of Cleaner Production*, 168, 163–172.

- Noh, M. (2021). Understanding the effect of information sources on college students' recycling/reuse behavior towards clothing and textile products. *Sustainability*, 13, 6298.
- Oke, A., Osobajo, O., Obi, L., & Omotayo, T. (2020). Rethinking and optimising post-consumer packaging waste: A sentiment analysis of consumers' perceptions towards the introduction of a deposit refund scheme in Scotland. *Waste Management*, 118, 463–470.
- Osei-Marfo, M., Vries, N. K., & Awuah, E. (2022). People's perceptions on the use of human excreta for biogas generation in Ghana. *Environment, Development and Sustainability*, 24, 352–376.
- Papaoikonomou, K., Latinopoulos, D., Emmanouil, C., & Kungolos, A. (2020). A survey on factors influencing recycling behavior for waste of electrical and electronic equipment in the municipality of Volos, Greece. *Environmental Processes*, 7, 321–339.
- Pierini, V. I., Mazzeo, N., Cazenave, M., & Semmartin, M. (2021). Waste generation and pro-environmental behaviors at household level: A citizen science study in Buenos Aires (Argentina). *Resources, Conservation and Recycling*, 170, 105560.
- Qonitan, F. D., Wayan Koko Suryawan, I., & Rahman, A. (2021). Overview of municipal solid waste generation and energy utilization potential in major cities of Indonesia. *Journal of Physics: Conference Series*, 1858, 12064.
- Rousta, K., Liu, Z. S., & Hellwig, C. (2020). Household waste sorting participation in developing countries—a meta-analysis. *Recycling*, 5, 6.
- Si, H. Y., Duan, X., Zhang, W. J., Su, Y. Y., & Wu, G. D. (2022). Are you a water saver? Discovering people's water-saving intention by extending the theory of planned behavior. *Journal of Environmental Management*, 311, 114848.
- Singh, M. P., Chakraborty, A., & Roy, M. (2018). Developing an extended theory of planned behavior model to explore circular economy readiness in manufacturing MSMEs, India. *Resources, Conservation and Recycling*, 135, 313–322.
- Snell, H., Nassour, A., & Nelles, M. (2017). Qualitative comparison of polyethylene terephthalate flakes from various collection systems in Germany. *Waste Management & Research: The Journal for a Sustainable Circular Economy*, 35, 163–171.
- Soomro, Y. A., Hameed, I., Bhutto, M. Y., Waris, I., Baeshen, Y., & Al Batati, B. (2022). What influences consumers to recycle solid waste? An application of the extended theory of planned behavior in the kingdom of Saudi Arabia. *Sustainability*, 14, 998.
- Strydom, W. (2018). Applying the theory of planned behavior to recycling behavior in South Africa. *Recycling*, 3, 43.
- Sun, Y., Wang, S. Y., Li, J., Zhao, D. T., & Fan, J. (2017). Understanding consumers' intention to use plastic bags: Using an extended theory of planned behaviour model. *Natural Hazards*, 89, 1327–1342.
- Tian, M., Pu, B., Chen, Y. N., & Zhu, Z. A. (2019). Consumer's waste classification intention in China: An extended theory of planned behavior model. *Sustainability*, 11, 6999.
- Uprichard, E. (2013). Sampling: Bridging probability and non-probability designs. *International Journal of Social Research Methodology*, 16, 1–11.
- Van, L., Abdul Hamid, N., Ahmad, M. F., Ahmad, A. N. A., Ruslan, R., & Muhamad Tamyez, P. F. (2021). Factors of single use plastic reduction behavioral intention. *Emerging Science Journal*, 5, 269–278.
- Vassanadumrongdee, S., & Kittipongvises, S. (2018). Factors influencing source separation intention and willingness to pay for improving waste management in Bangkok, Thailand. *Sustainable Environment Research*, 28, 90–99.
- Wang, Y., Gu, Y. F., Wu, Y. F., Zhou, G. L., Wang, H. B., Han, H. G., & Chang, T. (2020). Performance simulation and policy optimization of waste polyethylene terephthalate bottle recycling system in China. *Resources, Conservation and Recycling*, 162, 105014.
- Wang, K. Q., Lu, J. L., & Liu, H. M. (2021). Residents' waste source separation behaviours in Shanghai, China. *Journal of Material Cycles and Waste Management*, 23, 937–949.
- Wang, S. Y., Wang, J. P., Zhao, S. L., & Yang, S. (2019). Information publicity and resident's waste separation behavior: An empirical study based on the norm activation model. *Waste Management*, 87, 33–42.
- Xevgenos, D., Papadaskalopoulou, C., Panaretou, V., Moustakas, K., & Malamis, D. (2015). Success stories for recycling of MSW at municipal level: A review. *Waste and Biomass Valorization*, 6, 657–684.
- Yaghoubi Farani, A., Mohammadi, Y., & Ghahremani, F. (2019). Modeling farmers' responsible environmental attitude and behaviour: A case from Iran. *Environmental Science and Pollution Research*, 26, 28146–28161.
- Yan, Q. Y., Qin, G. Y., Zhang, M. J., & Xiao, B. W. (2019). Research on real purchasing behavior analysis of electric cars in Beijing based on structural equation modeling and multinomial logit model. *Sustainability*, 11, 5870.
- Yi, S. (2019). Determinants of consumers' purchasing behavior for certified aquaculture products in South Korea. *Sustainability*, 11, 3840.
- Zhang, D. L., Huang, G. Q., Yin, X. L., & Gong, Q. H. (2015). Residents' waste separation behaviors at the source: Using SEM with the theory of planned behavior in Guangzhou, China. *International Journal of Environmental Research and Public Health*, 12, 9475–9491.
- Zhang, S., Hu, D., Lin, T., Li, W., Zhao, R., Yang, H., Pei, Y., & Jiang, L. (2021). Determinants affecting residents' waste classification intention and behavior: A study based on TPB and A-B-C methodology. *Journal of Environmental Management*, 290, 112591.
- Zhang, B., Lai, K., Wang, B., & Wang, Z. (2019). From intention to action: How do personal attitudes, facilities accessibility, and government stimulus matter for household waste sorting? *Journal of Environmental Management*, 233, 447–458.
- Zhou, G. L., Gu, Y. F., Wu, Y. F., Gong, Y., Mu, X. Z., Han, H. G., & Chang, T. (2020). A systematic review of the deposit-refund system for beverage packaging: Operating mode, key parameter and development trend. *Journal of Cleaner Production*, 251, 119660.