

Article

What Influences Consumers to Recycle Solid Waste? An Application of the Extended Theory of Planned Behavior in the Kingdom of Saudi Arabia

Yasir Ali Soomro ¹ , Irfan Hameed ² , Muhammad Yaseen Bhutto ^{3,*}, Idrees Waris ⁴ , Yasser Baeshen ¹ and Bader Al Batati ⁵

¹ Faculty of Economics and Administration, King AbdulAziz University, Jeddah 21577, Saudi Arabia; dr.yasir@hotmail.com (Y.A.S.); ybaeshen@kau.edu.sa (Y.B.)

² College of Business Management, Institute of Business Management, Karachi 75190, Pakistan; irfanhameed.iu@gmail.com

³ Business School, Shandong Jianzhu University, Jinan 250101, China

⁴ Department of Management Sciences, University of Turbat, Turbat 92600, Pakistan; idrees1988@gmail.com

⁵ Jeddah College of Advertising, University of Business and Technology, Jeddah 23435, Saudi Arabia; b.albatati@ubt.edu.sa

* Correspondence: Bhutto.yaseen@hotmail.com



Citation: Soomro, Y.A.; Hameed, I.; Bhutto, M.Y.; Waris, I.; Baeshen, Y.; Al Batati, B. What Influences Consumers to Recycle Solid Waste? An Application of the Extended Theory of Planned Behavior in the Kingdom of Saudi Arabia. *Sustainability* **2022**, *14*, 998. <https://doi.org/10.3390/su14020998>

Academic Editors: Elena Rada, Marco Ragazzi, Ioannis Katsoyiannis, Elena Magaril, Paolo Viotti, Hussain H. Al-Kayiem, Marco Schiavon, Gabriela Ionescu and Natalia Sliusar

Received: 21 December 2021

Accepted: 12 January 2022

Published: 17 January 2022

Publisher's Note: MDPI stays neutral with regard to jurisdictional claims in published maps and institutional affiliations.



Copyright: © 2022 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (<https://creativecommons.org/licenses/by/4.0/>).

Abstract: This extant study attempts to present a comprehensive predictive model for solid waste recycling behavior. Solid waste is a major environmental concern globally. Particularly, the kingdom of Saudi Arabia (KSA), being the larger gulf country in the Middle East is a major contributor to solid waste. Consequently, this study was carried out to identify the motivational factors that consumers consider important for recycling their household waste. We extended the theory of planned behavior (TBP) and utilized actual behavioral variables such as resell, reuse, and donation. A structured questionnaire was carried out with 365 purposively selected respondents in the KSA. Among several other noteworthy findings consistent with previous studies, we found that reselling was the most significant factor of recycling behavior followed by donation. Further, the multi-group analysis (MGA) results reveal significant group differences in gender and age variables; the significance test indicates that the male group has much better pro-environmental behavior than the female group. In terms of age, our results showed that recycling intention and reselling behavior passed a significant test in the elderly group when compared to a younger group. This study has unique contributions and findings leading to practical implications for government authorities, businesses, and non-governmental organizations. The findings will particularly aid in increasing the recycling intention and behavior among household consumers. This research will guide in making laws and policies that can help to embrace the green challenges and boost recycling activities for a sustainable environment.

Keywords: recycling waste; theory of planned behavior; moral norms; convenience; awareness of consequence; resell; reuse; donate

1. Introduction

Environmental degradation, pollution and global warming are major challenges facing mankind in the 21st century [1]. Therefore, environmental sustainability has become a vital issue for the health of all living beings on the planet Earth. The primary cause for environmental depletion is the unhealthy activities of humankind [2]. Households are mainly considered accountable for environmental effects like pollution and the rapid increase in global warming. A sustainable environment can be attained by controlling the use of energy [3] and fossil fuels [4]. Similar results can also be expected by molding behavior towards organic food consumption [5], green products purchase behavior [6], and post-purchase behavior of recycling [7]. Extant literature suggests that developing

countries are the major contributor to an unhealthy environment [8]. Thus, this study attempts to contribute towards environmental sustainability by focusing on recycling behavior concentrated in a developing country.

Recycling is seen as an effective way of reducing the cost of collecting, transporting, and treating waste [9,10]. Additionally, it increases the life of landfills or an incinerator used for solid waste treatment and generates revenue for recyclers [11]. Recycling behavior is described as sorting waste into designated waste containers or collecting behavioral waste materials for resale to recyclers. After collection, these recyclable materials are converted into new goods. Paper, glass, plastics, and metals, such as iron, copper, and aluminum, are all included in solid waste (SW) [11]. Recycling is one way to help preserve the environment and decrease resource depletion. In fact, high levels of recycling, such as reduced usage, reuse, and repair or refurbishment, can enable a product to perform at a particular level of service with fewer material inputs than necessary. Therefore, recycling can reduce energy and materials used per output unit, resulting in increased eco-efficiency [12]. According to Ma et al. [13], a continuous increase in the amount of municipal solid waste limits the improvement of the population's quality of life. It has become an essential obstacle to sustainable development. Similarly, Zhang et al. [14] mentioned that improper management of waste streams caused health and environmental externalities.

The majority of researches on SW recycling behavior have been conducted in developed economies such as in the United Kingdom, Germany, Australia, Switzerland, and the United States [15,16] or emerging economies including China, South Korea, Vietnam, India, and Pakistan [8,17–19]. However, research on SW recycling behavior in the context of middle-eastern countries has been less investigated [20,21]. Developing countries lack a mechanism for managing SW generation and disposing of SW in landfill sites [22,23]. Saudi Arabia is the leading oil-producing country in the world [24]. While experiencing rapid industrial and economic growth, Saudi Arabia faces several severe environmental challenges and problems. These challenges include air pollution, energy and solid waste, and water pollution [25]. Out of the total 30.8 million tons of SW each year, Saudi Arabia creates over 15.3 million tons of urban municipal waste [26]. Personal and daily waste is estimated at 1.5–1.8 kg per day [27]. This substantial solid waste generation in Saudi Arabia creates serious ecological and communal health issues [28].

Therefore, to fill the contextual gap in the existing literature, this study has three significant theoretical contributions. Firstly, this research extends the TPB by incorporating moral norms as a determinant of subjective norms (SN), convenience as a determinant of perceived behavioral control (PBC), and awareness of consequences as a determinant of SW intention. Secondly, past literature has pointed out that SW intention positively correlates with SW behavior (Lou et al., 2020; Ma et al., 2018). However, the behavior is a broader term, in the majority of the existing studies; the impact of intention has been investigated behavior as a single factor. This study narrows down the gap by subdividing behavior into various types because the post-purchase behavior of individuals can also vary in terms of actual behavior. Therefore, this study investigates the relationship between SW intention and reuse, resell and donation. Recent studies concentrated on the factors that influence SW recycling intention and behavior by generally ignoring the categories of behavior [13,29]. Thirdly, most scholars have focused on the SW intentions and behaviors of samples of the broader population; nevertheless, the research on differences between groups is lacking. Some recent studies have attempted to add socio-demographic factors into their models to investigate group differences [30–32]. Thus, this study applies multi-group analysis (MGA) to deepen the structural equation model analysis and explore the SW intentions based on different characteristics, i.e., gender, age, and education.

Theories grounding the study, literature review, and hypotheses development have been presented in Section 2. Section 3 discusses the sample and instruments, followed by the interpretation of results in Section 4. Finally, Section 5 highlights the discussions, conclusion, implications, and dimensions of the future research.

2. Literature Review and Hypothesis Development

2.1. Theoretical Background

Several theories have been proposed, modified, and applied to enhance and understand recycling behavior. Prominent theories include the theory of reasoned action [33,34], behavioral reasoning theory [35], valence theory [36], Unified theory of acceptance and use of the social app (UTAU-SA) [37]. TPB is an extension of the TRA, which was necessitated given the original model's limits in evaluating behaviors in which people have only partial volitional control [38]. The TPB is widely acknowledged as reliable and is used to investigate all types of human behavior [39,40]. Several researchers have utilized it to explain buying and consuming behavior, such as predicting healthy consumption behaviors [41,42], sustainable consumption [40], and pro-environmental purchase intentions, such as customers' green hotel visit intention [43] and adoption of energy-efficient home appliances [32]. In addition, the theory of planned behavior (TPB) has been the most widely deployed theory to predict recycling behavior [18,44–47].

The TPB provides a framework for examining the predictors of behavioral choices. According to the TPB, individual behavior is an outcome of behavioral intentions, whereas intentions are a function of attitude toward the behavior, subjective norms, and perceived behavioral control [48]. Fundamentally, the TPB posits that the greater the behavioral intentions, the higher the probability that a specific behavior will be enacted. However, despite considerable support, the model has received several criticisms. The major criticism refers to the necessity to include additional variables to improve its predictive and explanatory power [49–51]. It is argued that the TPB framework does not explain a sufficient proportion of the variance in intentions. Ajzen [48] acknowledged that the TPB allows for integrating additional variables if they significantly contribute to explaining behavior. Therefore, several researchers have suggested incorporating new variables that are relevant in the sense that they may theoretically influence intentions and behavior to improve the explanatory power of the TPB [13,32,47]. Researchers have expanded TPB associated with recycling behaviors by adding more variables to improve the predictive accuracy of TPB such as environmental concern and self-efficacy [47], perceived benefits and perceived cost [52], past behavior [53], situational factors [13], concern for the community [54], awareness towards the environmental problems and knowledge [55,56], environmental consciousness [57], institution and governance [58], socio-economic factors [45], place attachment and awareness of consequences [46], peer and surrounding influence [59], and recycling habits [44]. Therefore, to attain the study contributions, the concepts of moral norms (MN), awareness of consequences, and convenience have been incorporated into the TPB model. To increase the predictive power of the recycling behavior model, our studies develop a conceptual model and provide empirical evidence to authenticate the proposed model in the context of KSA.

2.2. Extending Theory of Planned Behavior

The current study adopted the TPB model used by Ajzen [48] as a theoretical framework to explain recycling behavior. This theory states that specific behavior is driven by a person's intention to act. The intention reflects motivations and cognitive planning for engaging in the behavior and is determined by three key cognitive factors: attitude, subjective norm, and perceived behavioral control (PBC) [60].

The term "attitude" refers to an individual view and assessment of a particular behavior. Attitude is a subjective response to a specific situation that can be positive or negative [61]. Generally, it is an induced emotional state toward a particular object, issue, or organization [44]. Attitudes have been demonstrated to be significant predictors of pro-environmental behavior [62]. This was demonstrated by Rajaei et al. [25] who found that in Iran, tenants' attitudes toward green buildings significantly impact their tenancy intentions. According to Kelly et al. [63], a favorable attitude towards recycling has a noticeable effect on recycling behavior. Many studies on recycling have discovered that positive attitude regarding recycling impacts recycling intentions and behavior [47,54,64].

Therefore, in general, the literature is supportive of the hypothesis that there is a strong positive relationship between attitudes about recycling and intentions to recycle.

The concept of subjective norms (SN) refers to an individual's feeling of societal pressure regarding whether or not a person should do something [48]. When it comes to social pressure, the people in your life, such as your family and friends, can influence your behavior. People are likely to behave in such a way that is favored by close ones. Prior research has established that subjective norms have a significant effect on pro-environmental intentions [44]. Jiang et al. [13] investigated the psychological factors that influence the intentions of Chinese farmers to recycle agro-waste and claimed that subjective norms could significantly improve the intentions to recycle the waste. Correspondingly, Khan et al. [8] used the TPB lens to examine behavioral intentions to reuse or dispose of plastic waste in the developing context. Subjective norms have significantly influenced consumers' intention to return [65,66]. Numerous studies have revealed a significant positive relationship between subjective norms and intention [65,67].

Perceived behavioral control is defined as "people's perceptions of their ability to perform a particular behavior" [48]. It measures an individual's conviction and control over a specific activity, which reinforces their commitment to adopt that behavior. Numerous studies have examined PBC as a predictor of behavioral intention [8,32,47]. In developing countries, research revealed that behavioral control is a strong predictor of household users' intention to recycle or reprocess obsolete household or electronic devices every week [68]. Niaura [69] asserted that perceived behavioral control is a significant determinant of intention to protect the environment using a sample of young adults. Derived from TPB theory, we can propose the subsequent hypotheses:

Hypothesis 1 (H1). *Attitude has a positive impact on the intention to recycle solid waste.*

Hypothesis 2 (H2). *Subjective norms (SN) have a significant impact on solid waste recycling intention.*

Hypothesis 3 (H3). *PBC has a significant impact on solid waste recycling intention.*

2.2.1. Awareness of Consequences & Intention to Recycle

Awareness of Consequences (AC) refers to an individual's awareness of the consequences of their actions [54]. Awareness of Consequences are one of the most frequently added variables in the model of TPB [8,54]. Choosing to act in a way that complies with environmental development criteria necessitates an awareness of the consequences of such action [46]. Aboelmaged [44] suggested that people in emerging economies are less inclined towards e-waste recycling due to a lack of awareness regarding environmental issues. Wan et al. [70] studied university students' and staff's recycling behavior and found a direct and significant impact of awareness on recycling intention in university campuses. Khan et al. [8] found that awareness of consequence is one of the significant predictors of plastic recycling in developing markets. Similarly, Tonglet et al. [54] discovered that AC is a significant predictor of recycling intention. Wan et al. [46] recently found a significant effect of awareness of consequences on intention to use recyclable packaging. Based on substantial evidence from the literature, we suggest that AC can be added to the TPB model as a direct antecedent of recycling intention and propose the following hypothesis:

Hypothesis 4 (H4). *AC has a significant impact on solid waste recycling intention.*

2.2.2. Moral Norms as the Antecedent of Subject Norms

Moral norms refer to an individual's judgment of whether a particular behavior is morally correct or incorrect. In recent studies, moral norms have been added to the extended TPB to examine recycling behavior [44,71]. Previous research has established a strong link between moral norms and pro-environmental behavioral intention that is both significant and positive [72]. Kochan et al. [73] redefined subjective norms as perceived

norms, while others have proposed moral norms as new forms of perceived norms [46,74]. However, the link between moral norms and subjective norms towards the intentions to recycle was primarily ignored by researchers in the developing context, particularly in the context of Saudi Arabia. Therefore, it is argued that moral norms are an antecedent of subject norms. As such, this study suggested that the moral norms of an individual can positively influence subjective norms for recycling solid waste. Therefore, this study proposed the latter hypothesis.

Hypothesis 5 (H5). *MN has a significant impact on SN.*

2.2.3. Relationship between Convenience and PBC

Convenience is a subjective perception that relies on the limitations of time and space and the ease with which people complete an activity [46,54]. The frequency with which individuals visit recycling hubs or collection sites can be connected to their perceived convenience [75]. Kianpour et al. [68] stated that convenience and ease are typically addressed in the context of perceived behavior control, specifically in the perspective of recycling; however, both are conceptually different. Perceived behavioral control is an intrinsic motivation whereas, convenience is extrinsic. According to previous research, when recycling is convenient for customers, they are more likely to visit drop-off places [76]. Additionally, convenience is a significant aspect in encouraging recycling behavior [8]. Earlier research has established a strong positive association between convenience and recycling intention [72]. Additionally, there is an association between PBC and convenience. The PBC contains the perceptual function associated with certain behavior; furthermore, convenience is a valuable driver that influences an individual's behavior [77]. With these arguments, the authors proposed the following hypothesis:

Hypothesis 6 (H6). *Recycling Convenience has a positive impact on PBC.*

2.2.4. Recycling Intention to Reselling Behavior

The widely used theory of planned behavior also suggests that the intention can be converted into the behavior [48]. Sustainable consumer behavior is a complex term and can vary to a great extent [2]; therefore, we studied the phenomenon in more detail. An individual's behavior can be more precisely divided into several dimensions in terms of recycling. Though the idea of recycling has gained importance, however, it is only a single component of the reduce, reuse and recycle circle [78].

There is a useful life for each product. Products may not be further usable after achieving the purpose of purchase. Such products are no longer required for individuals and can be disposed of in many ways. One of the ways by which consumers can recover a certain portion of the cost of the product is reselling [79]. Reselling is a process by which consumers try to sell the used product to the other individuals seeking that product. Resale can be to earn money, help others by providing a good product at a low price, or even to protect the environment by not disposing it as waste [80].

However, the recycling resellers reported that they resold a product because their unwanted product still had perceived value, and they did not want it to be wasted. It has been reported that 12 to 15 percent of Americans make their purchases from resale stores [81]. Among various options available for purchasing used clothing, eBay alone has more visitors than Victoria Secret. Prior research has provided significant results about consumers' recycling intention and reselling behavior regarding certain categories of waste, e.g., textile [82] and plastic [8]. Hence, we posit the following:

Hypothesis 7 (H7). *Recycling intention has a positive impact on reselling behavior.*

2.2.5. Recycling Intention to Reusing Behavior

Consumers usually purchase a product for a purpose, and after using that product, they may consider using it for another purpose. After consumption, the product might have no or inferior monetary or functional value [83]. The consumers intending to recycle their products also tend to use the products for some other purposes. They prefer to convert the waste products into something usable [68]. Reusing the product increases the life of the product as it still has the share in the list of useful products. This delays the period of adding the product into waste and increases the recycling facilities.

Reusing consists of various ways of converting waste items into useful products. This may incorporate all together reprocessing to make different new products [81]. A consumer can reuse a product due to various reasons, including environmentally motivated reuse to preserve the natural environment (Shim, 1995). Thus we suggest the same regarding the recycling of solid waste as follows:

Hypothesis 8 (H8). *Recycling intention has a positive impact on reusing behavior.*

2.2.6. Recycling Intention to Donating

Consumers also consider donating their used products to others. Certain products may be usable, and the consumer has achieved the desired purpose of use [84]. These kinds of products are usually discarded by donating them to other potential users of the product. People prefer to donate their used stuff to their friends and family instead of throwing it as waste [85]. The practice of donating to charitable organizations is also common [86]. Morgan and Birtwistle [87] suggested that the remorse emotion stops people from disposing of their expensive clothing, and they ultimately opt for donation.

Shim [79] linked donation with environmental sustainability and concluded that people are expected to donate for environmental protection reasons. A few authors have discussed donating in relation to recycling behavior in different contexts, e.g., textile [82], and plastic [8]. The authors have further suggested that recycling intention and donating behavior are very thoroughly connected [87]. Thus, we recommend the same for solid waste as follows:

Hypothesis 9 (H9). *Recycling intention has a positive impact on donating behavior.*

2.2.7. Role of Gender, Age, and Education in the Model

Various socioeconomic characteristics including race, religion, and social status, affect environmental awareness, concern, and pro-environmental conduct. Prior studies have also analyzed how these socio-demo-economic elements converge to influence recycling behavior and environmental values [88,89]. The literature further suggests that pro-environmental behavior is impacted by gender, household size, income, community dynamics, age, marital status, and education [75,89].

The eco-feminist theoretical framework Nagel. Ref. [90] claims that women are more environmentally conscious and exhibit more pro-environmental behavior than men. Andrew et al. [89] have found that women demonstrate higher environmental concern than men, which means they exhibit more pro-environmental activities. Furthermore, according to Milfont and Sibley [91], women seem to be more environmentally conscious than men are. On the contrary, Andrew et al. [89] advocate that men have string environmental values than women.

Some researchers believe that if adolescents have a better education and understanding of climate change science, they will act to support the environment [15,92]. In a study, Wray-Lake et al. [93] demonstrated that high school seniors place greater responsibility on government agencies than themselves for environmental conservation. According to Andrew et al. [89], advancement through university education favorably affects environmental values. However, little research has investigated how literacy and age influence environmental beliefs and intentions. Thus, this study investigates the influence of three

demographic variables, namely gender, age, and education, through multi-group analysis on the conceptualized model, as shown in Figure 1.

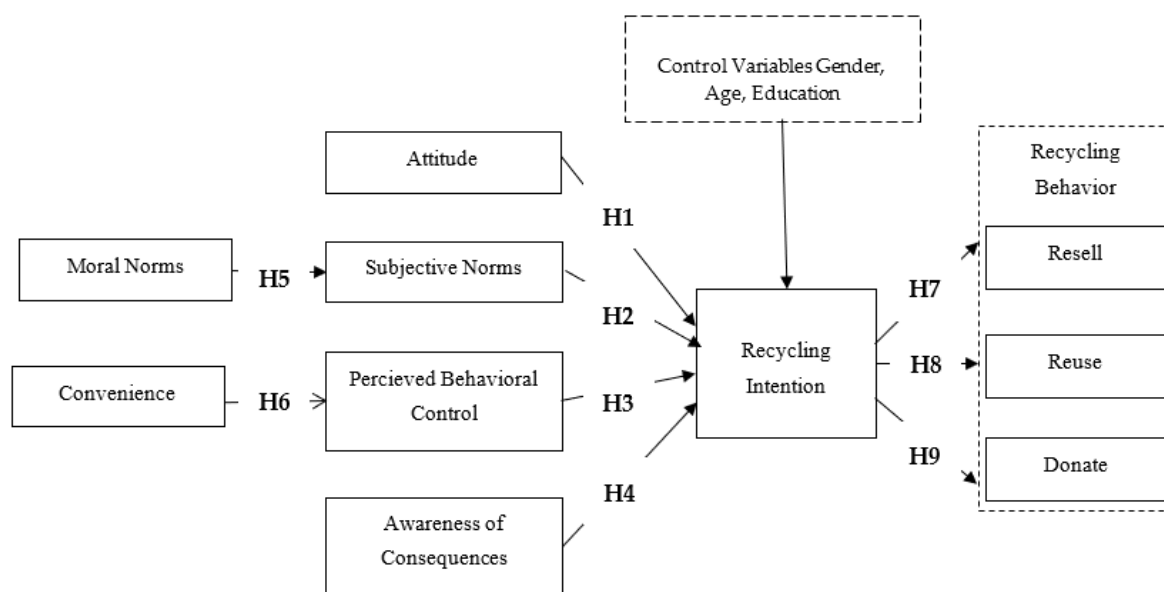


Figure 1. Conceptual Research Model TPB extended.

3. Methodology

3.1. Sample

In this study, respondents' data were collected via Google Form. The link was sent to the participants through convenience sampling. Owing to the COVID-19 restrictions in various locations of Saudi Arabia, we decided to collect online data from the respondents. Data collection was carried out from 8 March 2021 to 22 June 2021. A total of 702 questionnaires were sent through email and the WhatsApp numbers of the participants. We gathered the responses from 371 respondents with an effective response rate of 52.84%. The demographic profile of the respondents included gender, age, qualification, profession, and monthly household income in Saudi riyals. The detailed demographic profile of the respondents is given in Table 1.

3.2. Measurement

This study adopted the items from the work of past researchers. Although, the effectiveness of adopted measurement scales has been confirmed in many studies, we have followed item modification to ensure content and face validity. The first section was demographic information of the participants, and the second was related to the items of the constructs used in the study. As previously stated, all items for determinant constructs, namely Attitude (ATT), Subjective Norms (SN), Perceived Behavioral Control (PBC), Awareness of Consequences (CA), Moral Norms (MN), and Convenience (C), as well as recycling intentions (RI), were adapted [54,76] and modified using a five-point Likert scale to fit this study. Whereas, items for Recycling behavior (reuse, resell and Donate) were taken from Domina and Koch [82]. The description of constructs is provided in Table A1, Appendix A. Before distributing the questionnaire to the final respondents of the study, a pilot study was conducted on 65 respondents. The results of the pilot study showed that all items have satisfactory factor loadings. Then, we conducted a formal survey for data collection.

Table 1. Respondents' Profile.

		Frequency	Percentage
Gender	Male	272	74.5
	Female	93	25.5
Age	Below 20	10	2.7
	20–30	168	46
	31–40	104	28.5
	41–50	34	9.3
	Above 50	49	13.4
Qualification	Intermediate	47	12.9
	Bachelor's Degree	221	60.5
	Master's Degree	73	20
	Doctoral Degree	24	6.6
Profession	Government Employees	81	22.2
	Own Business	32	8.8
	Private sector employee	102	27.9
	Student	112	30.7
	Other	38	10.4
Household Income	Below 5000	148	40.5
	5000 to 10,999	49	39.56
	11,000 to 20,000	91	24.9
	Above 20,000	77	21.1

4. Results

4.1. Data Screening

To identify multivariate outliers, we used the Mahalanobis distance technique. In this technique, a probability variable was created to recognize the outliers in the data set. The probability variable values less than 0.001 were removed from the data set [2]. The totals of six outliers were identified from the data set. This resulted in the valid data set of 365 respondents for the final analysis.

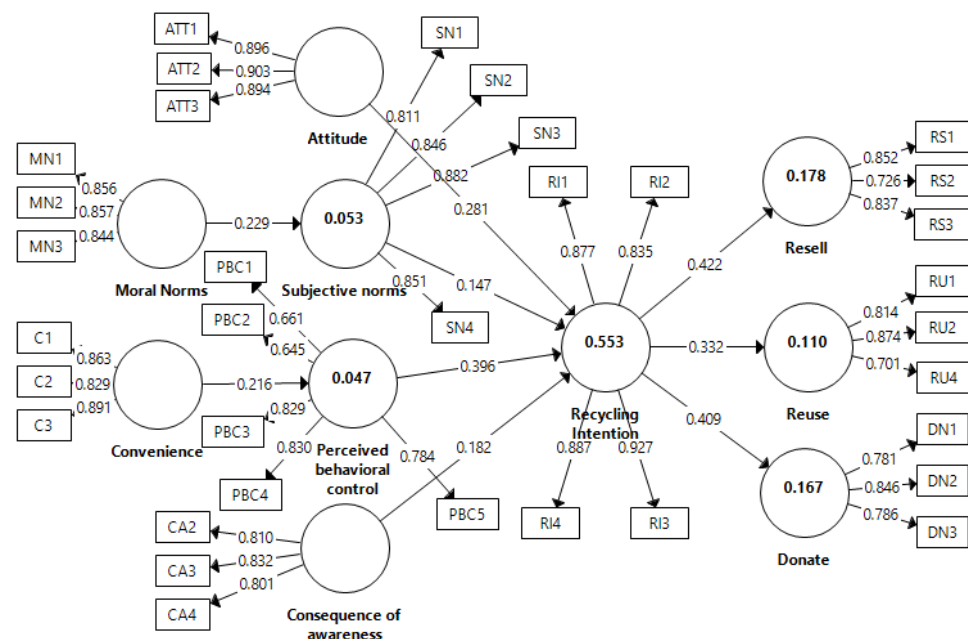
Further, we have applied Harman's single factor test to ensure the data are free from common method bias. The presence of common method bias indicates data weakness and inflates the study's outcome [94]. A single factor representing more than 50% indicates the presence of common method bias. In this study, a single factor has only explained 9.2% variance in the data that shows data are free from common method bias [95].

4.2. Measurement Model

In this study, Partial Least Squares Structural Equation Modelling (PLS-SEM) has been applied to assess measurement and structural models. PLS-SEM is a robust technique that can be used to reduce sample size, is suitable for theory development and does not require data normality [96]. We followed two approaches. First, we assessed the measurement model for reliability and convergent validity. Then, we evaluated the structural model for hypotheses testing. According to Hair et al. [97], data are reliable and internally consistent when Cronbach's alpha values exceed 0.70. In this study measurement model depicts that Cronbach's alpha values for all constructs are above 0.70. Composite reliability (CR) values for all constructs are above 0.70, confirming that data are reliable and internally consistent [97]. For confirming convergent validity, the values of CR must be greater than 0.70, and the values of average variance extracted (AVE) must be greater than 0.50 [98]. Convergent validity establishes as the values of CR and AVE are greater than the recommended threshold values as given in Table 2 and Figure 2.

Table 2. Measurement model.

Constructs	Items	Loading	Cronbach's Alpha	CR	AVE
Moral Norms	MN1	0.856	0.816	0.889	0.727
	MN2	0.857			
	MN3	0.844			
Convenience	C1	0.863	0.829	0.896	0.742
	C2	0.829			
	C3	0.891			
Attitude	ATT1	0.896	0.879	0.925	0.805
	ATT2	0.903			
	ATT3	0.894			
Subjective Norms	SN1	0.811	0.870	0.911	0.719
	SN2	0.846			
	SN3	0.882			
	SN4	0.851			
Perceived Behavioral Control	PBC1	0.661	0.808	0.867	0.569
	PBC2	0.645			
	PBC3	0.829			
	PBC4	0.830			
Consequence of Awareness	CA1	0.810	0.746	0.855	0.663
	CA2	0.833			
	CA3	0.801			
Recycling Intention	RI1	0.877	0.905	0.933	0.778
	RI2	0.835			
	RI3	0.927			
	RI4	0.887			
Resell	RS1	0.852	0.730	0.848	0.652
	RS2	0.726			
	RS3	0.837			
Reuse	RU1	0.814	0.715	0.841	0.639
	RU2	0.874			
	RU3	0.701			
Donate	DN1	0.781	0.728	0.846	0.648
	DN2	0.846			
	DN3	0.786			

**Figure 2.** Measurement model.

4.3. Discriminant Validity

Discriminant validity refers to the degree to which a construct is unrelated to other constructs [97]. In this study, we have used Fornell and Larcker and Heterotrait-Monotrait (HTMT) ratio criteria. According to Fornell and Larcker [99], discriminant validity confirms when the values of square roots of all AVEs are above the corresponding correlation values. Table 3 shows that all the values of square roots of AVEs are greater than the corresponding correlation values confirming discriminating validity. Second, we assessed discriminant validity through the HTMT criterion. As per the HTMT criterion, the values of all constructs should be less than 0.90. Table 4 shows that the discriminant validity establishes that the values of constructs are below 0.90 [100].

Table 3. Discriminant Validity (Fornell and Larcker’s criterion).

	ATT	CA	CO	DN	MN	PBC	RI	RS	RU	SN
Attitude	0.897									
Consequence of awareness	0.424	0.814								
Convenience	0.169	0.195	0.861							
Donate	0.398	0.266	0.309	0.805						
Moral Norms	0.256	0.337	0.406	0.218	0.852					
Perceived behavioral control	0.293	0.201	0.216	0.323	0.010	0.754				
RI	0.567	0.432	0.316	0.409	0.268	0.583	0.882			
Resell	0.294	0.360	0.318	0.389	0.379	0.247	0.422	0.807		
Reuse	0.194	0.194	0.285	0.387	0.111	0.445	0.332	0.308	0.800	
Subjective norms	0.626	0.342	0.166	0.326	0.229	0.457	0.567	0.338	0.326	0.848

Note: ATT = Attitude, CA = Consequences of awareness, CO = Convenience, DN = Donate, MN = Moral norms, PBC = Perceived behavioral condition, RI = Recycling intention, RS = Resell, RU = Reuse, SN = Subjective Norms.

Table 4. Discriminant Validity (HTMT criterion).

	ATT	CA	CO	DN	MN	PBC	RI	RS	RU	SN
Attitude										
Consequence of awareness	0.525									
Convenience	0.191	0.242								
Donated	0.494	0.359	0.389							
Moral Norms	0.300	0.429	0.504	0.273						
Perceived behavioral control	0.336	0.248	0.250	0.420	0.137					
RI	0.631	0.525	0.362	0.498	0.303	0.666				
Resell	0.370	0.491	0.403	0.532	0.494	0.305	0.516			
Reuse	0.245	0.274	0.366	0.541	0.158	0.592	0.410	0.431		
Subjective norms	0.708	0.422	0.194	0.407	0.254	0.535	0.633	0.420	0.417	

Note: ATT = Attitude, CA = Consequences of awareness, CO = Convenience, DO = Donate, MN = Moral norms, PBC = Perceived behavioral condition, RI = Recycling intention, RS = Resell, RU = Reuse, SN = Subjective Norms.

4.4. Assessment of Structural Model

In this study, we assessed the structural model using the 2000 bootstrapping re-sampling method. For model fit, we have evaluated cross-validating redundancy (Q^2), the model’s predictive accuracy through R^2 values. The values of Q^2 for all endogenous constructs were above 0, representing the model’s predictive relevance [100]. Further, R^2 values show the variance explained by the exogenous constructs on endogenous constructs.

In this study, the values of R^2 for all endogenous constructs were 11% to 55.3%. This shows the accuracy of the proposed model.

There were nine hypotheses for the proposed model. The acceptance and rejection of hypotheses were based on t -values and p -values. Further, we assessed the strength of the relationship among the constructs using path coefficient values. The values closer to +1 depict a higher correlation and vice versa. All the proposed hypotheses were significant at $p < 0.05$. H1 proposed positive relationship between attitude and recycling intention, which was accepted ($\beta = 0.281, p = 0.000$); H2 established a positive relationship between subjective norms and recycling intention, which was accepted ($\beta = 0.147, p = 0.010$); H3 and H4 were related to perceived behavioral control (PBC) and consequence of awareness effect on recycling intention, respectively, both were accepted ($\beta = 0.396, p = 0.000$; $\beta = 0.182, p = 0.000$). Results of H5 and H6 also revealed a positive relationship between Moral Norms and Subjective Norms ($\beta = 0.229, p = 0.000$); and convenience and PBC ($\beta = 0.216, p = 0.000$). Further, H7 was also supported that showed a significant positive influence of recycling intention on Resell. Results for Hypotheses H8 and H9 were in acceptable range ($\beta = 0.422, p = 0.000$; $\beta = 0.332, p = 0.000$); hence, the results revealed a positive relationship between recycling intentions and reuse and donation, respectively. Results can be seen in Table 5 and Figure 3.

Table 5. Hypotheses assessment summary.

Hypotheses	Beta	p -Values	t -Values	Decision
ATT→RI	0.281	0.000	5.045	Accepted
SN→RI	0.147	0.010	2.589	Accepted
PBC→RI	0.396	0.000	9.534	Accepted
CA→RI	0.182	0.000	3.918	Accepted
MN→SN	0.229	0.000	4.322	Accepted
CO→PBC	0.216	0.000	4.400	Accepted
RI→RS	0.422	0.000	8.155	Accepted
RI→RU	0.332	0.000	7.360	Accepted
RI→DN	0.409	0.000	8.635	Accepted

Note: ATT = Attitude, CA = Consequences of awareness, CO = Convenience, DO = Donate, MN = Moral norms, PBC = Perceived behavioral condition, RI = Recycling intention, RS = Resell, RU = Reuse, SN = Subjective Norms (The path is significant at a p -value of 0.05).

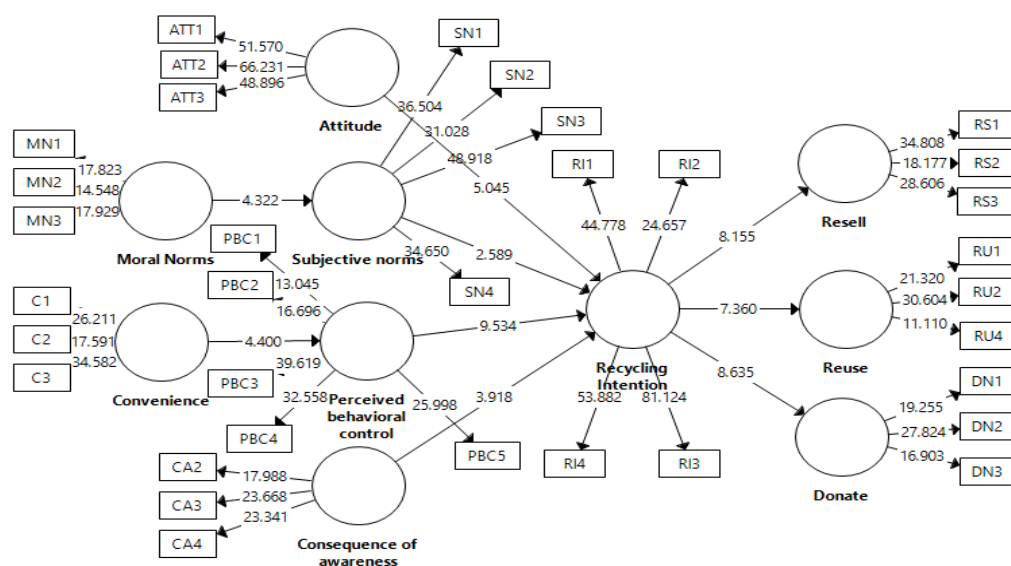


Figure 3. Structural model.

4.5. Multi-Group Analysis (Age, Gender, and Education)

To assess the effects of age, gender, and education on the distinct groups, multi-group analysis (MGA) was utilized in Table 6. Age and gender were already categorical variables,

and education level was converted by making two groups of high and low educated. Henseler [101] presented a more sophisticated extension: the PLS-MGA technique (Multi-Group Analysis), which identifies significant differences between groups when they are less than or equal to 0.05 or greater than 0.95. We applied the percentile bootstrapping method to analyze the differences between the groups in our investigation. When the p -value was larger than 95% or less than 5%, the results indicated a significant inter-group variance with an error margin of 5%. The percentile value less than 5% implies that group A's bootstrapping findings are greater than group B's. The percentile value greater than 95% indicates that group B's results are greater than group A's.

Table 6. MGA analysis.

	H1	H2	H3	H4	H5	H6	H7	H8	H9
Gender									
Male	0.266	0.215	0.409	0.121	0.186	0.257	0.358	0.340	0.362
Female	0.243	0.031	0.373	0.314	0.318	0.155	0.595	0.363	0.540
Diff	0.023	0.185	0.037	−0.193	−0.133	0.102	−0.238	−0.023	−0.178
PLS MGA Value	0.858	0.123	0.709	0.061	0.319	0.494	0.045	0.319	0.085
Age									
Young	0.254	0.194	0.398	0.187	0.116	0.242	0.453	0.312	0.380
Old	−0.040	0.084	0.026	−0.003	−0.239	0.022	0.045	−0.027	−0.059
Diff	0.294	0.110	0.372	0.190	0.356	0.220	0.408	0.339	0.440
PLS MGA Value	0.732	0.463	0.782	0.977	0.081	0.795	0.984	0.534	0.534
Education									
High	0.233	0.108	0.382	0.126	0.225	0.257	0.469	0.208	0.365
Low	0.266	0.168	0.399	0.199	0.244	0.204	0.414	0.372	0.418
Diff	−0.033	−0.060	−0.018	−0.073	−0.020	0.053	0.055	−0.164	−0.053
PLS MGA Value	0.783	0.782	0.890	0.559	0.945	0.608	0.576	0.161	0.659

Note: Bold font: PLS-MGA p -value below 5% and above 95% indicates significant values. Diff = Path Coefficient Differences.

The results of the PLS-MGA p -value show significant group differences. For gender, H7 ($p = 0.045$) differed significantly, representing that the relationship between recycling intention and reselling behavior was stronger for the male group than the female group. For age, H7 ($p = 0.986$) differed significantly, revealing that the relationship between recycling intention and reselling behavior was stronger in the older group than the younger group. For education, H5 ($p = 0.945$) differed significantly, showing that the relationship between moral norms and subjective norms is stronger for the less-educated group than for the group with high education level.

5. Discussion & Conclusions

Solid waste has been recognized as a major problem for environmental sustainability. Even though its importance has not been denied, the waste management behavior is not common in most developing countries of the world. One of the documented ways of dealing with waste is recycling. The recycling of waste is not a generally practiced method in the KSA. This study aimed to identify the motivational factors that are considered important by the consumers for recycling their waste. The current research paper adds to the body of knowledge in two ways; first, it identifies certain antecedents of TBP; secondly, it studies behavior into three different categories in order to explore into this vital aspect. Theoretically, this study identified the elements influencing post-purchase consumer behavior. The factors and the influence of each factor on the recycling intention and ultimately on the behavior.

The constructs of TBP are important concerning the recycling intention of the consumers. It has been revealed that a favorable attitude of the individuals towards recycling solid waste will evoke recycling intention (H1). The findings are consistent with the finding of the earlier study in the field [47,70]. The subjective norms also significantly convince the consumers to adopt recycling behavior (H2). This implies that the people trying to conform to society also adopt socially desired behavior. The study's findings align with the previous research findings [47,70,71]. The role of society has been confirmed in evoking the desire to perform sustainable behavior of recycling. The effect of perceived behavior control on recycling intention was found to be the greatest (H3). This suggests that people who can control their behavior are the most vigorous in the transition towards recycling their waste. PBC is also a significant predictor of intention in earlier pro-environmental studies [70,71,102]. We also incorporated the consequence awareness in the TBP model, and it provided a significant impact on recycling intention (H4). It highlighted that the people who are aware of the consequences of their actions are more likely to perform the recycling of waste materials. Earlier studies also presented a similar picture in this regard [8,103].

The key contribution of the study was to identify the determinants of the TBP constructs. In this regard, after a careful examination, two variables have been identified i.e., moral norms and convenience. It has been identified that the people concerned for moral behavior try to adapt their behavior according to the behavior of important people in their life (H5). Convenience is a key factor in terms of the collection of waste (H6). The results suggested that recycling convenience has a significant effect on PBC. Convenience can cover multiple aspects, including easy accessibility of recycling facility drop-off points. The findings are in line with the study conducted by Liu et al. [62] and Wang et al. [102].

The other major contribution of the current study was to segregate the recycling behavior further in terms of actual behavior. Experts have identified that the waste can be recycled in several ways, including resell, reuse, and donation. Hence, we tested the impact of recycling intention on all of these mentioned options in Hypotheses 7 to 9. The results revealed that the most significant factor is reselling (H7). This might be since it is the only option that gives the financial incentive. The promotion of this aspect that pro-environmental behavior can result in financial gain can induce people to adopt this behavior. The idea of reusing the products in place of throwing them away was also found popular (H8). Furthermore, donating was found to be the second most influencing factor. This might be because the KSA is a Muslim country and a hub of many religious activities. Donating being part of one of the basic teachings of Islam can be seen in their behavior concerning recycling (H9). The current study's findings are in line with earlier studies focusing on this aspect [8,79].

Lastly, this study shows significant differences due to demographic characteristics such as age, gender, and education. For the gender groups, the relationship between recycling intention and reselling behavior passes the significance test for male groups, indicating that the male group has more pro-environmental behavior than the female group. Our study found that males possess more knowledge, confidence, and economic freedom in the case of Saudi Arabia, which ultimately leads to their recycling intention towards reselling behavior. Hence, it shows that males are content to rummage through antique or used items than females as they have more knowledge about the markets where to recycle and resell or buy pre-owned items. The findings of this study support past studies in the context of pro-environmental behavior [82,84]. Moreover, this finding supports the present culture within Saudi Arabia as a country with more male dominance. As males are generally responsible for discarding the household waste and deal in second-hand market. In terms of age, our results indicated that recycling intention and reselling behavior passed a significant test in the elderly group. This indicates that older people are more economically and socially concerned [85–87] and therefore tend to buy products at low prices and help others by offering a good product at a low price or even protecting the environment by not throwing them away as waste. The relationship between moral and subjective norms passes the significance test for low-educated people in terms of education. The results suggest that

people with low level of education place more weight on the opinions of their friends and family, who encourage them to look for environmentally friendly products and behavior.

5.1. Implications

In terms of practical implications, the results provided information on solid waste recycling activities that positively contribute to the environment and the economy. Researchers and policymakers can use these findings to tackle the environmental and economic vulnerabilities of developing countries. Based on the results, the government, environmental and socioeconomic development organizations should evaluate the appropriateness of recycling material and build an ancillary system to smooth the progress of solid waste recycling among developing countries. Respective authorities should also adopt policies and measures to enhance environmental concern, personal norms, and awareness towards environmentally friendly products to encourage recycling behavior. As for the managers of recycling agencies, especially in Saudi Arabia, this study provides them with practical knowledge on solid waste recycling factors that can be manipulated to develop efficient curriculum and recycling-friendly infrastructure and facilities, raise social and environmental awareness and boost recycling behavior among Saudis.

To begin, customers should be educated about the benefits of recycling. Educational and promotional campaigns can help increase public awareness and comprehension of recycling. It is necessary to raise awareness about the benefits of recycling and how it contributes to environmental sustainability. Secondly, the government's adoption and improvement of waste management laws and regulations can help enhance the entire process of recycling and waste management system. Strict implementation of laws could potentially improve the current waste disposal system in Saudi Arabia.

The government and educational institutions should instill the values and importance of recycling among kids, students, and adults. To increase convenience for recycling, the government authorities could provide more collection points for recyclable materials. Establishing drop-off locations in each district will significantly boost public participation in recycling. Additionally, businesses should aggressively collect recyclables and develop their recycling channels. Government agencies, municipalities, and non-governmental groups should collaborate to improve the environment and promote recycling operations through public awareness. Government and companies should launch campaigns promoting recycling. They should develop environmentally friendly items and encourage domestic customers to invest in green and environmentally friendly products.

5.2. Future Research and Limitations

This study has numerous limitations, and some must be addressed in future studies. In the present research, the domestic consumers were the main focus, yet some entities contribute to a huge quantity of solid waste such as hotels, schools, universities, and hospitals. These entities can be examined in future studies. The other limitation relates to the sample which is not representative of female consumers. Males provided 74.5 percent of the replies, while females provided only 25.5 percent which does not represent the current gender structure of the Saudi Arabia. Due to convenience sampling, males dominated the sample; therefore, the results cannot be generalized. Future studies may balance the gender structure in the sample. The present study takes into consideration comprehensive solid waste; future studies can consider alternative recycling materials like e-waste, newspapers, cartons, aluminum cans, glass bottles, and plastic waste. This study does not offer precise division by location or geographical effect on recycling intention. In future studies, the questionnaire may be distributed to urban, suburban, and rural areas to evaluate remoteness depending on the specific locations of customers to examine the impact of location. In prospective studies, more extensive models can be developed by integrating factors that affect recycling behavior, for example, perceived political effectiveness, disinterest and hassle about recycling, etc., and various other factors could also be considered.

Author Contributions: Conceptualization, Y.A.S. and I.H.; methodology, M.Y.B. and I.W.; software, I.W. and M.Y.B.; validation, Y.B. and B.A.B.; formal analysis, I.W.; investigation, M.Y.B.; resources, Y.A.S. and I.H.; data validation, Y.A.S.; writing—original draft preparation, Y.B. and B.A.B.; writing—review and editing, Y.A.S. and I.H.; visualization, M.Y.B. and I.W.; supervision, Y.B. and B.A.B.; project administration Y.A.S.; funding acquisition, Y.B. and B.A.B. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: The study did not require a separate approval by the Ethics Board but it does follow ethics guidelines of authors' institutions. Additionally, authors had approval letter from their institution office to collect the data through survey from respondents.

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: The datasets analyzed during the current study are available from the corresponding author on reasonable request.

Conflicts of Interest: The authors declare no conflict of interest.

Appendix A

Table A1. Measurement Items.

Construct/Items	Construct/Items Description	Source
Construct: ATT	Attitude	
ATT1	Recycling is good	Tonglet et al. (2004) and Sidique et al. (2010)
ATT2	Recycling is useful	
ATT3	Recycling is responsible	
Construct: SN	Subjective Norms	
SN1	My friends expect me to recycle recyclables	Tonglet et al. (2004) and Sidique et al. (2010)
SN2	My classmates/colleagues expect me to recycle recyclables	
SN3	Media influences me to recycle recyclables	
SN4	Environmental groups influence me to recycle recyclables	
Construct: PBC	Perceived Behavioral Control	
PBC1	I know what items can be recycled	Tonglet et al. (2004) and Sidique et al. (2010)
PBC2	I know where to take my recyclables for recycling	
PBC3	I know how to recycle my recyclables	
PBC4	I know would recycle more if I had more information on recycling	
Construct: CA	Awareness of Consequences	
CA1	Recycling is a major way to reduce pollution	Tonglet et al. (2004) and Sidique et al. (2010)
CA2	Recycling is a major way to reduce wasteful use of landfills	
CA3	Recycling is a major way to conserve natural resources	
Construct: MN	Moral Norms	
MN1	It would be wrong of me not to recycle my recyclables	Tonglet et al. (2004) and Sidique et al. (2010)
MN2	I would feel guilty if I did not recycle my recyclables	
MN3	Not recycling goes against my principles	
Construct: C	Convenience	
C1	It is not a difficult task for me to recycle the recyclables	Tonglet et al. (2004) and Sidique et al. (2010)
C2	I have enough time to sort the materials for recycling	
C3	I have enough space to store the materials for recycling	

Table A1. Cont.

Construct: RI		Recycling Intention
RI1	I intend to recycle my recyclables in the next four weeks	
RI2	I will recycle my recyclables regularly	
RI3	I intent to participate in environmental programs hold by the government	
RI4	I will participate in the recycling program in the near future	
Construct: RS		Resell
RS1	I sell much of my waste for economic reasons	
RS2	I resell waste to recycle that is in good condition	
RS3	I often trade my waste at second-hand stores to save money	
Construct: RU		Reuse
RU1	I reuse it because it can significantly benefit the environment	
RU2	I reuse for other purposes to get the most out of them	
RU3	I donate to charity to do my part in decreasing the environmental problem	
Construct: DN		Donate
DN1	I donate to charity for needy people	
DN2	I often give away to charity	
DN3	Donating to charity is a good way to recycle	

References

- Baeshen, Y.; Soomro, Y.A.; Bhutto, M.Y. Determinants of Green Innovation to Achieve Sustainable Business Performance: Evidence From SMEs. *Front. Psychol.* **2021**, *12*, 5052. [\[CrossRef\]](#)
- Hameed, I.; Khan, K. An extension of the goal-framing theory to predict consumer's sustainable behavior for home appliances. *Energy Effic.* **2020**, *13*, 1441–1455. [\[CrossRef\]](#)
- Waris, I.; Dad, M.; Hameed, I. Promoting environmental sustainability: The influence of knowledge of eco-labels and altruism in the purchase of energy-efficient appliances. *Manag. Environ. Qual. Int. J.* **2021**, *32*, 989–1006. [\[CrossRef\]](#)
- Rezvani, Z.; Jansson, J.; Bengtsson, M. Consumer motivations for sustainable consumption: The interaction of gain, normative and hedonic motivations on electric vehicle adoption. *Bus. Strategy Environ.* **2018**, *27*, 1272–1283. [\[CrossRef\]](#)
- Tariq, A.; Wang, C.; Tanveer, Y.; Akram, U.; Akram, Z. Organic food consumerism through social commerce in China. *Asia Pac. J. Mark. Logist.* **2019**, *31*, 202–222. [\[CrossRef\]](#)
- Hameed, I.; Zaman, U.; Waris, I.; Shafique, O. A Serial-Mediation Model to Link Entrepreneurship Education and Green Entrepreneurial Behavior: Application of Resource-Based View and Flow Theory. *Int. J. Environ. Res. Public Health* **2021**, *18*, 550. [\[CrossRef\]](#)
- Botetzagias, I.; Dima, A.-F.; Malesios, C. Extending the Theory of Planned Behavior in the context of recycling: The role of moral norms and of demographic predictors. *Resour. Conserv. Recycl.* **2015**, *95*, 58–67. [\[CrossRef\]](#)
- Khan, F.; Ahmed, W.; Najmi, A. Understanding consumers' behavior intentions towards dealing with the plastic waste: Perspective of a developing country. *Resour. Conserv. Recycl.* **2019**, *142*, 49–58. [\[CrossRef\]](#)
- Ferronato, N.; Ragazzi, M.; Gorritty Portillo, M.A.; Guisbert Lizarazu, E.G.; Viotti, P.; Torretta, V. How to improve recycling rate in developing big cities: An integrated approach for assessing municipal solid waste collection and treatment scenarios. *Environ. Dev.* **2019**, *29*, 94–110. [\[CrossRef\]](#)
- Okan, M.; Aydin, H.M.; Barsbay, M. Current approaches to waste polymer utilization and minimization: A review. *J. Chem. Technol. Biotechnol.* **2019**, *94*, 8–21. [\[CrossRef\]](#)
- Apinapath, C. Community Mapping and Theory of Planned Behavior as Study Tools for Solid Waste Management. *J. Waste Manag.* **2014**, *2014*, 934372. [\[CrossRef\]](#)
- Reike, D.; Vermeulen, W.J.V.; Witjes, S. The circular economy: New or Refurbished as CE 3.0?—Exploring Controversies in the Conceptualization of the Circular Economy through a Focus on History and Resource Value Retention Options. *Resour. Conserv. Recycl.* **2018**, *135*, 246–264. [\[CrossRef\]](#)
- Ma, J.; Hipel, K.W.; Hanson, M.L.; Cai, X.; Liu, Y. An analysis of influencing factors on municipal solid waste source-separated collection behavior in Guilin, China by Using the Theory of Planned Behavior. *Sustain. Cities Soc.* **2018**, *37*, 336–343. [\[CrossRef\]](#)
- Zhang, A.; Venkatesh, V.G.; Liu, Y.; Wan, M.; Qu, T.; Huisingh, D. Barriers to smart waste management for a circular economy in China. *J. Clean. Prod.* **2019**, *240*, 118198. [\[CrossRef\]](#)

15. Whitley, C.T.; Takahashi, B.; Zwickle, A.; Besley, J.C.; Lertpratchya, A.P. Sustainability behaviors among college students: An application of the VBN theory. *Environ. Educ. Res.* **2018**, *24*, 245–262. [\[CrossRef\]](#)
16. Magazzino, C.; Mele, M.; Schneider, N. The relationship between municipal solid waste and greenhouse gas emissions: Evidence from Switzerland. *Waste Manag.* **2020**, *113*, 508–520. [\[CrossRef\]](#)
17. Bui, T.-D.; Tsai, F.M.; Tseng, M.-L.; Wu, K.-J.; Chiu, A.S.F. Effective municipal solid waste management capability under uncertainty in Vietnam: Utilizing economic efficiency and technology to foster social mobilization and environmental integrity. *J. Clean. Prod.* **2020**, *259*, 120981. [\[CrossRef\]](#)
18. Meng, X.; Wen, Z.; Qian, Y. Multi-agent based simulation for household solid waste recycling behavior. *Resour. Conserv. Recycl.* **2018**, *128*, 535–545. [\[CrossRef\]](#)
19. Rathore, P.; Sarmah, S.P. Investigation of factors influencing source separation intention towards municipal solid waste among urban residents of India. *Resour. Conserv. Recycl.* **2021**, *164*, 105164. [\[CrossRef\]](#)
20. Zafar, S. Waste Management Outlook for the Middle East. In *The Palgrave Handbook of Sustainability*; Brinkmann, R., Garren, S., Eds.; Palgrave Macmillan: Cham, Switzerland, 2018; pp. 159–181.
21. Haj-Salem, N.; Al-Hawari, M.A. Predictors of recycling behavior: The role of self-conscious emotions. *J. Soc. Mark.* **2021**, *11*, 204–223. [\[CrossRef\]](#)
22. Ouda, O. Assessment of the Environmental Values of Waste-to-Energy in the Gaza Strip. *Curr. World Environ.* **2013**, *22*, 355–364. [\[CrossRef\]](#)
23. Ferronato, N.; Torretta, V. Waste Mismanagement in Developing Countries: A Review of Global Issues. *Int. J. Environ. Res. Public Health* **2019**, *16*, 1060. [\[CrossRef\]](#)
24. Balat, M. The Position of Oil in the Middle East: Potential Trends, Future Perspectives, Market and Trade. *Energy Sources Part A Recovery Util. Environ. Eff.* **2006**, *28*, 821–828. [\[CrossRef\]](#)
25. Rajaei, M.; Hoseini, S.M.; Malekmohammadi, I. Proposing a socio-psychological model for adopting green building technologies: A case study from Iran. *Sustain. Cities Soc.* **2019**, *45*, 657–668. [\[CrossRef\]](#)
26. Mallick, J. Municipal Solid Waste Landfill Site Selection Based on Fuzzy-AHP and Geoinformation Techniques in Asir Region Saudi Arabia. *Sustainability* **2021**, *13*, 1538. [\[CrossRef\]](#)
27. Hadidi, L.A.; Omer, M.M. A financial feasibility model of gasification and anaerobic digestion waste-to-energy (WTE) plants in Saudi Arabia. *Waste Manag.* **2017**, *59*, 90–101. [\[CrossRef\]](#)
28. Radwan, N.; Mangi, S.A. Municipal Solid Waste Management Practices and Opportunities in Saudi Arabia. *Eng. Technol. Appl. Sci. Res.* **2019**, *9*, 4516–4519. [\[CrossRef\]](#)
29. Lou, T.; Wang, D.; Chen, H.; Niu, D. Different Perceptions of Belief: Predicting Household Solid Waste Separation Behavior of Urban and Rural Residents in China. *Sustainability* **2020**, *12*, 7778. [\[CrossRef\]](#)
30. Mi, L.; Zhu, H.; Yang, J.; Gan, X.; Xu, T.; Qiao, L.; Liu, Q. A new perspective to promote low-carbon consumption: The influence of reference groups. *Ecol. Econ.* **2019**, *161*, 100–108. [\[CrossRef\]](#)
31. Sun, Q.; Wang, B.; Zhang, B. Purchasing intentions of Chinese consumers on energy-efficient appliances: Is the energy efficiency label effective? *J. Clean. Prod.* **2019**, *238*, 117896.
32. Bhutto, M.Y.; Liu, X.; Soomro, Y.A.; Ertz, M.; Baeshen, Y. Adoption of Energy-Efficient Home Appliances: Extending the Theory of Planned Behavior. *Sustainability* **2021**, *13*, 250. [\[CrossRef\]](#)
33. Goldenhar, L.M.; Connell, C.M. Understanding and Predicting Recycling Behavior: An Application of the Theory of Reasoned Action. *J. Environ. Syst.* **1992**, *22*, 91–103. [\[CrossRef\]](#)
34. Ramayah, T.; Rahbar, E. Greening the environment through recycling: An empirical study. *Manag. Environ. Qual. Int. J.* **2013**, *24*, 782–801. [\[CrossRef\]](#)
35. Dhir, A.; Koshta, N.; Goyal, R.K.; Sakashita, M.; Almotairi, M. Behavioral reasoning theory (BRT) perspectives on E-waste recycling and management. *J. Clean. Prod.* **2021**, *280*, 124269. [\[CrossRef\]](#)
36. Dhir, A.; Malodia, S.; Awan, U.; Sakashita, M.; Kaur, P. Extended valence theory perspective on consumers' e-waste recycling intentions in Japan. *J. Clean. Prod.* **2021**, *312*, 127443. [\[CrossRef\]](#)
37. Juaneda-Ayensa, E.; Emeterio, M.; Cirilo-Jordan, S.; González-Menorca, L. Unified Theory of Acceptance and Use of Social Apps: (UTAU-SA): The Role of Technology in the Promotion of Recycling Behavior. In *Innovations in Digital Economy, Proceedings of the Second International Scientific Conference, SPBPU IDE 2020, St. Petersburg, Russia, 22–23 October 2020*; Rodionov, D., Kudryavtseva, T., Skhvediani, A., Berawi, M.A., Eds.; Springer: Cham, Switzerland, 2021; pp. 3–22.
38. Azjen, I. *Understanding Attitudes and Predicting Social Behavior*; Prentice Hall: Englewood Cliffs, NJ, USA, 1980.
39. Yuzhanin, S.; Fisher, D. The efficacy of the theory of planned behavior for predicting intentions to choose a travel destination: A review. *Tour. Rev.* **2016**, *71*, 135–147. [\[CrossRef\]](#)
40. Borusiak, B.; Szymkowiak, A.; Horska, E.; Raszka, N.; Żelichowska, E. Towards Building Sustainable Consumption: A Study of Second-Hand Buying Intentions. *Sustainability* **2020**, *12*, 875. [\[CrossRef\]](#)
41. Brouwer, A.; Mosack, K. Expanding the theory of planned behavior to predict healthy eating behaviors: Exploring a healthy eater identity. *Nutr. Food Sci.* **2015**, *45*, 39–53. [\[CrossRef\]](#)
42. Close, M.A.; Lytle, L.A.; Chen, D.-G.; Viera, A.J. Using the theory of planned behavior to explain intention to eat a healthful diet among Southeastern United States office workers. *Nutr. Food Sci.* **2018**, *48*, 365–374. [\[CrossRef\]](#)

43. Verma, V.K.; Chandra, B. An application of theory of planned behavior to predict young Indian consumers' green hotel visit intention. *J. Clean. Prod.* **2018**, *172*, 1152–1162. [\[CrossRef\]](#)
44. Aboelmegeed, M. E-waste recycling behaviour: An integration of recycling habits into the theory of planned behaviour. *J. Clean. Prod.* **2021**, *278*, 124182. [\[CrossRef\]](#)
45. Ma, J.; Yin, Z.; Hipel, K.W.; Li, M.; He, J. Exploring factors influencing the application accuracy of the theory of planned behavior in explaining recycling behavior. *J. Environ. Plan. Manag.* **2021**, 1–26. [\[CrossRef\]](#)
46. Wan, C.; Shen, G.; Choi, S. The place-based approach to recycling intention: Integrating place attachment into the extended theory of planned behavior. *Resour. Conserv. Recycl.* **2021**, *169*, 105549. [\[CrossRef\]](#)
47. Al Mamun, A.; Mohiuddin, M.; Ahmad, G.B.; Thurasamy, R.; Fazal, S.A. Recycling Intention and Behavior among Low-Income Households. *Sustainability* **2018**, *10*, 2407. [\[CrossRef\]](#)
48. Ajzen, I. The theory of planned behavior. *Organ. Behav. Hum. Decis. Processes* **1991**, *50*, 179–211. [\[CrossRef\]](#)
49. Ertz, M.; Huang, R.; Jo, M.-S.; Karakas, F.; Sarigöllü, E. From single-use to multi-use: Study of consumers' behavior toward consumption of reusable containers. *J. Environ. Manag.* **2017**, *193*, 334–344. [\[CrossRef\]](#)
50. Wang, P.; Liu, Q.; Qi, Y. Factors influencing sustainable consumption behaviors: A survey of the rural residents in China. *J. Clean. Prod.* **2014**, *63*, 152–165. [\[CrossRef\]](#)
51. Alam, S.S.; Ahmad, M.; Ho, Y.-H.; Omar, N.A.; Lin, C.-Y. Applying an Extended Theory of Planned Behavior to Sustainable Food Consumption. *Sustainability* **2020**, *12*, 8394. [\[CrossRef\]](#)
52. Jain, S.; Singhal, S.; Jain, N.K.; Bhaskar, K. Construction and demolition waste recycling: Investigating the role of theory of planned behavior, institutional pressures and environmental consciousness. *J. Clean. Prod.* **2020**, *263*, 121405. [\[CrossRef\]](#)
53. Oztekin, C.; Teksöz, G.; Pamuk, S.; Sahin, E.; Kilic, D.S. Gender perspective on the factors predicting recycling behavior: Implications from the theory of planned behavior. *Waste Manag.* **2017**, *62*, 290–302. [\[CrossRef\]](#)
54. Tonglet, M.; Phillips, P.S.; Read, A.D. Using the Theory of Planned Behaviour to investigate the determinants of recycling behaviour: A case study from Brixworth, UK. *Resour. Conserv. Recycl.* **2004**, *41*, 191–214. [\[CrossRef\]](#)
55. Echegaray, F.; Hansstein, F.V. Assessing the intention-behavior gap in electronic waste recycling: The case of Brazil. *J. Clean. Prod.* **2017**, *142*, 180–190. [\[CrossRef\]](#)
56. Nduneseokwu, C.K.; Qu, Y.; Appolloni, A. Factors Influencing Consumers' Intentions to Participate in a Formal E-Waste Collection System: A Case Study of Onitsha, Nigeria. *Sustainability* **2017**, *9*, 881. [\[CrossRef\]](#)
57. Kaffashi, S.; Shamsudin, M.N. Transforming to a low carbon society; an extended theory of planned behaviour of Malaysian citizens. *J. Clean. Prod.* **2019**, *235*, 1255–1264. [\[CrossRef\]](#)
58. Mak, T.M.W.; Yu, I.K.M.; Wang, L.; Hsu, S.-C.; Tsang, D.C.W.; Li, C.N.; Yeung, T.L.Y.; Zhang, R.; Poon, C.S. Extended theory of planned behaviour for promoting construction waste recycling in Hong Kong. *Waste Manag.* **2019**, *83*, 161–170. [\[CrossRef\]](#)
59. Ceschi, A.; Sartori, R.; Dickert, S.; Scalco, A.; Tur, E.M.; Tommasi, F.; Delfini, K. Testing a norm-based policy for waste management: An agent-based modeling simulation on nudging recycling behavior. *J. Environ. Manag.* **2021**, *294*, 112938. [\[CrossRef\]](#)
60. Carfora, V.; Cavallo, C.; Caso, D.; Del Giudice, T.; De Devitiis, B.; Viscecchia, R.; Nardone, G.; Cicia, G. Explaining consumer purchase behavior for organic milk: Including trust and green self-identity within the theory of planned behavior. *Food Qual. Prefer.* **2019**, *76*, 1–9. [\[CrossRef\]](#)
61. Ru, X.; Qin, H.; Wang, S. Young people's behaviour intentions towards reducing PM2.5 in China: Extending the theory of planned behaviour. *Resour. Conserv. Recycl.* **2019**, *141*, 99–108. [\[CrossRef\]](#)
62. Liu, J.; Bai, H.; Zhang, Q.; Jing, Q.; Xu, H. Why are obsolete mobile phones difficult to recycle in China? *Resour. Conserv. Recycl.* **2019**, *141*, 200–210. [\[CrossRef\]](#)
63. Kelly, T.; Mason, I.G.; Leiss, M.; Ganesh, S. University community responses to on-campus resource recycling. *Resour. Conserv. Recycl.* **2006**, *47*, 42–55. [\[CrossRef\]](#)
64. Ari, E.; Yilmaz, V. A proposed structural model for housewives' recycling behavior: A case study from Turkey. *Ecol. Econ.* **2016**, *129*, 132–142. [\[CrossRef\]](#)
65. Shaw, P.J. Nearest neighbour effects in kerbside household waste recycling. *Resour. Conserv. Recycl.* **2008**, *52*, 775–784. [\[CrossRef\]](#)
66. Ramayah, T.; Lee, J.W.C.; Lim, S. Sustaining the environment through recycling: An empirical study. *J. Environ. Manag.* **2012**, *102*, 141–147. [\[CrossRef\]](#) [\[PubMed\]](#)
67. Wan, C.; Shen, G.Q.; Yu, A. The moderating effect of perceived policy effectiveness on recycling intention. *J. Environ. Psychol.* **2014**, *37*, 55–60. [\[CrossRef\]](#)
68. Kianpour, K.; Jusoh, A.; Mardani, A.; Streimikiene, D.; Cavallaro, F.; Nor, K.M.; Zavadskas, E.K. Factors Influencing Consumers' Intention to Return the End of Life Electronic Products through Reverse Supply Chain Management for Reuse, Repair and Recycling. *Sustainability* **2017**, *9*, 1657. [\[CrossRef\]](#)
69. Niaura, A. Using the Theory of Planned Behavior to Investigate the Determinants of Environmental Behavior among Youth. *Environ. Res. Eng. Manag.* **2013**, *1*, 74–81. [\[CrossRef\]](#)
70. Wan, C.; Cheung, R.; Qiping Shen, G. Recycling attitude and behaviour in university campus: A case study in Hong Kong. *Facilities* **2012**, *30*, 630–646. [\[CrossRef\]](#)
71. Lizin, S.; Van Dael, M.; Van Passel, S. Battery pack recycling: Behaviour change interventions derived from an integrative theory of planned behaviour study. *Resour. Conserv. Recycl.* **2017**, *122*, 66–82. [\[CrossRef\]](#)

72. Chen, M.-F.; Tung, P.-J. The Moderating Effect of Perceived Lack of Facilities on Consumers' Recycling Intentions. *Environ. Behav.* **2010**, *42*, 824–844. [\[CrossRef\]](#)
73. Gonul Kochan, C.; Pourreza, S.; Tran, H.; Prybutok, V.R. Determinants and logistics of e-waste recycling. *Int. J. Logist. Manag.* **2016**, *27*, 52–70. [\[CrossRef\]](#)
74. Chan, L.; Bishop, B. A moral basis for recycling: Extending the theory of planned behaviour. *J. Environ. Psychol.* **2013**, *36*, 96–102. [\[CrossRef\]](#)
75. Saphores, J.-D.; Ogunseitan, O.; Shapiro, A. Willingness to Engage in Pro-Environmental Behavior: An Analysis of e-Waste: Recycling Based on a National Survey of US Households. *Recycle-D* **2012**, *60*, 49–63. [\[CrossRef\]](#)
76. Sidique, S.F.; Lupi, F.; Joshi, S.V. The effects of behavior and attitudes on drop-off recycling activities. *Resour. Conserv. Recycl.* **2010**, *54*, 163–170. [\[CrossRef\]](#)
77. Ding, Z.; Jiang, X.; Liu, Z.; Long, R.; Xu, Z.; Cao, Q. Factors affecting low-carbon consumption behavior of urban residents: A comprehensive review. *Resour. Conserv. Recycl.* **2018**, *132*, 3–15. [\[CrossRef\]](#)
78. United States Environmental Protection Agency (EPA). Reduce, Reuse, Recycle. Available online: <http://www.epa.gov/recycle> (accessed on 28 June 2021).
79. Shim, S. Environmentalism and Consumers' Clothing Disposal Patterns: An Exploratory Study. *Cloth. Text. Res. J.* **1995**, *13*, 38–48. [\[CrossRef\]](#)
80. Joung, H.M.; Park-Poaps, H. Factors motivating and influencing clothing disposal behaviors. *Int. J. Consum. Stud.* **2013**, *37*.
81. Claudio, L. Waste Couture: Environmental Impact of the Clothing Industry. *Environ. Health Perspect.* **2007**, *115*, A448–A454. [\[CrossRef\]](#)
82. Domina, T.; Koch, K. Consumer reuse and recycling of post-consumer textile waste. *J. Fash. Mark. Manag. Int. J.* **1999**, *3*, 346–359. [\[CrossRef\]](#)
83. Weber, S.; Lynes, J.; Young, S.B. Fashion interest as a driver for consumer textile waste management: Reuse, recycle or disposal. *Int. J. Consum. Stud.* **2017**, *41*, 207–215. [\[CrossRef\]](#)
84. Bubna, J.M.; Norum, P. Male apparel disposal: Case study of consignment versus donation. *J. Fash. Mark. Manag.* **2017**, *21*, 235–246. [\[CrossRef\]](#)
85. Bianchi, C.; Birtwistle, G. Sell, give away, or donate: An exploratory study of fashion clothing disposal behaviour in two countries. *Int. Rev. Retail. Distrib. Consum. Res.* **2010**, *20*, 353–368. [\[CrossRef\]](#)
86. Norum, P.S. Trash, Charity, and Secondhand Stores: An Empirical Analysis of Clothing Disposition. *Fam. Consum. Sci. Res. J.* **2015**, *44*, 21–36. [\[CrossRef\]](#)
87. Morgan, L.R.; Birtwistle, G. An investigation of young fashion consumers' disposal habits. *Int. J. Consum. Stud.* **2009**, *33*, 190–198. [\[CrossRef\]](#)
88. Dwivedy, M.; Mittal, R.K. Willingness of residents to participate in e-waste recycling in India. *Environ. Dev.* **2013**, *6*, 48–68. [\[CrossRef\]](#)
89. Andrew, D.; Buchanan, T.; Haney, T. Gender differences in environmentalism among students at a Southern university: The impact of gender role attitudes and university experience. *Soc. Sci. J.* **2020**, *1*–17. [\[CrossRef\]](#)
90. Nagel, J. *Gender and Climate Change: Impacts, Science, Policy*, 1st ed.; Routledge: New York, NY, USA, 2015.
91. Milfont, T.L.; Sibley, C.G. Empathic and social dominance orientations help explain gender differences in environmentalism: A one-year Bayesian mediation analysis. *Personal. Individ. Differ.* **2016**, *90*, 85–88. [\[CrossRef\]](#)
92. Jia, F.; Alisat, S.; Soucie, K.; Pratt, M. Generative Concern and Environmentalism: A Mixed Methods Longitudinal Study of Emerging and Young Adults. *Emerg. Adulthood* **2015**, *3*, 306–319. [\[CrossRef\]](#)
93. Wray-Lake, L.; Flanagan, C.A.; Osgood, D.W. Examining Trends in Adolescent Environmental Attitudes, Beliefs, and Behaviors Across Three Decades. *Environ. Behav.* **2010**, *42*, 61–85. [\[CrossRef\]](#)
94. Conway, J.M.; Lance, C.E. What Reviewers Should Expect from Authors Regarding Common Method Bias in Organizational Research. *J. Bus. Psychol.* **2010**, *25*, 325–334. [\[CrossRef\]](#)
95. Harman, H.H. *Modern Factor Analysis*; University of Chicago Press: Chicago, IL, USA, 1976.
96. Fornell, C.; Bookstein, F.L. Two Structural Equation Models: LISREL and PLS Applied to Consumer Exit-Voice Theory. *J. Mark. Res.* **1982**, *19*, 440–452. [\[CrossRef\]](#)
97. Hair, F.J., Jr.; Sarstedt, M.; Hopkins, L.; Kuppelwieser, V.G. Partial least squares structural equation modeling (PLS-SEM). *Eur. Bus. Rev.* **2014**, *26*, 106–121. [\[CrossRef\]](#)
98. Gefen, D.; Straub, D.; Boudreau, M.-C. Structural Equation Modeling And Regression: Guidelines For Research Practice. *Commun. Assoc. Inf. Syst.* **2000**, *4*, 7. [\[CrossRef\]](#)
99. Fornell, C.; Larcker, D.F. Evaluating Structural Equation Models with Unobservable Variables and Measurement Error. *J. Mark. Res.* **1981**, *18*, 39–50. [\[CrossRef\]](#)
100. Henseler, J.; Ringle, C.M.; Sarstedt, M. A new criterion for assessing discriminant validity in variance-based structural equation modeling. *J. Acad. Mark. Sci.* **2015**, *43*, 115–135. [\[CrossRef\]](#)
101. Henseler, J. Why generalized structured component analysis is not universally preferable to structural equation modeling. *J. Acad. Mark. Sci.* **2012**, *40*, 402–413. [\[CrossRef\]](#)

-
102. Wang, Y.; Long, X.; Li, L.; Wang, Q.; Ding, X.; Cai, S. Extending theory of planned behavior in household waste sorting in China: The moderating effect of knowledge, personal involvement, and moral responsibility. *Environ. Dev. Sustain.* **2021**, *23*, 7230–7250. [[CrossRef](#)]
 103. Liobikienė, G.; Juknys, R. The role of values, environmental risk perception, awareness of consequences, and willingness to assume responsibility for environmentally-friendly behaviour: The Lithuanian case. *J. Clean. Prod.* **2016**, *112*, 3413–3422. [[CrossRef](#)]