

Exploring Household Recycling Intentions in South Korea:

A Moral-Psychological and Contextual Extension of the Theory of Planned Behavior*

계획된 행동 이론 확장을 통한 한국 가구 재활용 의도 분석:
도덕-심리 및 맥락적 접근

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Abstract: This study investigates the determinants of household recycling intentions in South Korea by extending the Theory of Planned Behavior (TPB) with moral-psychological and contextual factors. Although TPB has extensively been used to explain pro-environmental attitudes, theory explanatory power can be enhanced by using internal moral obligations and infrastructural convenience. To address this, the research integrates Sense of Duty (SD), Awareness of Consequences (AC), and Convenience of the Available Recycling Infrastructure (CARI) into the TPB framework. Data were collected through an organized questionnaire survey conducted by a professional agency, resulting in 500 valid responses from South Korean households. The model was validated with partial least squares structural equation modeling via the WarpPLS approach, which is well suited to a model using moderating variables, and the analysis was conducted with WarpPLS 8.0 software. The findings demonstrate that sense of duty is a particularly strong predictor of recycling intentions, surpassing Subjective Norms (SN) and significantly influencing recycling attitudes. Awareness

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of consequence and convenience of the available recycling infrastructure also had significant positive effects on recycling intentions, underscoring the importance of environmental awareness and accessible infrastructure in sustainable waste management behavior. This study offers valuable theoretical and practical insights, recommending that policymakers promote personal environmental responsibility alongside investment in clear, convenient recycling facilities. The proposed extended TPB model enhances understanding of household recycling behaviors in the context of rapid urbanization.

Key Words: Household Recycling, Theory of Planned Behavior, Sense of Duty, Awareness of Consequences, Recycling Infrastructure

요약: 본 연구는 계획 행동 이론 (TPB)을 도덕적, 심리적 및 맥락적 요인으로 확장하여, 한국 가정 내 재활용 의도 결정 요인을 분석하는 데 목적이 있다. TPB는 친환경적 태도를 설명하는 데 광범위하게 사용되어 왔으며, 개인의 내적 도덕적 의무와 인프라의 편의성 요인을 함께 활용함으로써 이론의 설명력을 높일 수 있다. 이를 위해, 본 연구에서는 의무감(SD), 결과인식(AC)과 재활용 인프라의 편의성(CARI) 요인을 TPB 모델과 통합하였다. 데이터는 전문 조사기관을 통해 체계적으로 설문조사를 통해 수집하였으며, 한국인을 대상으로 500건의 응답 데이터를 수집하였다. 조절변수가 포함된 구조방정식 모델 검증을 위해 WarpPLS 8.0을 활용하여 부분최소제곱법(PLS-SEM) 분석을 수행하였다. 분석결과, 의무감(SD)요인이 재활용하려는 의도(IR)에 가장 큰 영향을 미쳤으며, 주관적 규범 또한 유의미한 영향을 보였다. 결과인식과 이용가능한 재활용 인프라의 편의성 또한 재활용 의도에 유의미한 긍정적 효과를 보였으며, 이는 지속가능한 폐기물 관리 행동에서 환경 인식과 접근 가능한 인프라의 중요성을 보여준다. 본 연구는 가치 있는 이론적·실용적 통찰을 제공하며, 특히 정책입안자들에게는 명확하고 편리한 재활용 시설 투자와 개인적 환경 책임감 축진의 필요성을 시사한다. 제안된 확장된 TPB 모델은 급속한 도시화 맥락에서 가정의 재활용 행동을 이해하는 데 기여한다.

핵심주제어: 가정 재활용, 계획행동이론, 의무감, 결과인식, 재활용 인프라

I. Introduction

The production of household waste stems from the fundamental activities of daily human existence. Every member of society generates some sort of waste (Muthukumari, Ahn and Kim, 2024). The global waste challenge has worsened because of fast urban growth and expanding populations together with rising incomes and irregular waste sorting practices and excessive waste production (Lu, Zhou, Wang, Jackson and Kempes, 2024). The World Bank predicts that worldwide waste generation rates will increase by 70% by 2050 until they reach 3.40 billion tons starting from 2.01 billion tons produced in 2016 (Kaza, Yao, Bhada-Tata

and Woerden, 2018). Waste outputs amounting to 3.40 billion tons by 2050 will be split nearly equally between all regions of the planet but East Asia and Pacific leads with 23% indicating strong waste-management systems are essential. The absence of waste management systems makes it impossible for communities to achieve sustainability and inclusivity and health due to ecosystem destruction through wrong waste management methods that also endanger human health and fuel climate change (Yadav, Kumar, Yadav, Patel, Birla and Singh., 2024).

Recycling stands among the highest waste management approaches that conserve environmental resources through proactive methods to minimize environmental impact. Global governments implement multiple strategies for recycling promotion through essential laws, paid discard systems and yard pickup services coupled with community waste sorting containers and educational outreach programs (Thomas and Sharp, 2013; Wilson, Velis and Cheeseman., 2006). The results that waste management programs deliver depend completely on how well people participate. Policymakers together with researchers must obtain thorough knowledge of what makes people form intentions about recycling if they want to develop effective interventions for higher recycling rates (Muthukumari et al., 2024).

The South Korean waste-management is internationally recognized in terms of stringent volume-based system on waste-fees as well as mandatory recycling guidelines. But according to recent surveys, residential recycling engagement is already starting to decline (Chang, Karunarathne and Kim, 2022) and the general amount of generated household waste has grown, especially during and after the COVID-19 pandemic (Chang et al., 2022; Song and Park, 2024). In spite of the introduction of infrastructure expansion and awareness campaign, there

is a gap in the comprehension of the role that internalized moral obligations play in the recycling functions when integrated with convenience of infrastructure. There is a weakness in the fact that the previous studies concerning the prediction of behavioral intentions related to recycling in Korea have been predominantly discussed based on either psychological factors or the envisagement of situational circumstances on their own and without incorporating moral scales, e.g. SD and practical variables, e.g. CARI, in one integrated model.

To counter this weakness, the current paper suggests the expanded TPB model that combines SD, AC, and CARI to better clarify South Korean household recycle intentions. In addition to identifying theoretical predictors, this study also aims to generate actionable policy recommendations to improve household recycling practices in South Korea.

II. Literature Review

1. Waste Management in Psychological Perspective

Our daily lives depend on waste disposal, so we need to understand what motivates people to follow waste separation rules (Comber and Thieme, 2013; Kim, 2023). Research indicates that environmental behaviors related to waste management receive substantial impact from both external and internal motivations (Li, Zhao, Ma, Shao and Zhang, 2019). Many theoretical models select internal mental factors to explain pro-environmental behavior as their core predictors though such models rarely incorporate external physical elements like the environment (Linder, Rosenthal, Sörqvist and Barthel, 2021). This systematic assessment

of 7,000 studies regarding home recycling habits by Macklin, Curtis, and Smith (2023) demonstrates the territory's dependence on psychological evaluation. The research establishes that even though analyses primarily examine individual aspects, scientists must incorporate information about household and community domains (Macklin et al., 2023). The authors in Li et al. (2019) examine internal motivational factors that include attitudes alongside beliefs and perceived behavioral control. Waste-management policy adjustments need comprehensive knowledge about recycling barriers while accounting for the driving factors behind waste disposal and recycling (Miliute-Plepiene et al., 2016; Wei, S., J. Xu, S. She, Y. Wang and Y. Zhang, 2021). The authors note that designing outside habitual responses leads to enhanced recycling and food waste behaviors through three behavioral mechanisms: persuasion, social influence, and aversive effects (Comber and Thieme, 2013).

The waste management concept features several actors who handle waste generation alongside recycling collection and eventual disposal (Seadon, 2010). WM follows standardized rules which regulate how people form their disposal behaviors while discarding household waste. National waste policies differ due to six key factors including investments in incineration infrastructure as well as incentive structures and investment strategies and institutional arrangements and organizational efficiencies and responsibilities assignment among stakeholders (Miliute-Plepiene et al., 2016). The availability of infrastructure proves essential because Kollmuss and Agyeman (2002) found numerous pro-environmental behaviors must have suitable infrastructure available. Household responsibilities begin with packaging tasks along with food-waste separation duties taking central importance. Service availability (such as collection and containers) along with non-monetary incentives and

cultural norms together with market conditions and market conditions represent additional contextual factors (Cecere, Mancinelli and Mazzanti, 2014; Kollmuss and Agyeman, 2002; Xu, Ling, Lu and Shen, 2017). Xu et al. (2017) established that external variables played a vital role in shaping waste separation practices of residents in Hangzhou, China. The authors of Srun and Kurisu (2019) explain that findings regarding external factors maintain their specificity to settings and need additional research in different environments before generalization. The public delivery of waste management receives citizen assessment through ratings of service quality combined with policy equality and institutional integrity (Yang and Holzer, 2006). The OECD (2017) supports the relationship between public trust in institutions, which enables successful service usage as stated by Yang and Holzer (2006). Trust operates as a fundamental factor for household waste program participation because it describes the psychological state of accepting vulnerability from positive outlooks about authorities' intentions (Sapienza 2021; Scafuto, Sodano and La Barbera, 2018). An association between recycling behavior and social trust exists (Scafuto et al., 2018).

2. Household waste management in South Korea

South Korea maintains an organized waste collection system that operates through sophisticated environmental regulations and cutting-edge waste processing facilities. The 1995 VBWF system established an obligation for residents to buy standardized waste disposal bags for general waste yet allows a free separate collection of recyclable materials. The economic incentive through VBWF made South Korea a global leader in waste recycling by cutting down municipal solid waste volume and boosting recycling collections (Yumitro, Oktaviani and Deniar, 2024).

The COVID-19 pandemic created new obstacles which affected this established system. During lockdowns South Korea witnessed an increasing amount of waste produced by households combined with the growing use of package deliveries from 2019 to 2022. The pandemic exposed long-term deficiencies in waste management infrastructure while revealing the necessity to research psychological forces responsible for domestic waste creation habits. Lockdowns alongside increased remote work caused people to produce larger amounts of residential waste through their online purchases and food deliveries thus increasing plastic waste (Song and Park, 2024).

Research findings prioritize psychological variables as primary determinants of waste management practices. The study of Korean resident food waste perceptions during COVID-19 showed that personal sense of behavioral control together with subjective social opinion strongly influenced waste reduction goals. The results indicate individual perspectives and social pressure perceptions act more powerfully than policy or infrastructure when it comes to waste management behaviors (Chang et al., 2022).

The adverse effects of the pandemic extend beyond health issues because it damages individual mental well-being (Kim, Kim, Oh, Lee, Chang and Kim, 2025). The COVID-19 pandemic led South Koreans to develop depressive symptoms because they increased their instant food consumption and reduced their physical activity which resulted in lifestyle modifications throughout their daily routine (Lee et al., 2024). Households modified their waste generation behavior through coping mechanisms which emerged as a result of psychological stressors brought by the pandemic (Chang et al., 2022).

The COVID-19 pandemic combined with increased single-use plastic

consumption made waste management tasks more difficult for service providers. Plastic waste generation rose by 31% from 9.6 million tons in 2019 to 12.6 million tons in 2022 as South Korea experienced a significant increase in plastic packaging for food items and gifts and other online order deliveries that emerged due to pandemic developments. The growing amount of plastic waste demonstrates the critical requirement to solve both recycling system problems along with human behavior-related recycling issues (Song and Park, 2024).

Waste management strategies require understanding of all psychological factors to build complete solutions. Policymakers must use TPB constructs along with duty sense measurements and awareness of outcomes and convenience perceptions to develop interventions focused on handling both external and internal triggers of household waste practices. A comprehensive strategy suits the current situation, especially after the pandemic because human behavior has fundamentally changed.

3. The Extended Theory of Planned Behavior Framework

The TPB has been extensively used to forecast pro-environmental behaviors like household recycling identifying how AT, SN, and PBC affect behavioral intentions (Ajzen, 1991; Kumar, 2019). Though being effective, scholars have stated that TPB prediction capacity can be improved if moral-psychological and situational variables are incorporated, particularly in environmental studies (Chen and Tung, 2010; Hua and Dong, 2022).

In Korea, a number of empirical studies have used TPB framework in examining household recycling. As the example of Park and Ha (2014) shows, attitude and the subjective norms turned out to be significant factors that affected the intentions of residents to recycle, meanwhile,

the impact of PBC was minimal because of the established systems of waste separation in this country which diminished how residents perceived its barriers. Most recently, Kim (2023) also replicated the robust predictive linkage between social norms and environmental concern and pro-environmental behavior but failed to test internalized moral requirements like SD. Using TPB, Muthukumari et al. (2024) enlightened its context with the additional factors of moral norms and awareness of consequences, which showed that the moral norm was especially influential on the aspect of recycling intention compared to subjective norm and that the infrastructural convenience is an aspect that would need further research. Notwithstanding these developments, no prior Korean research has incorporated both moral-psychological forces such as SD and this notional practical circumstances such as the CARI into a unified extended TPB model. This research closes the discussed gap by suggesting a more comprehensive model incorporating SD, AC, and CARI in the explanation of household intentions to recycle in the Korean context.

Among them, a particularly influential factor has appeared: it is SD itself. While SN captures perceived expectations from others, SD reacts to personal moral responsibility anchored on internal ethical values. Based on the Norm-Activation Model (Schwartz, 1977), SD is an internalized yet not necessary if there is not external approval or moral obligation to take environmentally responsible actions. The latest study confirms that SD is a separate predictor in the extensions of TPB that influences both attitudes and the recycling intentions (Dong, He, Hu and Jiang, 2024; Kumar, 2019). In South Korea's socially collectivist but also growingly individualistic culture, SD has shown particular significance in encouraging recycling behaviors that exceed social expectations (Kim,

2023; Razali, Daud, Weng-Wai and Jiram, 2020; Wan, Shen and Choi, 2021).

Awareness of consequences (AC) completes this process by exposing human beings to the negative environmental, social and health consequences that result from improper waste management. Awareness is positively related to heightened salience of personal responsibility, which in turn augments pro-environmental intentions by consolidating AT as well as SD (Onel and Mukherjee, 2017; Yuriev, Dahmen, Boiral and Guillaumie, 2020). In fast developing South Korea, AC incorporation into behavior models increase effectiveness of public awareness campaigns and policy interventions (Muthukumar et al., 2024; Song and Park, 2024).

The convenience of available recycling infrastructure (CARI) serves as a crucial practical factor influencing PBC and behavioral intentions. Empirical evidence shows that when recycling infrastructure is readily available, accessible, and user-friendly, households are significantly more likely to participate in recycling programs (Miliute-Plepiene, Hage, Plepys and Reipas, 2016; Ramayah, Lee and Lim, 2012). In Korea, advanced infrastructure and clearly labeled waste separation systems have enabled consistently high recycling participation, with CARI also indirectly shaping attitudes by lowering practical barriers (Muthukumari et al., 2024).

This study presents an enhanced TPB framework that includes SD, AC, and CARI to provide a comprehensive, context-specific model for assessing household recycling intents in South Korea. Recognizing that recycling behavior is influenced by human attitudes, social conventions, moral obligations, environmental awareness, and infrastructural assistance gives a multifaceted approach to addressing contemporary waste management concerns.

III . Research Methodology

1. Data collection

In this research, the authors created the survey instrument and subsequently partnered with a well-known professional survey firm to administer the survey instrument to the probable respondents. The survey company gave professional advice on questionnaire distribution options, tips on how to curb down sampling bias and suggestions on how to maximize response rates.

Data was collected by selecting the adult population residing in households and aged 20 years old and above during the 14-day period in both the metropolitan cities and the provinces in addition to all the 17 metropolitan cities and provinces in mainland Korea as well as the entire Jeju Island.

A geographically stratified sampling procedure was adopted, which resulted in the proportionate representation of the number of respondents of the individual cities and provinces of the national population. Moreover, the sample was equalized in terms of gender (250 male and 250 female respondents), and thus depicted the national gender distribution properly.

The completed responses were 500 in number, because the discarded responses were incomplete or inconsistent, and these were the final valid data. The questionnaire was grouped into three sections that include demographic characteristics, TPB construct assessment items, and other variables of the extended model. There are 24 items to measure latent constructs, being taken after scales that are already proved valid in the studies of household recycling behavior (Ahmad, Bazmi, Bhutto, Shahzadi and Bukhari, 2016; Chen and Tung, 2010; Fan, Yang and Shen,

2019; Razali et al., 2020; Wan et al., 2021). (All items were rated on a 5-point Likert scale (1 = strongly disagree, 5 = strongly agree).

The detailed demographic characteristics of the respondents are presented in Table 1.

〈Table 1〉 Demographic characteristics

	Categories	n	(%)
Gender	Male	250	50.0
	Female	250	50.0
Age	20s	100	20.0
	30s	100	20.0
	40s	100	20.0
	50s	100	20.0
	60s and above	100	20.0
	Education	Middle school	50
	High school	86	17.2
	University	368	73.6
	Graduate	41	8.2
Occupation	General office worker	244	48.8
	Self-employed	37	7.4
	Professional	34	6.8
	Government official	10	2.0
	Student	35	7.0
	Housewife	64	12.8
	Agriculture	5	1.0
	Retired	27	5.4
	Others	44	8.8
	Region	Seoul	144
Busan		37	7.4
Daegu		23	4.6
Incheon		36	7.2
Gwangju		9	1.8
Daejeon		15	3.0
Ulsan		13	2.6
Gyeonggi		135	27.0
Gangwon		10	2.0
Chungbuk		8	1.6

	Chungnam	9	1.8
	Jeonbuk	9	1.8
	Jeonam	6	1.2
	Gyeongbuk	18	3.6
	Gyeongnam	25	5.0
	Jeju	1	0.2
	Sejong	2	0.4
Income (Won / month)	Less than 1 million	71	14.2
	1.0–1.99 million	62	12.4
	2.0–2.99 million	115	23.0
	3.0–3.99 million	110	22.0
	4.0–4.99 million	47	9.4
	More than 5 million	95	19.0
	Total	500	100.0

2. Hypothesis development

The statistical analysis of each stage and the software used to empirically analyze this study are presented as follows. To investigate the demographic characteristics of respondents, and to determine the basic reliability and factor analysis in preliminary validation of the measurement items, we have performed the type of frequency analysis by using IBM SPSS Version 24.0. Second, the structural equation model (SEM) was estimated by using the Partial Least Squares (PLS) method with WarpPLS Version 8.0. This technique was selected because it accommodates complex models with multiple latent variables, tolerates non-normal data distributions, and performs well with small to medium sample sizes. It is especially suitable for analyzing both direct and indirect effects within behavioral research frameworks.

Based on the extended TPB framework applied in this study, the following hypotheses were proposed to explore the determinants of household recycling intentions in South Korea:

- H1: Attitude (AT) positively influences recycling intention (IR).
- H2: Subjective Norm (SN) positively influences recycling intention (IR).
- H3: Perceived Behavioral Control (PBC) positively influences recycling intention (IR).
- H4: Convenience of Recycling Infrastructure (CARI) positively influences recycling intention (IR).
- H5: Awareness of Consequences (AC) positively influences recycling intention (IR).
- H6: Sense of Duty (SD) positively influences Attitude (AT).

The assessment process for model measurement allowed researchers to eliminate items which exhibited outer loadings less than 0.7 to enhance the model's reliability as well as its fitness. The measurement model required removal of four items SN2, AC1, CARI3, and PBC2. The research team checked the remaining items through measures of internal consistency reliability and convergent validity together with discriminant validity and model fit index testing. The analysis of the final model with hypothesis testing occurred through path analysis.

IV. Results

The measurement model's reliability and validity were assessed first. Table 1 summarizes the convergent validity, discriminant validity, and internal consistency reliability results. All constructs achieved acceptable CR values above 0.7 and AVE values exceeding 0.5. VIF values for all constructs were below the recommended threshold of 3.3, confirming no multicollinearity issues.

Path analysis was then conducted to test the proposed hypotheses. As shown in Table 2, SD had a strong positive effect on AT ($\beta = 0.656$, $p <$

0.001), confirming H6.

(Table 2) Validity and Reliability

Latent Variables	Indicator	Discriminant Validity		Convergent Validity	Internal Consistency	
		VIF	Loading Value	AVE	Cronbach's Alpha	Composite Reliability
AT	AT1	2.391	0.755	0.587	0.765	0.850
	AT2		0.800			
	AT3		0.726			
	AT4		0.782			
SN	SN1	1.791	0.833	0.702	0.788	0.876
	SN3		0.840			
	SN4		0.840			
PBC	PBC1	2.410	0.703	0.536	0.798	0.787
	PBC3		0.765			
	PBC4		0.701			
	PBC5		0.780			
CARI	CARI1	2.439	0.734	0.518	0.814	0.866
	CARI2		0.719			
	CARI4		0.705			
	CARI5		0.708			
	CARI6		0.722			
	CARI7		0.760			
AC	AC2	2.223	0.839	0.735	0.765	0.845
	AC3		0.827			
	AC4		0.809			
	AC5		0.747			
SD	SD1	2.445	0.709	0.544	0.832	0.877
	SD2		0.755			
	SD3		0.752			
	SD4		0.756			
	SD5		0.741			
	SD6		0.711			
IR	IR1	1.882	0.778	0.601	0.833	0.882
	IR2		0.755			
	IR3		0.800			
	IR4		0.840			
	IR5		0.708			

AT = attitude, SN = subjective norm, PBC = perceived behavioral control, CARI = convenience of the available recycling, AC = awareness of consequence, SD = sense of duty, IR = intention of recycling

In turn, AT significantly influenced IR ($\beta = 0.185$, $p < 0.001$), supporting H1. SN also had a positive and significant effect on IR ($\beta = 0.127$, $p = 0.002$), supporting H2.

PBC's relationship with IR was positive but marginal and statistically non-significant ($\beta = 0.059$, $p = 0.091$), partially supporting H3 and aligning with previous findings in contexts with well-established infrastructure. Both AC ($\beta = 0.335$, $p < 0.001$) and CARI ($\beta = 0.108$, $p = 0.007$) exerted significant positive effects on IR, confirming H4 and H5.

The extended TPB model explained 46% ($R^2 = 0.46$) of the variance in recycling intention, indicating moderate predictive power.

〈Table 3〉 Results of Hypotheses testing

Path	Hypothesis	Path coefficient(β)	Effect size	p-values	Results
AT → IR	H1	0.185	0.108	0.000	Supported
SN → IR	H2	0.127	0.060	0.002	Supported
PBC → IR	H3	0.059	0.027	0.091	Supported
CARI → IR	H4	0.108	0.049	0.007	Supported
AC → IR	H5	0.335	0.216	0.000	Supported
SD → AT	H6	0.656	0.431	0.000	Supported

AT = attitude, SN = subjective norm, PBC = perceived behavioral control, CARI = convenience of the available recycling, AC = awareness of consequence, SD = sense of duty, IR = intention of recycling

V. Discussion

The research reveals essential information about household recycling practices in South Korea through an extended application of the TPB. The research establishes SD as the main factor which drives recycling intentions among participants ($\beta = 0.656$, $p < 0.001$; Table 3). Past studies proved moral responsibility to be an essential predictor of environmental behavior which this research supports (Chen and Tung, 2010; Kaiser,

Hübner and Bogner, 2005). According to research data, a well-developed moral responsibility within individuals serves as a motivational force which drives them toward sustainable waste handling behavior.

Recycling behavior research validates the impact of AC on recycling behavior as observed by both Schultz (2002) and Bamberg and Möser (2007). In this study, AC showed a strong positive effect on recycling intentions ($\beta = 0.335$, $p < 0.001$; Table 3), confirming that disclosure of waste-related environmental impacts in society leads people toward better waste disposal behavior.

Research by Saphores, Ogunseitan, and Shapiro(2012) and Thi Thu Nguyen, Hung, Lee and Thi Thu Nguyen (2018) support the finding that easily accessible facilities for recycling enhance participation rates in recycling programs. The current study's results indicate that improvements in CARI significantly influence recycling intentions ($\beta = 0.108$, $p = 0.007$; Table 2), reinforcing the importance of infrastructure availability. Policymakers need to provide necessary infrastructure support because it determines whether household-level recycling initiatives will achieve success.

Results concerning SN influence matched previous findings identified by Park and Ha (2014) and Botetzagias, Dima, and Malesios (2015), with SN positively influencing recycling intentions ($\beta = 0.127$, $p = 0.002$; Table 3). This study discovered the lack of the significant impact of the PBC on recycling intentions ($\beta = 0.059$, $p = 0.091$; Table 3). Perceptions of behavioral control may not be as important in decision-making because of South Korea's highly standardized and established recycling infrastructure, which has decreased practical barriers to recycling. In socio- environments where recycling systems are well defined, accessible, and known to the public, PBC has a reduced value, as similar

results have been reported in institutionalized waste management scenarios. South Korean society maintains significant social and community influence regarding environmentally responsible actions while its inhabitants also embrace personal moral responsibility to protect their environment.

VI. Conclusion and Future Directions

The determinants of household recycling intentions in South Korea were investigated in this study, using TPB extended with SD, the AC and CARI. With the help of a quantitative survey and PLS-SEM analysis, this research brought new understanding of the synergistic effect of psychological, moral, and infrastructural factors on recycling behavior.

The results emphasize the importance of internalized moral obligations (especially SD) that predict recycling intentions, which remain under-considered in traditional models. Moreover, the study highlights the importance of infrastructural convenience and awareness of the environment for the promotion of sustainable waste practices. These results answer recently made calls for the incorporation of moral-psychological and contextual variables into models of pro-environmental behavior, particularly in quickly urbanized contexts such as South Korea.

Based on these results, several practical policy implications can be proposed.

First, environmental agencies should implement value-based environmental education programs starting in schools and community centers to instill a personal moral sense of environmental responsibility

from an early age. Second, local governments and waste management authorities should improve the visibility, accessibility, and clarity of recycling infrastructure, including clear labeling of bins and waste sorting instructions, especially in high-density residential areas and mixed-use complexes. Third, public awareness campaigns should not only promote recycling habits but also emphasize the moral and social responsibility of protecting one's community environment, highlighting the societal benefits of proper waste separation and recycling.

These combined efforts can improve recycling participation by addressing both the moral-psychological drivers and practical infrastructural realities that shape behavior, as this study's integrated TPB extension suggests.

Despite the contribution to environmental behavior research, the following limitations exist. The cross-sectional design precludes causal interpretation, and other variables such as habit strength or trust in public services were not considered. Further research should use longitudinal approaches as well as expand the model to different cultural settings to enhance generalizability and theoretical robustness. Comparative studies in diverse cultural settings would also be valuable in confirming the generalizability of this extended TPB framework.

In conclusion, this study not only advances theoretical understanding of pro-environmental behavior but also offers clear, actionable guidance for policymakers and community leaders seeking to strengthen household recycling practices in South Korea and similarly urbanized societies.

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