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THE DRIVING MECHANISM OF WASTE CLASSIFICATION BEHAVIOUR STUDIES THE ROLE OF ENVIRONMENTAL VALUE, SUBJECTIVE NORM AND PERCEIVED BEHAVIOUR CONTROL

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ABSTRACT

Waste classification is an important environmental governance problem in urban sustainable development, but the formation mechanism of residents' classification behaviour is not clear. Based on the theory of planned behaviour and values-belief-norm theory, this study constructed a structural equation model to explore the influence of environmental values, subjective norms, and perceived behaviour control on waste classification behaviour, and analyzes the mediating role of waste classification intention. Based on the empirical analysis of 468 valid questionnaires in Hefei, it is found that: (1) subjective norms and perceived behaviour control have a significant positive impact on waste classification behaviour, among which subjective norms have the strongest influence; (2) environmental values have no direct influence on waste classification behaviour, but can indirectly influence behaviour through the intention of waste classification; (3) waste classification consciousness plays a partial intermediary role between various variables and waste classification behaviour. Research shows that to improve residents' waste classification behaviour, it needs to strengthen the guidance of social norms, to improve the classification facilities, to enhance the perception of behaviour control, and to enhance the intention of waste classification through publicity and education, so as to provide empirical support for policy formulation.

Keywords: Waste classification behaviour, Environmental values, Subjective norms, Perceived behaviour control, Intention of waste classification, Structural equation model (SEM).

1. INTRODUCTION

In recent years, with the acceleration of urbanization and the improvement of residents' living standards, the output of urban waste has increased sharply, and the problem of waste classification has attracted global attention(Kuang & Lin, 2021). As an effective means to reduce waste pollution and improve the efficiency of resource recycling, waste classification is crucial to promoting the sustainable urban development (Ma et al., 2023). In positive response, the Chinese government has introduced a series of policies to promote waste classification. However, in practice, it still

faces challenges such as low participation of residents, weak classification intention and inconsistent implementation standards(Guo & Chen, 2022).

As the provincial capital of central China, Hefei urbanization has developed rapidly, and waste management has become an urgent problem to be solved(Qin et al., 2024). To this end, Hefei has adopted a series of policies and measures, such as the establishment of a whole-process supervision system, the implementation of fixed-time classification, the introduction of policy guidance and the construction of waste classification education base, which has effectively enhanced the residents' participation and intention of classification, unified the implementation standards, and significantly improved the effect of waste classification(Tang et al., 2024).

This study selected Hefei as a case, and discussed the factors affecting the behaviour of residents. This paper mainly analyzes the influence of environmental values, subjective norms and perceived behaviour control on residents' waste classification behaviour, and examines the intermediary effect of waste classification consciousness in order to reveal the psychological mechanism of waste classification behaviour.

In the context of new urbanization, the comprehensive treatment of urban solid waste has become a major environmental governance problem for urban development. The amount of municipal solid waste continues to increase, which causes load pressure on the ecological environment system and challenges to the sustainable development capacity of the city(Shamaee et al., 2024). The Chinese government has recognized the importance of waste classification and has taken several measures to promote its implementation, but it still faces multiple challenges(Meng et al., 2021).

Therefore, this study takes Hefei City, aims to reveal the key factors affecting the waste classification behaviour of residents through thorough analysis, and provide targeted suggestions for the government and policy makers. It is expected to help them formulate more effective waste classification policies, improve the participation and implementation of residents, so as to promote the in-depth development of urban waste classification work, and contribute to the sustainable development of the city.

2. LITERATURE REVIEW

2.1 The theoretical basis of waste classification behaviour

The formation mechanism of waste classification behaviour is complex and diverse, involving individual psychological decision-making, social norms and external environmental influence. Many theoretical models provide explanations for this purpose, including the theory of planned Behaviour (TPB), proposed by Ajzen (1991). The theory states that individual behaviour is directly driven by behavioural intention, which is jointly influenced by three core factors: attitude, subjective norms, and perceived behavioural control. Specifically, residents of waste classification of positive or negative evaluation (attitude), from family members, friends, community or government expectations (subjective norms) and residents of the subjective judgment of the difficulty of waste classification (perceived behaviour control) together on its behaviour intention, thus affect the actual waste classification behaviour(Lou et al., 2022). In

addition, the value-belief-norm theory (VBN) also provides a favorable perspective for understanding waste classification behaviour. VBN theory emphasizes the influence of personal values on environmental behaviours, pointing out that personal environmental values will shape their environmental beliefs, and then form normative intention, and eventually guide them to adopt environmental behaviours(Lee et al., 2023). This study specifically focused on the mechanisms of environmental value on waste classification behaviour, especially exploring how individuals; sense of responsibility for ecological environment can stimulate their intention for waste classification. By integrating the theory of planning behaviour and the value-belief-norm theory, we aim to fully reveal the psychological mechanism and social motivation of waste classification behaviour, and provide theoretical support for promoting the popularization and implementation of waste classification.

2.2 Main factors affecting waste classification behaviour

Residents' waste classification behaviour is complex and changeable, influenced by multiple factors. Among them, subjective norms (SN), perceived behaviour control (PBC) and environmental values (EV) are particularly critical, while waste classification intention (WCI) plays a bridge role in this role.

Environmental values are individuals' attitudes and beliefs towards environmental protection, which determines whether residents are willing to take environmental actions(Tamar et al., 2021). Residents with a strong sense of environmental responsibility and ecological beliefs are more likely to recognize the importance of waste classification and view it as a necessary measure of personal responsibility and social sustainability. Such environmental values will stimulate residents' intention to classify, and then promote the occurrence of their actual classification behaviour.

Subjective norms embody the influence of social stress on individual behaviour. The expectations and regulations of families, friends, communities and governments will all encourage residents to participate in waste classification(Mouloudj et al., 2023). If residents feel the positive attitude of the surrounding people and the social environment towards waste classification, they are more likely to initiate the intention of classification. For example, the exemplary role of relatives and friends, the publicity atmosphere of the community, and the government's policies and regulations will enhance the subjective norms of residents, and then promote their waste classification intentions.

Perceived behavioural control reflects individuals' assessment of their ability to perform waste classification. The lack of waste classification knowledge, the inconvenience of facilities and the consumption of time and energy may weaken the residents' perceived behaviour control, and thus hinder the formation of their classification intention(Oehman et al., 2022). On the contrary, when the residents have mastered sufficient classification knowledge, the community is equipped with convenient classification facilities, and the waste classification does not cause too much burden on them, they tend to form a positive classification will.

Waste classification intention, as a mediating variable, plays a bridge between subjective norms, perceived behavioural control and environmental value and waste classification behaviour. According to the TPB theory, individuals are more likely to implement classification behaviour only after they want to conduct waste classification(Al Mamun et al., 2024). Thus, we can expect that subjective norms, perceived behavioural control, and environmental values first influence the residents 'categorical intentions, while intentions can further drive the residents' actual categorical behaviour.

In conclusion, this study constructs a theoretical framework in which environmental values, subjective norms and perceived behavioural control indirectly influence waste classification behaviour. Intent plays a mediating role in this process, connecting the leading factor variable to the outcome variable. This theoretical framework provides a theoretical basis for the subsequent structural equation model (SEM) analysis, and aims to fully reveal the main factors affecting waste classification behaviour and their action mechanisms.

3. RESEARCH METHODS

3.1 Study model and hypothesis

This study integrates the framework of planned behaviour theory (TPB) and values-belief-norm theory (VBN), and aims to deeply analyze the mechanism of environmental values, subjective norms and perceived behaviour control on waste classification behaviour, and to verify the mediation effect of waste classification intention in it. See theoretical framework. Through systematic literature review and theoretical deduction, this study constructs a following research hypothesis system:

First of all, environmental values, as the core dimension of individual environmental protection cognition, have a significant impact on the decision-making process of individual participation in environmental governance. When residents establish a clear sense of environmental responsibility and fully realize the ecological value of waste classification, their intention to participate in waste classification and the probability of practical actions will be significantly increased. Based on this, this study makes the following assumptions:

H1: Environmental values positively affect the intention of waste classification;

H2: Environmental values positively affect waste classification behaviour.

Secondly, subjective norms reflect the external binding force of social groups on individual behavioural decision-making. When community residents perceive normative pressure from relatives, peers and community organizations, their practical tendency to conduct waste classification will be strengthened. Accordingly, the present study proposed the following hypotheses:

H3: Subjective norms positively affect the intention of waste classification;

H4: Subjective norms positively affect the waste classification behaviour.

Moreover, perceived behaviour control focuses on the effectiveness assessment of individuals on the implementation of waste classification, involving key elements such as knowledge reserve, facility convenience and time cost. When residents form a positive perception of ability, their

behavioural intentions will increase simultaneously with their actual participation. Thus, this study establishes the following assumptions:

H5: Perceived behaviour control positively affects the intention of waste classification;

H6: Perceived behaviour control positively affects waste classification behaviour.

According to the behaviour prediction model of the theory of planned behaviour, the behaviour intention is the most direct pre-variable of the actual behaviour. Existing empirical studies show that there is a significant causal association between environmental behaviour and behavioural intention. Therefore, the present study proposed the following core hypotheses:

H7: The intention of waste classification positively affects the waste classification behaviour.

At the same time, this study constructed a mediation effect hypothesis system, which believes that environmental values, subjective norms and perceived behaviour control have indirect effects on waste classification behaviour through the intermediary transmission mechanism of waste classification intention. The specific assumptions are made as follows:

H8a: Residents waste classification intention plays an intermediary role between environmental values and residents' waste classification behaviour;

H8b: Residents waste classification intention plays an intermediary role between subjective norms and residents' waste classification behaviour;

H8c: Residents waste classification intention plays an intermediary role between perceived behaviour control and residents' waste classification behaviour.

In order to empirically test the above paths, this study uses structural equation model (SEM) to conduct data analysis, aiming to verify how subjective norms, perceived behaviour control and environmental values indirectly drive waste classification behaviour through the intermediary variable of behaviour intention, and to confirm the direct predictive effect of behaviour intention on actual behaviour. Through the verification of this series of research hypotheses, this study hopes to reveal the psychological mechanism of waste classification behaviour, provide scientific basis for policy makers, and promote the effective development of waste classification work.

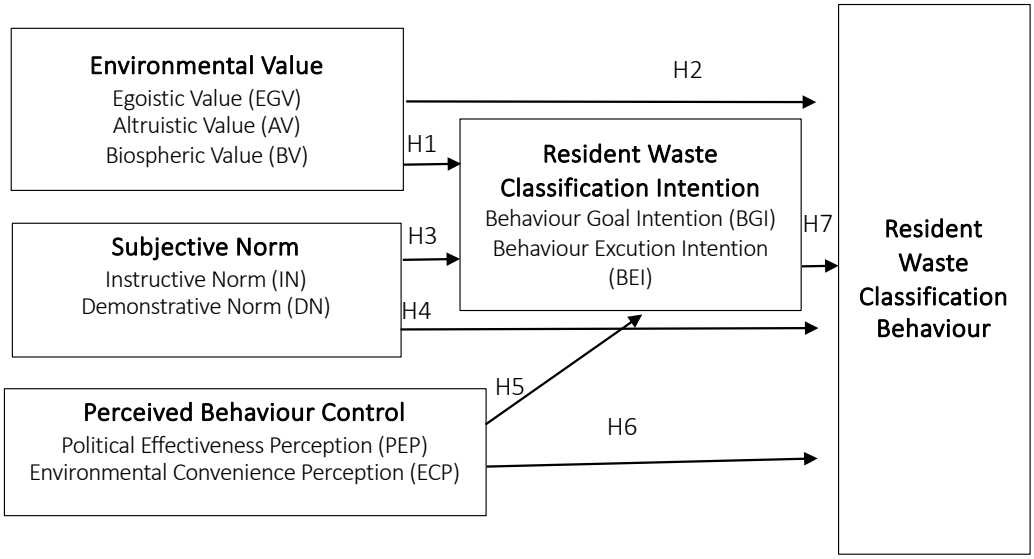

Figure 1: Concepture Framework

3.2 Data collection and sample description

3.2.1 Data collection method

This study used a questionnaire survey method to fully understand the waste classification behaviour of Hefei residents and its influencing factors. In order to ensure the scientific and effective data, the questionnaire was designed with Likert 5 scale, and the options were changed from “completely disagree” to “fully agree”, which is detailed and accurate for follow-up analysis.

In terms of sample extraction, this study combines multi-stage sampling and systematic sampling methods. First of all, according to the administrative region division of Hefei City, Luyang District, Baohe District, Shushan District and Yaohai District are selected as the preliminary sampling framework. These four regions are representative and can reflect the overall situation of Hefei City. Secondly, streets were taken as the focus of sampling, 45% of streets were randomly selected, and 17 streets were finally locked as secondary sampling units to ensure the representativeness of the street level sample. Finally, a systematic sampling strategy was adopted to select the top 30 communities from the list of residential communities in each street, and distribute questionnaires to the residents of Room 201 of Building 2, so as to ensure both the sample size and the representativeness of the community and the household level, and reduce the deviation. The survey lasted for several months from January to April 2024 to ensure full and complete data collection.

3.2.2 Sample description

A total of 510 questionnaires were distributed in this survey. After screening and classification, 468 valid questionnaires were collected, with an effective recovery rate of 91.7%, which was similar to the effective recovery rate of 93.28% in the satisfaction survey of residents in the service industry of Anhui Province. The specific characteristics of the samples are shown in the table 1.

Table 1 Demographic characteristics of the respondents (N=468)

Demographic Information	Frequency(n)	Percentage(%)
Gender		
Male	244	52.14
Female	224	47.86
Total	468	100
Age		
21-30 years old	78	16.7
31-40 years old	102	21.8
41-50 years old	105	22.4
51-60 years old	99	21.4
Above 60 years old	84	18.1
Total	468	100
Education level		

Junior High School and below	38	8.2
High school & secondary school	188	40.1
Degree	194	41.4
Masters & PhD	48	10.3
Total	468	100
Monthly Income		
Less than CNY2,000	119	25.5
CNY2001 – CNY4,000	111	23.7
CNY4,001 – CNY7,000	74	15.8
CNY7,001 – CNY10,000	104	22.2
More than CNY 10,000	60	12.8
Total	468	100

3.2.3 Representative analysis of the samples

In order to verify the representativeness of the samples, this study used the Chi-square test (Chi-square test) to compare the demographic characteristics of the samples with the overall population structure of Hefei city. The results showed that the distribution of the sample in sex, age, education and income level was not significantly different from the overall distribution ($p > 0.05$), which fully proves that the sample data collected in this study performed well in terms of representativeness and generalizability.

In conclusion, this study ensures the reliability and validity of the data through rigorous sampling methods and data collection process. Next, a reliability and validity analysis will be conducted to further verify the scientificity and rationality of the measurement tools.

4. ANALYSIS AND FINDINGS

4.1 Descriptive statistical analysis

According to the descriptive statistical analysis of 468 residents, the scores of residents in all dimensions were generally biased to medium and high levels, indicating that most residents hold positive attitudes in environmental values, subjective norms, and perceived behaviour control. The mean value of environmental values was 3.558, indicating that residents' recognition of environmental values was relatively balanced, but there were significant differences among individuals, especially the recognition of self-interest environmental values was relatively low. The average value of subjective norms is 3.606, showing that residents' social expectations of waste classification behaviour are more recognized, among which the recognition degree of mandatory norms is slightly higher than that of demonstrative norms. The mean value of perceived behaviour control was 3.591, indicating that residents generally believed that they were capable of performing waste classification, but there were some differences in the perception of the effectiveness of remediation and environmental convenience. The average value of waste classification intention is 3.665, which shows that residents' theoretical cognition and behaviour intention of waste classification are quite positive. However, the gap between the behaviour execution intention and the target intention can not be ignored. In general, the waste classification

behaviour of residents (mean 3.628) showed some enthusiasm, but there were significant differences among individuals, indicating that although most residents have certain waste classification intention and behaviour intention, some groups still have great differences in the actual classification behaviour.

Table 2 Statistical description of the variables

	N	Mean	Median	Variance	Skewness	Kurtosis
EGV	468	3.49	3.6	0.77	-0.71	0.27
AV	468	3.56	3.8	0.74	-0.78	0.32
BV	468	3.63	3.8	0.63	-0.99	1.06
EV	468	3.56	3.67	0.48	-0.12	-0.49
IN	468	3.62	3.8	0.72	-0.92	0.90
DN	468	3.60	3.8	0.76	-0.91	0.60
SN	468	3.61	3.75	0.60	-0.50	0.09
PEP	468	3.58	3.8	0.54	-0.72	0.68
ECP	468	3.60	3.8	0.57	-0.89	1.26
PBC	468	3.59	3.7	0.46	-0.37	0.16
BGI	468	3.71	3.8	0.48	-0.95	1.93
BEI	468	3.62	3.8	0.52	-0.78	0.88
WCI	468	3.67	3.8	0.406	-0.274	-0.048
WCB	468	3.63	3.8	0.68	-1.05	1.02

4.2 The reliability analysis

Table 3 reliability analysis shows the Cronbach' Alpha coefficient, minimum CITC value, item number and evaluation of each construct. Total table Cronbach' Alpha value is 0.946, with extremely high internal consistency. The Cronbach' Alpha value of EGV, AV, BV, IN, DN, PEC, ECP are 0.889-0.928 (extremely high reliability); BGI, BEI and WCIA are 0.878-0.909 (high reliability). All constructs whose minimum CITC values exceeded 0.349, indicating that the measured items were correlated well with the constructs. The study shows that the reliability of each construct reaches the standard, laying the foundation for the subsequent analysis of the structural equation model.

Table 3. Results of the reliability analysis

Constructs	Cronbach's Alpha(α)	Minimum CITC	Items	Comment
EGV	0.910	0.699	5	Excellent Reliability
AV	0.918	0.739	5	Excellent Reliability
BV	0.902	0.703	5	Excellent Reliability
IN	0.914	0.725	5	Excellent Reliability
DN	0.928	0.772	5	Excellent Reliability
PEP	0.889	0.691	5	Excellent Reliability
ECP	0.895	0.670	5	Excellent Reliability

BGI	0.878	0.641	5	High Reliability
BEI	0.888	0.672	5	High Reliability
WCI	0.909	0.712	5	High Reliability
Total	0.946	0.349	60	Excellent Reliability

4.3 Exploratory factor analysis

The exploratory factor analysis showed that the number of KMO sampling suitability was 0.934, indicating that the data was suitable for factor analysis, with sufficient sample size and strong correlation. The approximate chi-square value of Bartlett sphericity test is 20546.869, degrees of freedom of 1770, and significance level is 0.000, further verifying that there was significant correlation between the variables in the data and suitable for factor extraction.

Table 4 Results of KMO and Bartlett

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.937
Bartlett's Test of Sphericity	Approx. Chi-Square	16920.548
	df	1225
	Sig.	.000

In this study, principal component analysis was used to extract factors and use the criteria of 10 Kaiser feature root greater than 1, and these factors explained 73.368% of the variance, indicating good structural validity of the questionnaire. The factorial load matrix after rotation showed that all the measured variables were loaded more than 0.5 on the respective attributed factors, and this result further verified the good validity of the questionnaire. In conclusion, the results of the factor analysis indicated that the measurement dimensions of the questionnaire have a clear structure and good reliability and validity, and are, therefore, suitable for subsequent behavioural studies.

4.4 Confirmatory factor analysis

The confirmatory factor analysis showed that the model fit well. The CMIN / DF was 1.432, below 3, meeting the goodness of fit criteria. The RMSEA was 0.030, well below 0.08, indicating the model with minimal approximation error and good fit. Furthermore, NFI, IFI, TLI and CFI were 0.906,0.970,0.968 and 0.969, respectively, all greater than 0.9, indicating a very high fit of the model. Therefore, overall, the model has a good fit, and the results of the confirmatory factor analysis support the rationality of the assumed structure.

4.5 Validity test

4.5.1 Convergent Validity

The purpose of this study is to evaluate the internal consistency and convergence validity of the tool for measuring factors of waste classification behaviour using mean variance extraction (AVE) and combined reliability (CR) indicators. Table 6 presents in detail the analysis results of the main variables, including environmental values, subjective norms, perceived behaviour control, waste classification intention and their dimensions.

Specifically, the AVE values of egoistic values (EV), altruistic values （AV） and biospheric values (BV) were 0.674,0.692 and 0.651, respectively, with CR values exceeding 0.9, indicating good convergent validity and internal consistency of the measured items of these variables. The AVE values of the mandatory specification (IN) and the demonstrative norm (DN) in the subjective norms were 0.681 and 0.722, respectively, and the CR values were higher than 0.91, showing high explanatory power and stability. The AVE values of political effectiveness perception (PEP) and environmental convenience perception (ECP) in perceived behaviour control were between 0.621 and 0.635, and the CR values were both close to 0.9, indicating that residents have a relatively stable cognition of the policy implementation effect and waste classification facilities. The AVE values of behavioural goal intention (BGI) and behavioural execution intention (BEI) in waste classification consciousness were 0.603 and 0.623, respectively, and the CR values were higher than 0.87, indicating that residents had strong waste classification intention and high consistency during implementation. The AVE value of the waste classification behaviour (WCB) was 0.715 and the CR value was 0.925, showing the high reliability of the measurement tool.

In conclusion, the AVE values of the measurement tools in this study were higher than 0.60 and the CR value was higher than 0.87 on all variables, indicating that all variables have good convergent validity and internal consistency, and providing a reliable basis for subsequent structural equation model (SEM) analysis to further verify the relationship between variables.

4.3.2 Discriminant Validity

The discriminatory validity analysis was validated by comparing the correlation coefficients between the constructs and the square root value of the mean variance extraction (AVE) for each construct. According to the data in the table, the number of the diagonal diagonal is the square root of the AVE value of each component, showing the high correlation between each latent variable and its own measurement item. To verify discrimination validity, the correlation coefficients between other components need to be less than the square root of the AVE value of each component. From the results in the table, the correlation coefficients between all latent variables were lower than the square root of the respective AVE, and most of the correlations were significant at 1% or 5% significance levels, indicating that the differences between the latent variables were well distinguished. For example, the correlation coefficient of EGV and AV is 0.605, which is also lower than its AVE square root of 0.820, further verifying the good discrimination validity. In addition, the correlation coefficients of BGI and BEI were 0.77 and 0.783, respectively, which were higher, but still lower than the correlation coefficient among other latent variables, so the discriminatory validity was still maintained. Taken together, the test results of discrimination validity showed significant discrimination among the latent variables, which strongly supported the hypothesis of discrimination validity proposed by the model. The conception of each latent variable is clear and independent, and can be effectively distinguished from other components, ensuring the accuracy and reliability of the measurement.

Table 5 The discriminant validity table

	EGV	AV	BV	IN	DN	PEP	ECP	BGI	BEI	WCB
EGV	0.82									
AV	0.605**	0.831								
BV	0.387**	0.513**	0.806							
IN	0.191**	0.196**	0.073**	0.825						
DN	0.176**	0.272**	0.168**	0.619**	0.849					
PEP	0.167**	0.245**	0.141**	0.087	0.241**	0.787				
ECP	0.152**	0.3**	0.231**	0.153**	0.345**	0.665**	0.797			
BGI	0.114*	0.28**	0.224**	0.087**	0.219**	0.264**	0.29**	0.77		
BEI	0.207**	0.368**	0.376**	0.196**	0.368**	0.325**	0.391**	0.628**	0.783	
WCB	0.368**	0.458**	0.333**	0.307**	0.486**	0.374**	0.44**	0.413**	0.523**	0.818

**, * Represents 1%, 5% significance level diagonal number is the root value of the AVE of this factor

4.6 Structural equation model fitting analysis

This paper uses AMOS to analyze the statistics of model fit in SPSS to test the degree of model fit. After the model path significance test of the software, the model standardized path coefficient, critical proportion value C.R. and P value of significance of the influencing factors are obtained. In general, in the structural equation model (SEM), if the critical ratio (C.R.) of the standardized path coefficient is greater than 1.96 and the P value is less than 0.05, the path coefficient is significant within the 95% confidence interval, and the corresponding path assumption in the preset model can be considered valid. Conversely, assuming the path coefficient is not significant, i. e. C.R. value less than or equal to 1.96 or P-value greater than or equal to 0.05.

Use software to establish environmental cognition, environmental values, subjective norms, perceived behaviour control of residents waste classification consciousness and residents waste classification behaviour and residents waste classification consciousness of residents waste classification behaviour structure equation model, and to the fitting results, path coefficient and significance test, establish structural equation model, model is shown in the following figure 2.

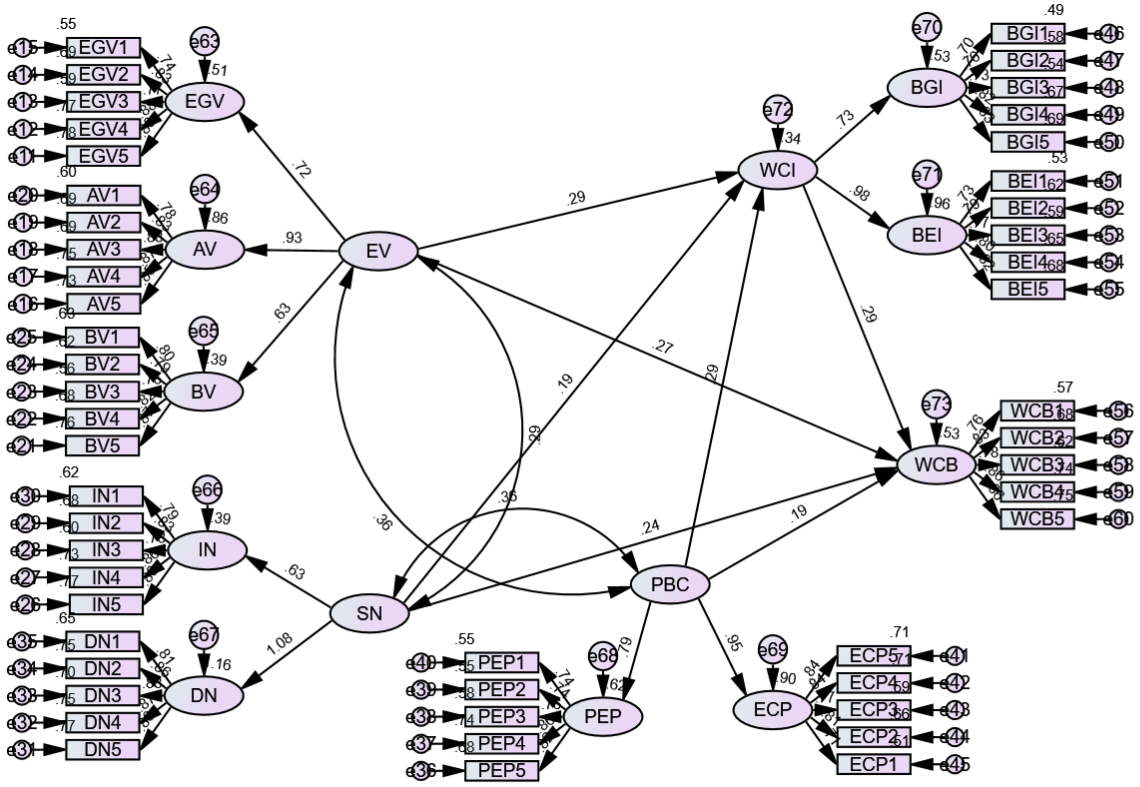

Figure 2 Structural Equation Model Diagram

After the model fitting calculation of the software, the fitting index corresponding to the structural equation model is shown in the table below.

Table 6 Model-fit indicators

	CMIN/DF	RMSEA	NFI	IFI	TLI	CFI
Standard	<3	<0.08	>0.9	>0.9	>0.9	>0.9
Fit result	1.432	0.030	0.906	0.970	0.968	0.969

The analysis of the table 7 above shows that the model fits well and meets most commonly used fitting index criteria. The model was well fit. CMIN / DF was 1.432, below 3, meeting the goodness of fit. The RMSEA was 0.030, well below 0.08, indicating the model with minimal approximation error and good fit. Moreover, NFI, IFI, TLI and CFI were 0.906,0.970,0.968 and 0.969, respectively, all greater than 0.9, showing the high fit of the model during the fitting process and able to accurately and effectively explain the relationship between variables.

Environmental values had a statistically significant positive effect on residents' intention of waste classification (path coefficient β =0.172, critical ratio C.R.=2.093, p=0.036), but their effect value was relatively limited and only reached the traditional significance threshold (p <0.05). Structural equation modeling showed that the predictive power of environmental values is low compared to subjective norms (SN) and perceived behavioural control (PBC). As a multi-dimensional construct covering the value orientation of self-interest, altruism and ecosphere,

environmental values can effectively stimulate individuals' internal identification of environmental protection behaviours. Although the effect size is small, the results of the significance test still support hypothesis H1, which confirms that there is a significant promotion effect of environmental values on the intention of waste classification. The finding suggests that policy makers should pay attention to the long-term cultivation of value guidance strategies while improving the environmental cognition system, so as to achieve the sustainable improvement of waste classification intention.

It is worth noting that the direct effect of environmental values on waste classification behaviour did not pass the statistical significance test (β = 0.145,C.R.=1.761, p=0.078), indicating significant limitations in its behavioural explanatory power. This finding echoes the empirical research of Wen et al. (2019a), revealing that the environmental attitude variables are susceptible to external variables such as social norms, policy framework and infrastructure in the process of behaviour prediction. The results show that there may be theoretical thresholds for the direct promotion mechanism of environmental values on classified behaviour, and the behaviour practice not only needs value drive, but also depends on the synergy of habit formation mechanism and social support system. Although assuming H2 is unsupported, the mediation effect analysis suggests that environmental values may have indirect effects on behaviour through the conscious mediation pathway.

Subjective norms showed significant predictive effects on waste classification intention (β = 0.209,C.R.=3.392, p <0.001) and behaviour (β = 0.344,C.R.=5.252, p <0.001), and their standardized path coefficient was the first among all predictive variables. This finding highlights the central role of social referential groups in environmental behavioural decision-making, generating significant motivation for behavioural compliance when individuals perceive normative expectations of important others or social networks. The research results effectively verify the hypothesis H3 and H4, which provides a clear direction for policy making: through community consensus building, demonstration group cultivation and institutional pressure transmission, the guiding effect of social norms can be effectively amplified.

The dual path effects of perceived behavioural control (PBC) on the intention of waste classification (β = 0.281,C.R.=4.41, p <0.001) and behaviour (β = 0.217,C.R.=3.374, p <0.001) reached significant levels, confirming the central position of behavioural efficacy in the theoretical framework of planned behaviour. The data show that situational factors such as infrastructure accessibility, operational convenience and institutional support indirectly enhance the probability of behaviour implementation by enhancing the perception of individual behaviour control. The verification results of H5 and H6 suggest that the policy implementation should focus on optimizing the hardware support system for waste classification, and strengthen the efficacy of residents' participation by lowering the behavioural threshold.

The mediation effect test showed that the intention of waste classification had a significant positive prediction effect on the actual behaviour (β = 0.21,C.R.=3.011, p=0.003), confirming the theoretical expectation of H7. This pathway coefficient indicates that the conscious variable can explain about 4.41% of the behavioural variance, indicating that the cognitive transformation

mechanism has an irreplaceable role in environmental behavioural decision making. This finding provides important enlightenment for behavioural intervention strategies: through the combination of cognitive reinforcement training and situational cue cue, it can effectively promote the practice transformation of environmental intention.

This study found that in the interpretation model of waste classification behaviour, subjective norms (β =0.344) had a direct effect advantage with perceived behavioural control (β =0.217), while environmental values (β =0.172) had indirect effects through the conscious mediation path. The fitting index of the structural equation model (RMSEA = 0.042, CFI = 0.962, TLI = 0.953) showed that the theoretical model has a good fit. The conclusion of the research emphasizes that waste classification policy needs to build a trinity intervention system of "value-norm-control": strengthen the internalization of environmental values at the micro level, improve the restraint mechanism of social norms at the middle level, and optimize the supporting environment for the implementation of behaviour at the macro level.

Table7 Structural Model Results for Residents' Waste Classification Behaviour and Intention

Hx	Estimate	S.E.	C.R.	P	Standardized Regression Weight	Relationship	Finding
H1	0.172	0.082	2.093	0.036	0.141	Very Weak, Positive	Supported
H2	0.145	0.082	1.761	0.078	0.100	Extremely Weak, Positive	Not Supported
H3	0.209	0.062	3.392	***	0.163	Very Weak, Positive	Supported
H4	0.344	0.065	5.252	***	0.225	Very Weak, Positive	Supported
H5	0.281	0.064	4.41	***	0.252	Very Weak, Positive	Supported
H6	0.217	0.064	3.374	***	0.164	Very Weak, Positive	Supported
H7	0.21	0.07	3.011	0.003	0.176	Very Weak, Positive	Supported

4.7 Mediation effect test

The Bootstrap is used to verify the mediation role of waste classification intention in the influence of environmental values, subjective norms, and perceived behaviour control on residents' waste classification behaviour (WCB). The results are shown in the following table:

The influence of environmental values on residents' waste classification behaviour plays a partial intermediary role through waste classification intention. The total effect was 0.540, with the direct effect being 0.337 and the mediation effect being 0.203. The P-value was 0.001, indicating a significant mediation effect. The 95% confidence interval was [0.140,0.286], excluding 0, further confirming that environmental values influence waste classification behaviour through waste classification intention. This indicates that although the direct influence of environmental values on waste classification behaviour is relatively limited, its indirect influence on residents' behaviour is significantly enhanced through waste classification intention. Therefore,

policy and education work can promote behaviour change by enhancing residents' environmental values and guiding them to establish their intention of waste classification, so H10b is assumed.

The influence of subjective norms on waste classification behaviour also shows a significant mediation effect through waste classification intention. The total effect was 0.508, direct effect 0.326, mediation effect 0.182 and P value 0.001, indicating a significant mediation effect. The 95% confidence interval is [0.129,0.249], excluding 0, indicating that the path of subjective norms affecting waste classification behaviour through waste classification intention is significant. This suggests that social norms and the expectations of others can indirectly promote residents' classification behaviour by influencing their intention of waste classification. Strengthening the support of social norms for waste classification behaviour can further promote the change of actual behaviour by enhancing residents' behaviour intention. Therefore, it is assumed that H10c is established.

The influence of perceived behavioural control on waste classification behaviour also showed a significant mediation effect through waste classification intention. The total effect was 0.512, direct effect 0.290 and mediation effect 0.222. The P-value was 0.001, indicating a significant mediation effect. The 95% confidence interval was [0.155,0.315], excluding 0, verifying the indirect influence of perceived behaviour control on waste classification behaviour through waste classification intention. The results show that the perceived behaviour control perception is crucial to promote the waste classification behaviour, and its function is mainly realized through the improvement of the waste classification intention. Therefore, policies should enhance individuals' control perception of waste classification, effectively enhance their intention, and then promote the actual behaviour of waste classification, on which the hypothesis H10d can be verified.

The study found thaenvironmental values, subjective norms and perceived behaviour control had a significant impact on waste classification behaviour. As a intermediary variable, the intention of waste classification was significant in the 95% confidence interval and does not include 0, which indicates that it plays a key intermediary role in promoting the classification behaviour of residents' waste classification. With the advancement of urbanization process, waste classification as a solution has been adopted by more and more communities, and its positive impact on improving the quality of life of community residents has been widely recognized. For example, after the implementation of the waste classification policy, the total amount of household waste in a city has decreased by 20 percent, and the recovery rate of recyclables has increased by 30 percent. In addition, residents' intention of waste classification has increased by 30%, and their enthusiasm for participation has also increased. Through the community carrying out waste classification publicity activities, the residents from the initial passive acceptance to active participation, forming a good environmental atmosphere. These changes show that the waste classification policy has achieved remarkable results in improving residents' intention of environmental protection, and effectively promoted the waste classification behaviour of residents. Therefore, in order to promote waste classification behaviour, policies should pay more attention to enhance residents' intention of waste classification, and enhance the influence of this intention by strengthening factors such as environmental cognition, values, social norms and perceived behaviour control.

Table 8 Results of the analysis of mediation effects

H(X)	Path	Effect Type	Estimate	Boot SE	P	95%BootCI		Result
						LLCI	ULCL	
H8a	WCB←WCI←EV	Direct effect	0.337	0.058	0.001	0.223	0.453	Partial Mediation
		Indirect effect	0.203	0.037	0.001	0.140	0.286	
		Total effect	0.540	0.051	0.001	0.439	0.640	
H8b	WCB←WCI←SN	Direct effect	0.326	0.056	0.001	0.217	0.443	Partial Mediation
		Indirect effect	0.182	0.031	0.001	0.129	0.249	
		Total effect	0.508	0.056	0.001	0.400	0.614	
H8c	WCB←WCI←PBC	Direct effect	0.290	0.064	0.001	0.170	0.422	Partial Mediation
		Indirect effect	0.222	0.040	0.001	0.155	0.315	
		Total effect	0.512	0.058	0.001	0.389	0.618	

5. DISCUSSION AND CONCLUSION

Based on the structural equation model (SEM), this study deeply explores the influence of environmental values, subjective norms, and perceived behaviour control on waste classification behaviour, and reveals the intermediary role of waste classification intention in it. The results showed that subjective norms and perceived behaviour control had significant direct effects on waste classification behaviour, while environmental values indirectly influenced behaviour through waste classification intention. Specifically, social pressure and behavioural feasibility are important factors driving residents to conduct waste classification, and environmental education and value cultivation are also crucial to enhance the intention of waste classification and then promote the classification behaviour. The intention of waste classification plays a key intermediary role between various variables and waste classification behaviour, emphasizing its importance in the process of behaviour formation. In addition, this study integrates the theory of planned behaviour with the values-belief-norm theory, which provides a new theoretical framework for the study of waste classification behaviour and provides empirical support based on the survey data of residents in Hefei. However, the study also had sample limitations, cross-sectional data limitations, and not considering other potential variables. Future studies could be extended to more regions, use longitudinal tracking data, and examine more influencing factors. Overall, this study

emphasizes the important role of social norms, behaviour control perception and waste classification intention in promoting waste classification behaviour, provides theoretical support for the government and community to formulate relevant policies, and provides a useful reference for promoting the sustainable development of urban waste management.

REFERENCES

- Ajzen, I. (1991). The theory of planned behavior. *Organizational behavior and human decision processes*, *50*(2), 179-211.
- Al Mamun, A., Ma, Y., Reza, M. N. H., Ahmad, J., Wan, H. W. M. H., & Lili, Z. (2024). Predicting attitude and intention to reduce food waste using the environmental values-beliefs-norms model and the theory of planned behavior. *Food Quality and Preference*, *120*, 105247.
- Guo, S., & Chen, L. (2022). Why is China struggling with waste classification? A stakeholder theory perspective. *Resources, conservation and recycling*, *183*, 106312.
- Kuang, Y., & Lin, B. (2021). Public participation and city sustainability: Evidence from Urban Garbage Classification in China. *Sustainable Cities and Society*, *67*, 102741.
- Lee, S. S., Kim, Y., & Roh, T. (2023). Pro-environmental behavior on electric vehicle use intention: Integrating value-belief-norm theory and theory of planned behavior. *Journal of Cleaner Production*, *418*, 138211.
- Lou, S., Zhang, X., & Zhang, D. (2022). What influences urban residents' intention to sort waste?: Introducing Taoist cultural values into TPB. *Journal of Cleaner Production*, *371*, 133540.
- Ma, W., de Jong, M., Zisopoulos, F., & Hoppe, T. (2023). Introducing a classification framework to urban waste policy: Analysis of sixteen zero-waste cities in China. *Waste Management*, *165*, 94-107.
- Meng, M., Wen, Z., Luo, W., & Wang, S. (2021). Approaches and policies to promote Zero-waste City construction: China's practices and lessons. *Sustainability*, *13*(24), 13537.
- Mouloudj, K., Bouarar, A. C., & Mouloudj, S. (2023). Extension of the theory of planned behaviour (TPB) to predict farmers' intention to save energy. AIP Conference Proceedings,
- Oehman, J. M., Babbitt, C. W., & Flynn, C. (2022). What predicts and prevents source separation of household food waste? An application of the theory of planned behavior. *Resources, conservation and recycling*, *186*, 106492.
- Qin, X., Xia, W., & Hu, X. (2024). Investigating the evolutionary relationship of coupling coordination between the social economy and lake water environment integrating multi-source data: a case study of Hefei, China. *Environment, Development and Sustainability*, 1-21.
- Shamaee, S. H., Yousefi, H., & Zahedi, R. (2024). Assessing urban development indicators for environmental sustainability. *Discover Sustainability*, *5*(1), 341.
- Tamar, M., Wirawan, H., Arfah, T., & Putri, R. P. S. (2021). Predicting pro-environmental behaviours: the role of environmental values, attitudes and knowledge. *Management of*

Environmental Quality: An International Journal, *32*(2), 328-343.

- Tang, J., Wang, T., Xia, H., & Cui, C. (2024). An overview of artificial intelligence application for optimal control of municipal solid waste incineration process. *Sustainability*, *16*(5), 2042.