



MUNICIPAL SOLID WASTE SEGREGATION IN DEVELOPING COUNTRIES: ROLE OF COGNITIVE FACTORS

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Abstract

This study investigates the factors influencing household waste segregation behavior in developing countries, with a specific focus on India. Employing the Value-Attitude-Behavior Theory (VABT), it examines how personal values (Self-Transcendence and Self-Enhancement) influence attitudes towards waste segregation, ultimately affecting waste segregation behavior. A survey was conducted among participants in India using established scales to measure these variables. The results show that attitudes towards waste segregation are strongly influenced by personal values, particularly Power (self-interest) and Benevolence (concern for others and the environment), which in turn affect trash segregation behaviour. It's interesting that gender did not turn out to be a major influence. These findings highlight how crucial it is to comprehend inhabitants' cognitive characteristics—more especially, their values—in order to advance environmentally friendly trash management techniques. Policymakers and stakeholders can promote positive behavioural changes towards trash segregation in developing nations by creating interventions that focus on particular values.

Keywords: Municipal Solid Waste, Waste segregation, Environment, Values, Attitude, Behaviour.

INTRODUCTION

The fast development in population, urbanization, industrialization, and enhancement in consumption has given birth to the wicked problem of municipal solid waste (MSW). Household waste, a major component of MSW, comprising both organic (40-60%) and inorganic recyclable materials (17.5%), if not segregated at source, remain unusable. In this context, segregation of solid waste at source significantly influences the subsequent stages of waste management. Therefore, the active participation of citizens has been identified as a critical aspect of the successful completion of one of the Sustainable Development Goals (SDGs) pertaining to municipal solid waste management (MSWM) (Zagozewski et al., 2011). MSWM refers to a systematic approach to the generation, collection, storage, transfer, segregation, processing, recycling, and disposal of residuals. MSW is a huge source of environmental contamination, but it may also be a valuable resource if mined correctly (Bourtsalas, 2023). Hence, it becomes imperative to explore ways and cost-effective approach for MSWM.

MSW collection efficiency in India is around 70%; the remaining is either scattered or disposed of haphazardly in low-lying areas or dumps (Kumar et al., 2017), compared to about 100% in developed countries. MSW segregation is mandatory in developed countries, wherein around 90% of collected MSW is utilized through recycling, whereas most developing and under-developed countries opt for MSW disposal through landfills, leading to serious environmental deterioration (Cheela et al. 2021). Many studies have revealed that major portion of the MSW generated can be recycled or reused for another use. However, as residents in developing and under-developed countries dispose of their MSW in an unsegregated form, the recycling MSW rate is less than 1%. In a study of Indian cities, it was found that majority of households dispose of their household waste in community bins without segregation (Sahoo et al. 2022). Because



of this, MSW heaps in the form of legacy waste that are situated outside of Indian cities are an eyesore in most of these cities.

India is a rapidly developing nation where there has been a significant increase in urbanisation, leading to a corresponding rise in garbage generation. The Government of India (GOI)'s Ministry of Housing and Urban Affairs (MOHUA) reported that the yearly production of MSW in urban areas is anticipated to be 55 million tonnes, with an additional projection of 165 million tonnes by 2030 and 436 million tonnes by 2050 (MOHUA, 2021; ASSOCHAM 2017). A major portion of MSW generated in India is managed in unfavourable and unsatisfactory way for which GOI complied “Solid Waste Management Rules 2016” (CPCB, 2016). Consequently, GOI has launched a countrywide campaign, namely “Clean India Mission” or “Swachh Bharat Abhiyan” which has brought a significant behavioural change in Indian people towards waste management. According to the latest CPCB Report (CPCB 2022), despite significant expenditure and efforts by the government, only a few cities in India have adopted waste segregation at a source. Resultantly, the government needs to chalk out appropriate strategies and policies for a required change in the attitude and behaviour of the residents towards MSW segregation (Mushtaq et al. 2020).

A plethora of research articles are available on investigation on various aspects influencing waste segregation behaviour in countries other than India. The present research employs the Value-attitude-behaviour Theory (VABT) (Homer and Kahle (1988) as its theoretical foundation for examining the role of cognitive factors in affecting waste segregation behaviour. The research attempts to fill this gap via identifying the role of cognitive aspects that affect the MSW segregation behaviour of urban residents in India. The findings of the study pertaining to the role of different cognitive factors concerning waste segregation at the household level shall be useful for policymakers, scholars, and academicians in designing appropriate policy interventions to modify the attitudes and behaviours of the citizens for enabling the attainment of the MSWM in a sustainable manner.

The introductory part of this paper is followed via conceptual background and a description of theoretical underpinning. Subsequent sections include contextual background, development of hypothesis, research methodology, findings, and results. Further, it is followed through discussion and conclusion sections.

CONCEPTUAL BACKGROUND AND THEORETICAL FRAMEWORK

This section outlines the theoretical background and illustrates the conceptual and contextual description of various concepts employed in the present study.

Prior research examining the key factors influencing residents' waste segregation behaviour has primarily focused on waste separation techniques, efficiency of waste recycling policies and critical determinants of individual waste separation behaviour. Scholars have also examined collaboration and partnerships among public authorities, private businesses and social organizations during waste segregation and disposal. However, a deeper knowledge of human values in connection with sustainable behaviour is still warranted, which is essential to inspect the predictors of householders' waste segregation behaviour. The influence of the Self-transcendence value (STV) has unlikely been tested in the context of waste-separation practice. Studies should be undertaken by taking into consideration demographic and cultural variables while investigating the factors impacting the Indian urban residents' intention toward segregating MSW.

Schwartz's Norm activation model (Schwartz 1973) and the Theory of planned behaviour (TPB) have been used in the earlier studies for investigating aspects influencing waste segregation behaviour. The present research employs the Value-attitude-behaviour Theory (VABT) as its theoretical foundation for examining the role of cognitive factors in affecting waste segregation behaviour.

VALUE-ATTITUDE-BEHAVIOUR THEORY

It's critical to comprehend why people don't convert their environmental concern into regular trash segregation procedures. To close this gap between attitudes and behaviour, social psychologists have created several models, such as the Theory of Planned Behaviour. They combined the research on the relationship among values, attitudes, and behaviour by a causal, hierarchical, and stratified effect amongst these variables through a model, which has been used and tested in several spheres. According to this logical hierarchy model, values exert an indirect influence on behaviour through attitudes. Thus, values, attitude and behaviour form a cognitive ladder with the effect deriving from strong abstract logics, i.e., values to attitudes, and then to specific actions based on the premise that values guide, motivate and affect attitudes and behaviours as shown figure 1.

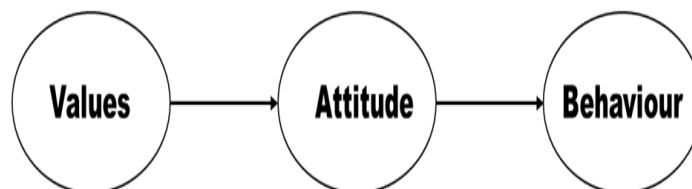


Figure 1: Theoretical model: Value-Attitude-Behaviour (Homer and Kahle 1988)

Cognitive factors concerning waste segregation.

Individual values

It is critical to investigate the effect of Values in waste segregation since they refer to fundamental beliefs and guiding fundamentals that serve as stable, meaningful, and supervisory coherent frameworks in people's lives (Rohan 2000). Values are our core convictions about what matters most in life. These core concepts guide our attitudes as behaviours. They serve as a framework that modifies our viewpoints and affects how we make decisions.

This study (Schwartz 2012) proposed a systematic classification of values into nineteen core values. A broad range of human values converge with the attainment of sustainability imperatives and can contribute significantly to the adoption of sustainable behaviour. This study looks at the relationship between waste segregation behaviour and Self-Transcendence Values (STV) and Self-Enhancement Values (SEV) (Brown et al. 1992) STV makes people prioritise the welfare of the world and other people by fusing altruism and environmental concerns (biosphere). Studies indicate a robust correlation between STV and actions and attitudes that support the environment.

The STV representing an individual's experience of expansion, both forward and backward, while feeling connected to mankind, earth and nature comprises two values, namely Universalism and Benevolence. For the present study, the Benevolence value was considered as it represents preserving and improving the well-being of those who are in contact and emphasize voluntary concern for others' welfare. Benevolence refers to altruism toward in-groups with the motivational objective of the welfare of close others, whereas universalism refers to altruism on a broader scale with the goal of the welfare of all individuals, including humanity.

SEV is a multifaceted source of motivation that spans the spectrum from enhancing oneself to protecting oneself from harmful thoughts and feelings. SEV comprises Power and Achievement values. The Power value was considered because it is concerned with one's standing in society and the importance of achieving and maintaining dominance in one's social group (Lafreniere et al., 2016). The Power value's driving force is the desire for control over other people and resources, which is diametrically opposed to the altruism and compassion that underpin the other two values.

Attitude toward waste segregation

Attitude can be defined in terms of its three characteristics: state of mind, faith or feelings, and the predisposition to behaviour (Ajzen 2014). Attitude, a speculative construct originating from an internal set of values and beliefs, refers to an internal psychological disposition characterised by the evaluation of a certain favor/disfavor toward an item. Therefore, attitude is the propensity to observe a certain thing or respond with a positive or negative degree of preference (Altmann 2008).

Behaviour towards waste segregation

Behaviour generally refers to how individuals conduct, interact, or behave with one another. Ecological behaviour is stated to be benevolent or generous as the quality of the environment is mainly dependent upon human behaviour systems. The behaviour of urban households towards MSW segregation leads to efficient recycling, which is a part of the waste management process for reducing the problem of MSW disposal (Chen et al. 2019).

HYPOTHESES BUILDING

This study utilises VABT as a theoretical framework to check for the associations as shown in Figure 2.

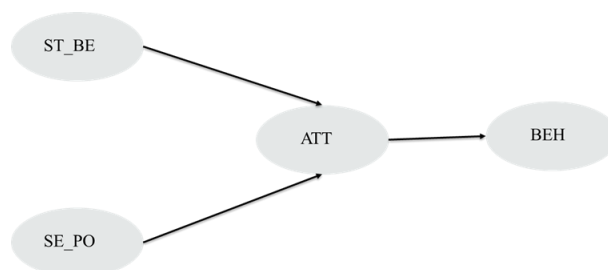


Figure 2: The Conceptual Model

(ST: Self-Transcendence; BE: Benevolence; SE: Self-Enhancement; PO: Power; ATT: Attitude; BEH: Behaviour)

Attitude-Behaviour relationship

Attitude is an individual cumulative, positive, or negative assessment of behaviour. A positive attitude toward the activity at hand influence a person's desire to act upon it, even if the necessary abilities and knowledge are not present in an individual. The seminal literature suggests that attitude is an important aspect for the prediction of behaviour towards MSW (Norazah and Norbayah 2016). In a survey, (Isa 2016) found participants' attitudes were positively associated with their plans to separate waste. As one's attitude determines their actions, a change in one's attitude will inevitably result in new behaviors. Attitude as an analytical factor impacts the behaviour of individuals towards MSW segregation (Srivastava 2020) and proves to be a significant variable in knowing about an individual's segregating actions.

In this context, examining the attitude-behaviour relationship concerning household waste segregation is important. As per discussion above, it is hypothesized that:

H1: Individuals' attitude toward waste segregation influences their waste segregation behaviour positively.

Values-Attitude relationship

Literature focuses the significance of recognizing how one's own values shape one's perspective on a certain behaviour. Understanding the attitude-behavior interaction requires placing attitudes within the context of relevant psychological factors such as values (Boer and Fischer 2013).

In this research, we consider a set of Schwartz values, namely Benevolence (Self-Transcendence Value) and Power (Self-Enhancement Value), which may influence individuals' attitudes toward solid waste management. The study chose these values because these have been associated with attitudes and behaviour of individuals towards sustainability initiatives, energy saving and waste management.

Benevolence-Attitude relationship

Benevolence as STV of individuals has a significant relationship with their attitude toward sustainability issues like environmental management, environmental concerns, commitment towards environmental projects (Gattiker et al. 2014) e.g. MSWM. The individuals who place a premium on STVs are more likely to participate in environment friendly programmes like MSW segregation because they see them crucial for sustainable development.

H2a: STV (Benevolence) has a significant association with attitude towards waste segregation.

Relationship Between Power (Self-Enhancement Value) and Attitude

An individual's Power as a SEV has a poor relationship to waste management, environmental concerns, attitudes towards environmental management, and pro-environmental attitudes (Wu, Yu, Wong, and Poon 2021). It has been found that those with higher SEVs are less likely to support environmental regulations because they view them as a barrier to achieving their goals (Fukukawa, Shafer, and Lee 2007). Since STVs and SEVs are in direct competition with one another, it stands to reason that the impact of SEVs on attitudes will be counter to that of STVs.

H2b: SEV (Power) has a negative association with attitude towards waste segregation.

Mediation of attitude

Attitude is a mediating variable that show a crucial role in interpreting human behaviour. It has been suggested in seminal works that studying how attitude mediates motivations of choice in a given context can shed light on the underlying mechanisms at work (Choo et al. 2023). An individual's attitude towards behaviour helps them to adjust to their environment and influence the intended behaviour in the presence of other psychological factors like values. Literature has investigated the interactions between values, attitudes, and behaviours via a causative aspect on the effect amongst them, with the influence of values on behaviour occurring indirectly via attitudes. These findings posit that values influence attitude, which further shapes an individual's behaviour towards an activity. Though there are a few studies examining the effect of different aspects on the attitude, purpose, and behaviour towards MSW segregation, there is a lack of studies in respect of India, the 2nd populous country and globally one of the largest generators of MSW. This study advances the following hypotheses regarding the potential

mediating effect of attitude between individuals' personal values and their behaviour regarding waste segregation:

H3a: Individual's attitude toward waste segregation entirely mediates the positive association between STV (Benevolence) and waste segregation behaviour.

H3b: Individual's waste segregation attitudes totally moderate the adverse association between SEV (Power) and waste segregation behaviour.

Gender association

A person's age, gender, income, social and professional standing and level of education are all crucial in determining the scope and motivations for their participation in MSWM. Gender, peer influence, education level, marital status, size of the household's land and its location, membership in an environmental organization, family income all contribute to the explanation of household waste segregation behaviour (McAllister 2015). Multi-group analysis showed no significant difference in trash segregation behaviour across gender, even though research found that women are more likely to recycle than men. The current study's hypothesis is based on the literature and findings:

H4: Gender determines the correlation between an individual's attitude toward waste segregation and waste segregation behaviour.

METHODOLOGY

Variables of study

This study used scales that had already been validated to examine several pertinent factors. We consulted three academic experts in the fields of operations management, sustainability, and psychology to confirm the survey instrument's validity and intelligibility. To improve the questionnaire's face validity—the degree to which the questions seem to assess what they are supposed to—they evaluated it and made some modest phrasing suggestions. Pilot research was carried out once the original questionnaire design was completed. To finish the poll, thirty people who reflected the typical homeowner demographic were chosen. After that, we had follow-up interviews with these individuals to evaluate how clear each survey item was. To increase their internal consistency and clarity, a few survey items were changed in response to suggestions from the pilot research.

A questionnaire with twelve items measuring four variables made up the final data collection tool (see Appendix 1). The questionnaire's measuring characteristics proved to have the necessary degrees of validity and reliability.

DATA COLLECTION

Using a survey instrument, information was obtained from individuals in India. The data was collected from various segments of society, mainly the households. Individuals from whom the data was collected include both genders, i.e., males and females, employees, industrialists, college students, people having different income levels, and educational qualifications.

Ten times the number of items for each item was used to calculate the sample size (Hair et al. 2014). Using a snowball sampling method, we were able to obtain 453 valid responses from the participants. The intent and goals of the study were communicated to the respondents prior to their participation. Furthermore, individuals were free to stop participating anytime they felt it was necessary, and their involvement was entirely voluntary. They also received no payment for it.

Data Analysis

For statistical analysis in this work, SPSS 25 was used, while AMOS 26 was used for structural equation modelling (SEM). A final sample size of 453 useable responses for additional research was obtained by eliminating inconsistent and incomplete responses before analysis. The sample size was sufficient for conducting exploratory factor analysis (EFA) (Habibi, Yusop, and Razak 2020), according to the results of Bartlett's Test of Sphericity ($\chi^2 = 3147$, $df = 136$, $p\text{-value} = 0.000$) and the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy (0.771). Two-step analysis was used, adhering to accepted research standards. Confirmatory factor analysis (CFA) was first used to test measurement model fit, which matched the gathered data with the theoretical model, and construct validity and reliability, which ensured the survey items accurately measured the intended ideas. Second, to assess the causal model's model fit metrics and ascertain the statistical significance and potency of the proposed correlations between the variables, structural equation modelling, or SEM, was employed. An overview of the different reference thresholds used to assess model fit may be found in Table 1 of the Appendix.

Table 1: Threshold Values for Assessing Model Fit Parameters in Structural Equation Modeling Analysis"

Parameter	Threshold value	Reference
Composite reliability	$CR \geq 0.6$	(Bagozzi and Yi 1988)
Average variance extracted	$AVE \geq 0.5$	(Bhatt and Ghuman 2022)
χ^2 / df	$(\chi^2 / df \leq 3)$	(Hu and Bentler 1999)
RMSEA	$(RMSEA \leq 0.10)$	
CFI	$(CFI \geq 0.9)$	

The possible common method bias (CMB) was investigated, and different approaches to data collection were used to reduce the CMB (Podsakoff, MacKenzie, and Podsakoff 2012). To test for CMB, we used Harmon's single factor test where the component accounted for less than 50% (25.13%) of the variance. CMB is therefore not a problem for the examination. Finally, each variable was examined for multicollinearity using variance inflation factors (VIFs). Our computed VIF fell between 1.1 and 2.1. These results fall within the desired range, indicating that there are no multicollinearity concerns (O'Brien 2007).

RESULTS

Profile of respondents

Table 2 presents the educational background, income, and gender characteristics of the participants. As shown in Table 2, most participants (56%) were male, 43% had a master's degree or above and 59% had an annual income ranging INR (0.035 - 1.7) million.

Table 2: The Demographic profile of participants

Demographic variables	Classification	%
Educational qualification	Diploma	5%
	Graduation	34%
	Post-graduation	43%
	PhD	18%
Income level (INR millions)	Below 0.35 INR (millions/year)	23%
	Between 0.35 to 1.7 INR (millions/year)	59%
	Above 1.7 INR (millions/year)	18%
Gender	Female	44%
	Male	56%

Measurement model

With model fit measures ($\chi^2/df = 2.51$, CFI = 0.94, SRMR = 0.011, RMSEA = 0.058, PClose = 0.069), we determined the measurement model's required validity and reliability (Kline 2015). The desired values of composite reliability (CR>0.7) and average variance extracted (AVE>0.5) is shown in Table 3.

Table 3: Validity and Reliability

	CR	AVE	MSV	MaxR (H)	ATT	BEH	ST_BE	SE_PO
ATT	0.889	0.617	0.130	0.898	0.785			
BEH	0.819	0.531	0.130	0.822	0.360***	0.728		-0.015
ST_BE	0.729	0.576	0.123	0.751	-0.238***	-0.235***	0.759	-0.061
SE_PO	0.735	0.581	0.295	0.736	0.127	**	**	0.762

(ATT: Attitude toward segregation at source; BEH: Behaviour.

ST_BE: Self-transcendence_Benevolence; SE_PO: Self-Enhancement_Power)

STRUCTURE MODEL

The SEM analysis produced the expected model fit ($\chi^2/df = 2.35$, CFI = 0.943, SRMR = 0.051, RMSEA = 0.055, PClose = 0.164). The model explains 8% of the diversity in individuals' attitudes and 15% in conduct toward waste segregation at source (Figure 3). Table 4 displays which hypotheses are supported, and which are not.

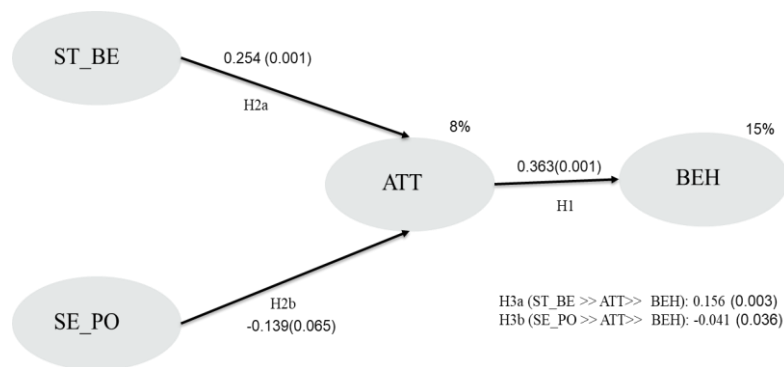


Figure 3: Results of SEM

Table 4: Hypotheses Test Results (Direct relation)

Hypothesis	Path	β	P-value	Hypothesis Result at 90% CI
H1	ATT >> BEH	0.363	0.001	Yes
H2a	ST_BE >> ATT	.254	0.001	Yes
H2b	SE_PO >> ATT	-0.139	0.065	Yes

Mediation analysis

The mediation analysis was studied to quantify and establish the extent to which attitude as a variable participates in the transmittance of influence from values to its effect on waste segregation behaviour. As illustrated in Table 5, attitude significantly mediates the association between personal values, namely Benevolence and Power. If the influence of nature on the attitude toward waste segregation was discovered to be beneficial for Benevolence, it was detrimental for the personal value of Power.

Table 5: Hypotheses Test Results (In-direct direct relations)

Hypothesis	Path	β	P-Value	Hypothesis Result at 90% CI
H3a	ST_BE >> ATT >> BEH	0.156	.003	Yes
H3b	SE_PO >> ATT >> BEH	-0.041	.036	Yes

Multi-group analysis

The multi-group analysis examined the relationship between Attitude and Behaviour of male and female respondents. The results showed that the model applies equally to both genders.

DISCUSSION

For Municipal Solid Waste Management (MSWM) to be sustainable, waste must be separated at the source. Cities may treat municipal solid waste (MSW) in a scientific manner, minimise landfill dumping, preserve land, water, and air quality, and make money all at the same time with the help of efficient source segregation. The present research examined the relationship between human values and people's attitudes regarding garbage segregation and how that relationship impacts waste segregation practices within households. The study found a connection between people's attitudes towards trash segregation and two personal value types: power and benevolence. Variations in people's waste segregation behaviour can also be explained by these values. Because of their connections to attitudes and behaviours relevant to sustainability, these two values were selected.

Views regarding trash segregation were found to be influenced by both power and benevolence values, which is consistent with other studies. One kind of Self-Transcendent Value (STV) that demonstrated a good correlation with an environmental attitude is the Benevolence value. Conversely, Power, a Self-Enhancement Value (SEV), was negatively correlated with being environmentally conscious. These results imply that people with high STVs may have a stronger inclination to support environmental activities such as waste segregation at the source because they value environmental conservation.

Like earlier research, the study also discovered a favourable correlation between household-level waste segregation behaviour and attitudes towards waste segregation. It implies that a person's viewpoint on waste segregation affects their behaviour. Positive thinkers are more likely to exhibit good waste segregation conduct, and vice versa.

The significance of mediating factors like attitude in closing the attitude-intention gap has been underlined in the literature. This study's high correlation between behaviour and attitude validates previous findings. Value-Attitude-Behavior Theory (VABT) proponents contend that an individual's attitude towards a behaviour determines that person's behaviour. Positive behaviour frequently follows from a positive attitude towards something, and vice versa. Since attitudes are specifically linked to things, examining their mediating function might aid in understanding the motivations behind a person's choices in particular circumstances. The results of this research showed that a person's mindset towards waste segregation completely mediates both the positive link between kindness and waste segregation behaviour as well as the negative relationship among power & waste segregation behaviour. As the previous discussion indicates, different values have varying effects on assessments, perceptions, and decisions made when acting in a particular scenario. As a result, altering public perceptions (by carefully thought-out awareness campaigns) may be able to effect the required change in viewpoints towards MSW management.

Lastly, the study examined how gender affects the link between attitude and behaviour. For both male and female respondents, there was no discernible difference in the association

between Attitude and Behaviour. This result differs from other earlier research that claimed subjective standards had no beneficial effect on female urban respondents' desire to segregate their waste.

THEORETICAL CONTRIBUTIONS AND PRACTICAL IMPLICATIONS

In addition to contributing to the existing literature, the findings of the study can have important implications for the researchers, institutions, companies involved in waste management, and policymakers in state and central governments as well.

Theoretical contribution

This study mainly makes the following three important theoretical contributions. First, it provides a rich contribution to the body of scholarly literature as to the best of our understanding this is the first attempt to use VABT to investigate how individuals' values affect their attitude towards waste segregation, and further the waste segregation behavior in Indian context.

Second, this research has empirically established value-attitude-behavior relationship in household for MSW segregation. The study establishes the impact of STV (Benevolence) and SEV (Power) values on the attitude and behavior concerning MSW segregation at the household level.

Third, the study also confirms that the demographic factor, i.e., gender plays no significant role about attitude-behavior relationship towards MSW segregation. This study enriches the literature by empirically investigating the important question of waste segregation behavior in the setting of a populous and leading developing country, India generating an enormous quantity of MSW.

Implication for policymakers

The present study provides the following insights which can be used by policymakers in the domain of MSWM. NITI Aayog, a national level policy making Commission of GOI, has brought out Policy Guidelines in 2021 wherein a special emphasis was laid upon, promoting behavioral changes for encouraging waste segregation at source (NITI 2021). These guidelines also compliment the results of our study wherein the behavioral changes are commended for implementing and strengthening individuals' behavior towards MSW segregation at household level. The guidelines further corroborate that effective messaging can reduce MSW segregation problems because of attitude-behavior gaps and miscalculation of consequences of waste littering. Though the guidelines by NITI Aayog advocate for Information, Education and Communication (IEC) messaging, but it does not enhance the knowledge with respect to how to design these messages and what elements need to be made a part of these messages to make the communication effective.

The specific factors upon which focus is to be laid for enabling behavioral changes towards MSW segregation is not provided in the policy framework. In addition, the policy guidelines do not take into consideration the important aspect of cognitive factors, i.e., Values and Attitude concerning MSW segregation at source. The findings of this study can be considered by the policymakers for a new understanding on underlying cognitive factors that play an important role regarding the MSW segregation at source. Since, MSW segregation at source is of utmost importance in MSWM systems, keeping in view the findings of this research, they should acknowledge that values and attitude of citizens play a vital role in MSWM behavior towards MSW segregation at source, i.e., household level.

Implication for practitioners

The present work provides inputs for designing the communications and advertisements targeted at changing the behavior of individuals concerning waste segregation. As the study demonstrates that personal values, specifically Benevolence and Power, have a substantial impact on attitude, it is possible to appeal to these values when crafting communication and marketing strategies. The ULBs can signify the importance of MSW segregation by appealing to benevolence and power values while designing public awareness campaigns. As different values influence attitudes in a very different manner, the communication campaigns should take this fact into consideration. A different type of approach towards MSW segregation is required for the individuals having different values as their predominant value. Social media analytics provides an opportunity to develop profiles of different individuals using data analytics. Different messages can be sent accordingly to people with different values through social media. The curriculum in educational institutions can be designed by employing these values, i.e., Benevolence and Power, while discussing and deliberating the issue of waste segregation. This can help to enhance the adoption of MSW segregation practices at household level for a sustainable MSWM systems in India and other developing countries in the world.

CONCLUSION, LIMITATIONS AND FUTURE DIRECTION

MSW segregation is an important prerequisite for an efficient, effective, and sustainable MSWM as it lays the foundation for recycling for achieving the optimum utilization of household waste. To bring a positive change in residents' behavior, it is crucial to understand the role of individuals' cognitive aspects, which affect their attitude and behavior towards waste segregation. This study provides insights concerning those cognitive factors and suggests interventions for the government authorities, policymakers, and other stakeholders to address issues concerning MSW segregation.

It was observed that personal values, namely Power and Benevolence, significantly affect the Attitude towards waste segregation, which further influences the behavior. Therefore, communication strategies need to be developed that appeal to these values so that a corresponding attitude can be influenced/developed towards waste segregation for bringing in the requisite change in the behavior of the residents regarding waste segregation at the household level. The survey found no significant difference between male and female respondents on their attitudes toward waste separation at the home level.

In this study, VABT has been employed to examine the impact of cognitive factors on MSW segregation behavior via applying cross-sectional research design. Future studies may be undertaken by employing longitudinal and experimental research design. To investigate this phenomenon of MSW segregation, more studies can be undertaken by employing behavioral theories other than VABT. The present study only takes into consideration two personal values, i.e., Benevolence, Power; future studies can examine this phenomenon by employing values other than these two. The study examines MSW segregation from the perspective of cognitive factors; some non-cognitive factors may also be impacting this behavior. Therefore, the role of non-cognitive factors such as infrastructure and the provision of financial incentives may also be examined in future research. Last, but not least, the present study examined the role of one demographic variable, i.e., gender, on account of parsimony; future studies in the Indian context can include other demographic variables. Considering these limitations, this research makes substantial theoretical and practical contributions to the field of MSWM.



Declaration of competing interest.

There is no competing interest.

Financial interest

The author declares that there is no financial interest.

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Annexure 1: Variables used in the study

Variable	Within the past two weeks	SD (1)	D (2)	N (3)	A(4)	SA(5)	Reference
Waste segregation behaviour at source (Behaviour)	I typically separate my garbage						(Ngah, Hussain, and Safian 2022)
	I recycle specific portions of my household garbage on a regular basis						
	I am engaged in waste sorting activities						
	I have practice waste separation for some time						
Attitude toward waste segregation at source	I am considering segregating my household waste						(Razali et al. 2020)
	I find waste separation at the source to be beneficial						
	Source separation is rational and profitable						
	Source-separation of waste is beneficial to the environment						
	It is beneficial to separate household waste						
Values	Statement	(1) Very much like me	(2) Like me	(3) Some what like me	(4) A little like me	(5) Not like me	Reference
Benevolence (BE)	It is crucial for him/her to assist those around him/her. He/she is concerned for their welfare						(Bardi and Schwartz 2003)
	It is essential for him/her to be loyal to his buddies. He/she desires to devote herself to family and friends						
Power (PO)	Being wealthy is vital to him/her. He/she desires wealth and luxury possessions						
	It is essential for him/her to be in charge and instruct others. He/she desires that others do as he/she instructs						