MUNICIPAL SOLID WASTE SEGREGATION: A BEHAVIOURAL PERSPECTIVE

A Thesis submitted in fulfillment of the requirement for the degree of

DOCTOR OF PHILOSOPHY

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2024

Declaration

I certify that this thesis titled **"MUNICIPAL SOLID WASTE SEGREGATION: A BEHAVIOURAL PERSPECTIVE"** is my original research work.

I have not submitted this research work previously to any other University or Institute for the grant of any degree or diploma.

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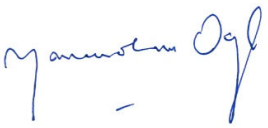

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This is certified that **Manmohan Singh, Registration No. 951813001**, has completed his Ph.D. thesis titled **"MUNICIPAL SOLID WASTE SEGREGATION: A BEHAVIOURAL PERSPECTIVE"** under my supervision.

This Ph.D. thesis is a bonafide research study carried out by him and it is being submitted to **L.M. Thapar School of Management, Thapar Institute of Engineering and Technology (Deemed to be University), Patiala**, for the award of the degree of **Doctor of Philosophy (Ph.D.)**.

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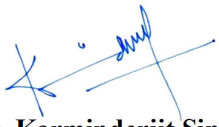

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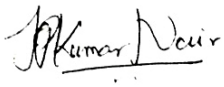

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Abstract

In developing countries, the collection and disposal of Municipal Solid Waste without segregation is a wicked problem concerning Municipal Solid Waste Management, leading to environmental pollution. The major reasons for the prevailing Municipal Solid Waste Management, scenario in India are unsegregated Municipal Solid Waste at the source of its generation i.e., households, citizens' attitudes, an unorganized informal trash sector, ill-prepared fiscal policies, and ineffective government policies.

The government, policy makers, urban-local bodies, and households are highly concerned about this issue. Further, the literature spotlights the significance of the role of household and individuals' cognition in shaping their environmental behaviour and hence the environmental behaviour of the public, at large. The scholars have called for research to gain in-depth insights into individuals' cognitive factors, principally the impact of their personal values, attitude in shaping their behaviour towards environmental issues in the context of a household.

Understanding of cognitive factors regarding community waste segregation behaviour can help decipher the underlying causes for developing appropriate action programmes to bring a desired change in the behaviour of individuals generating the Municipal Solid Waste. This study is a detailed analysis of the cognitive factors affecting MSW segregation at the household level and suggests possible solutions for policy makers and urban local bodies, like municipal corporations.

Hence, to have a thorough knowledge of the subject and to bridge the research gaps, this research empirically investigates the relationships between individuals' values, attitude, and behaviour towards Municipal Solid Waste initiatives, like collection, its

segregation and dumping at the landfill sites, in the cities and townships in the State of Punjab (India), by employing the Value- Attitude- Behaviour theory, as a theoretical background. For undertaking the same, the data was collected from the residents living in the cities and towns of state of Punjab, to examine their attitude and behaviour regarding Municipal Solid Waste Segregation at source.

This study establishes that values of individuals have significant impact upon their attitude, different type of values put impact upon attitude differently. Self-Transcendence Value (Benevolence) has positive influence upon Municipal Solid Waste segregation behaviour, on the other hand Self Enhancement Value (Power) is found to be having negative impact upon waste segregation behaviour. Similarly, an individual having Self Transcendent Value (Benevolence) carries a positive attitude towards environmental concerns, person having Self Enhancement Value (Power) has a negative approach towards pro-environmental behaviour. It has further been observed, in our findings, that the attitude of an individual acts and mediates between his values and behaviour. It is also found in the present study that gender as a demographic variable of individuals, be a male or female, has an insignificant impact upon Municipal Solid Waste segregation behaviour.

Based on the findings, the study presents different implications for several stakeholders. Firstly, this study illustrates the significance of individuals' personal values in influencing their attitude towards waste segregation. Second, the study extends the conceptual foundations in the realm of study, and as per best of our knowledge, this is the first ever endeavour to apply Value–Attitude-Behaviour theory, in understanding the behaviour of individuals at the household level, towards Municipal Solid Waste segregation. As far as the theoretical contribution of the study is concerned, this research broadens the scope of existing literature by investigating the value, attitude and behaviour

relationship and the impact thereof upon Municipal Solid Waste segregation. This study and its results have a thought-provoking benefit for policymakers to inculcate its results, which have never been part of the previous rules, regulations, and policy guidelines, so far. A lot of benefits can be derived by the practitioners, major stakeholders i.e., urban local bodies, state governments and executing agencies, specifically those who undertake such projects upon Public Private Partnership mode. The study also presents future research directions.

Keywords: Attitudes, Behaviour, Environment, Municipal Solid Waste, Municipal Solid Waste Management, Waste Segregation, Urban Local Bodies, Values, Value-Attitude-Behaviour Theory.

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ABBREVIATION

ATT	Attitude
AVE	Average Variance Explained
BE	Benevolence
BEH	Behaviour
CDM	Clean India Drive Mission
CFA	Confirmatory Factor Analysis
CFI	Comparative Fit Index
CMB	Common Method Bias
CMIN	Chi Square Statistics
CPCB	Central Pollution Control Board
CR	Composite Reliability
GEN	Gender
GHGs	Green House Gases
GOI	Government of India
IEC	Information, Education and Communication
IETC	International Environment Technology Center
ISWA	International Solid Waste Association
ISWM	Integrated Solid Waste Management
KMO	Kaiser-Meyer-Olkin
MoHUD	Ministry of Housing and Urban Development
MSW	Municipal Solid Waste
MSWM	Municipal Solid Waste Management
NITI	National Institution for Transforming India
PO	Power

PPP	Public Private Partnership
RMSEA	Root Mean Square Error of Approximation
RQs	Research Questions
SEV	Self-Enhancement Value
SEM	Structural Equation Modeling
SPSS	Statistical Package for the Social Sciences
SRM	Standardised Root Mean
SRMR	Standardised Root Mean Squared Residual
STV	Self-Transcendent Value
ULBs	Urban Local Bodies
UNEP	United Nations Environment Program
VAB	Values-Attitudes-Behaviour
VABT	Value Attitude Behaviour Theory
VIF	Variance Inflation Factor

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CHAPTER 1

INTRODUCTION

This chapter presents the overview and introductory discussions on municipal waste generation in urban areas that is city and tones, and behaviour pattern of the citizens towards waste Municipal Solid Waste (MSW) segregation, upon which the present thesis is based. Objective of the research work along with the organization of the thesis are also presented.

1.1 Overview

Through the ages, human requirements have grown exponentially, necessitating the mass manufacture of a wide range of goods. The rise in socioeconomic level and increase in e-commerce activities have also sharply increased the usage of cardboard as packaging materials, leading to generation of waste (Cooke, 2020). This rise in both production and consumption, which is essential for rising living standards, has given rise to the wicked problems of growing amounts of Municipal Solid Waste (MSW) (**Ojewale, 2014**). The MSW denotes waste generated via natural individuals in their homes, businesses, and construction projects, which is collected and handled by Urban Local Bodies (ULBs) (**Chen et al., 2019**). Growth in urban areas and industrialization are trends that have been directly linked to increase in MSW generation. MSW is increasing both in type as well as quantity all around the world. A high growth in population and urbanization is a major reason for the problems pertaining to Municipal Solid Waste Management (MSWM) which can be minimized by way of waste recycling and composting etc. (**John, 2010**). According to **Kalamdhad et al. (2009)**, MSW in India comprises 40-85% of organic

materials, keeping it in view, in the early initiatives, Government of India (GOI) focused upon conversion of urban waste into compost.

The quantum of MSW generated in developing countries has increased significantly. (**Chen et al., 2020**). **Zhao (2010)** identified and quantitatively analyzed the factors responsible for the carbon emission in Shanghai between 1996 and 2007 as this knowledge is important towards the efforts in the reduction of anthropogenic greenhouse gases emissions. The management of household waste has become a challenge for all the countries because of the increase in the production of waste and the high cost of its management systems, and above all, the lack of knowledge of the factors having an impact upon Municipal Solid Waste Management (MSWM) (**Guerrero, Maas, & Hogland, 2013**). Even though the amount of garbage generated in India is lower than therein industrialized countries, the inability to collect, process or dispose of it has resulted in an inefficient MSWM system (**Kansal, 2002**; **Vergara & Tchobanoglous, 2012**). In many circumstances, waste segregation at the source does not occur, or if it does, biodegradable and non-biodegradable trash goes to the disposal units in a combined form. Usually, these disposal units are in the shape of open dumps or landfills (**Kaartinen, Sormunen, & Rintala, 2013**). The open waste dumps pose major challenges to the land and its resources, and eventually has an impact upon the lives of those who live nearby. According to **Siddiqua, Hahladakis, & Al-Attiya (2022)**, landfills have a large influence upon biodiversity, ecosystem and marine life, there is every possibility of emission of Green House Gases (GHGs) e.g., CO_2, H_2S, CH_4 and NO_x into the air causing respiratory and other serious health problems. The burning of crop residues emit air pollutants leading to adverse effects on human health, environment, and climatic conditions in the cities of the northern region of India **(Khaiwal, et al., 2019)**.

Biodegradable garbage accounts for a significant fraction of the world's total MSW, because biodegradable wastes are usually disposed of in open dumps/landfills along with other trash, underutilizing their potential and possibilities (**Masi et al., 2014**; **Gutierrez-Gutierrez et al., 2015**). However, in a metropolis, land availability for such dumps/landfills is one of the most pressing challenges. Furthermore, dumping garbage on the ground without its treatment might result in long-term environmental risks like leachate and emission of GHGs (**Qin et al., 2001**; **Amritha & Anilkumar, 2016**). MSW dumping in the landfill sites leads to environmental degradation by way of contamination of ground water through leaching, resulting in pollution of soil and its adverse impact on public health (**Kaur et al., 2023**). Although bioleaching is an effective technique, low leaching rate limits its application (**Yang, et al., 2023**).

To overcome environmental pollution problems and to maintain cleanliness, Government of India (GOI) introduced a national level project, namely Clean India Drive Mission (CDM) in 2014.The total allocation under this project for the Financial Year 2022-23 was Rs.23 billion (App 287 million USDs). The Ministry of Housing and Urban Development (MoHUD), of GOI, has also launched the mandatory segregation of municipal waste program in June 2016. But as per Central Pollution Control Board of India (CPCB) Report-2017, despite huge expenditure and a lot of other initiatives by GOI, only a small number of cities in India have adopted waste segregation at source.

It is an established fact that citizen's engagement is vital to the effective rollout of MSWM initiatives. **Kumar & Nandini (2013)** observed the mindset of public in India, that the job for maintaining cleanliness within the cities is sole responsibility of the ULBs, make them quite indifferent towards MSW disposal protocol and such mindset is basically responsible for ineffective and inefficient MSWM. Most of the MSW is produced within houses; therefore, understanding what factors influence householders'

waste segregation behaviour is crucial for effectively reducing MSW output (**Scott, 1999**; **Barr, 2007**). **Stern (2000)** recognized four individual and environmental factors having environmental importance: attitudes, context, skills, and routines. Inadequate community involvement prevented complete success of home waste segregation at source in China (**Tai et al., 2011**). It was also observed that people take environmental protection seriously if they share the values of their home region (**Steg & Vlek, 2009**; **Slavoljub et al., 2015**). To have a better grasp of the relationship between these elements and people's waste segregation practices, multiple studies demonstrate the importance of dissecting MSWM social norms into its component cognitive aspects, like values, attitude, and behaviour. Cognitive psychology modeling can help to find the driving reasons behind waste segregation behaviour (**Tonglet, Phillips, & Bates, 2004**; **Yuan et al., 2016**).

The current research makes an earnest effort to discover, what motivates and what impedes individuals' behaviour with regards to MSW segregation at source, i.e., household level. The research also aims to investigate the significance of cognitive factors by taking into consideration the connection between values, attitude, and behaviour, with a focus on waste segregation at household level. To accomplish this, information was gathered from different households in the cities and towns of Punjab (India), with the help of a survey instrument. The findings of this research would provide vital information to governmental authorities, practitioners and policymakers that are attempting to build an effective and sustainable MSWM system in India.

1.2 Status of MSWM in India

India produced 1,43,449 tons of MSW garbage every day, of which 1,11,000 tons was collected and 35,602 tons were treated and currently has thousands of open dumpsites, which are unscientific and poorly managed, each with its own set of short and long-term challenges, along with environmental and social consequences (**Kurian et al., 2003;**

Kumar & Samadder, 2017). With changing consumption patterns and strong economic expansion, the amount of MSW generation in metropolitan cities in India, may touch 165 million tons by 2030 and 436 million tons by 2050 (**MoHUD, Report 2021**). On the other hand, as per the latest CPCB report-2021 (**CPCB, 2021**), 31.7% of MSW is stated to be disposed of in the landfills without proper management, thus causing pollution of air, water, and soil. As per this report, there were 1924 landfill sites and 3184 dumpsites in the country for waste disposal and the number of such sites are still increasing. As illustrated in Figure 1.1, MSW production, land requirements, and population growth have increased over time, resulting in a scarcity of dump sites. The average per capita MSW generation in developed countries is more than in India. According to **Mammides (2019)**, the average per capita rate of MSW generation rate in India is 370 grams/day as compared to Denmark, USA and China having 2200, 2000 and 700 grams/day, respectively. The various other aspects of MSWM system regarding India are given in Table 1.1.

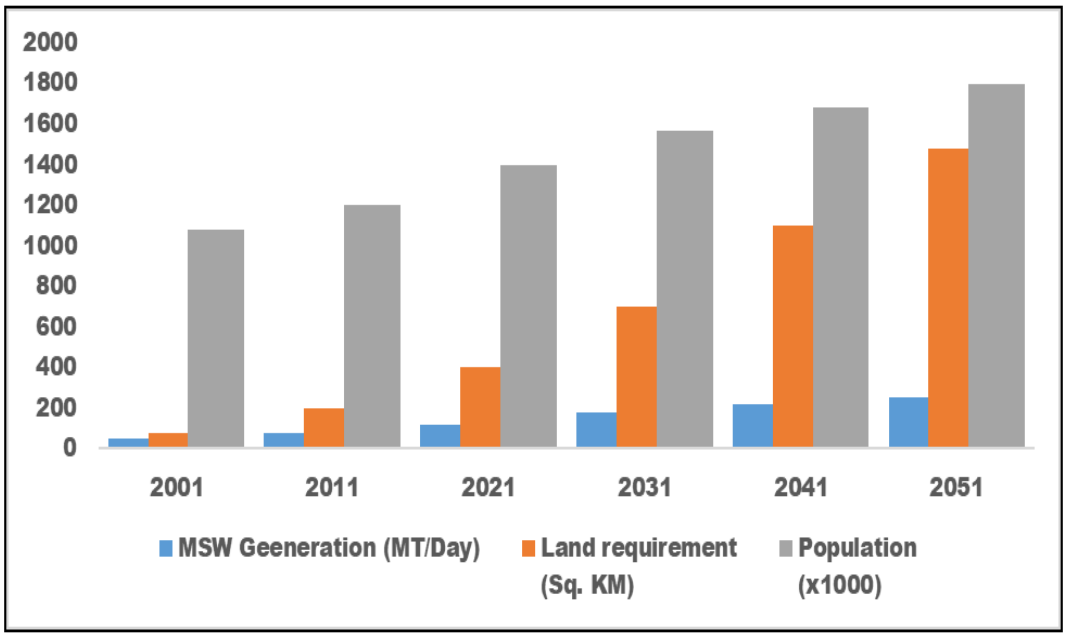

Figure 1.1: MSW production, land requirements, and population projections from 2001 to 2051 (Joshi & Ahmed, 2016)

Table 1.1: MSWM status in India (Kumar & Agrawal, 2020)

Door to door collection	18 States (out of 29 States)
Segregation of the waste at the source	5 States (out of 29 States)
No. of unsanitary landfill sites constructed	1285
No. of compost plant facilities	7000
No. of Residue Derived Fuel (RDF) Facilities	12
No. of biogas plants in operation	645
No. of power generation plants	11 (6 are operational)
MSW generation Mt per day	143.449
MSW Collection	111,000 Mt./day (77.6% of total MSW generated)
MSW processing	35.602 Mt./day (24.8% total MSW generated)

1.2.1 MSW Composition

According to **Annepu (2012)** as shown in Table 1.2, in India, the organic matter accounts for a significant portion of MSW (51%), recyclables account for 17.5% of MSW, and the remainder is the inert garbage (31%) (**Sharma & Jain, 2019**). This composition is after partial segregation at the household level which separates paper, plastics, glass, and metal, to be sold or discarded textile cloths, for the re-use thereof or after picking of waste by informal poor waste collectors and rag-pickers (**Ngoc & Schnitzer, 2009**; **Rajput et al., 2009**). The amount of fresh waste of urban MSW at the dump site is 47%, with a calorific value of 7.3 MJ/kg (1,751, Kilocalories) and

because of lack of adequate segregation at source, the average calorific value of Indian MSW is between 1500-2200 Kcal/kg, which is lower than its value in the developed countries (**Ahmad & Choi, 2010**; **Ramaswami et al., 2016**). Table 1.2 displays the percentage and calorific value of waste mix in various regions of India.

Table 1.2: The regional composition of MSW (Annepu, 2012)

Area	Percentage				Calorific Value	
	Compostable	Recyclable	Inert	Moisture	mj/kg	kacl/kg
Major towns	50.89	16.28	32.82	46	6. 4	1,523
Additional places	51.91	19.23	28.86	49	8.7	2,084
India (eastern division)	50.41	21.44	28.15	46	9.8	2,341
India (northern division)	52.38	16.78	30.85	49	6.8	1,623
India (southern division)	53.41	17.02	29.57	51	7.6	1,827
India (west division)	50.41	21.44	28.15	46	9.8	2,341
Overall	51.3	17.48	31.2	47	7.3	1,751

Figure 1.2 depicts a comparative analysis of MSW composition in Indian cities versus the scenario in the developed countries.

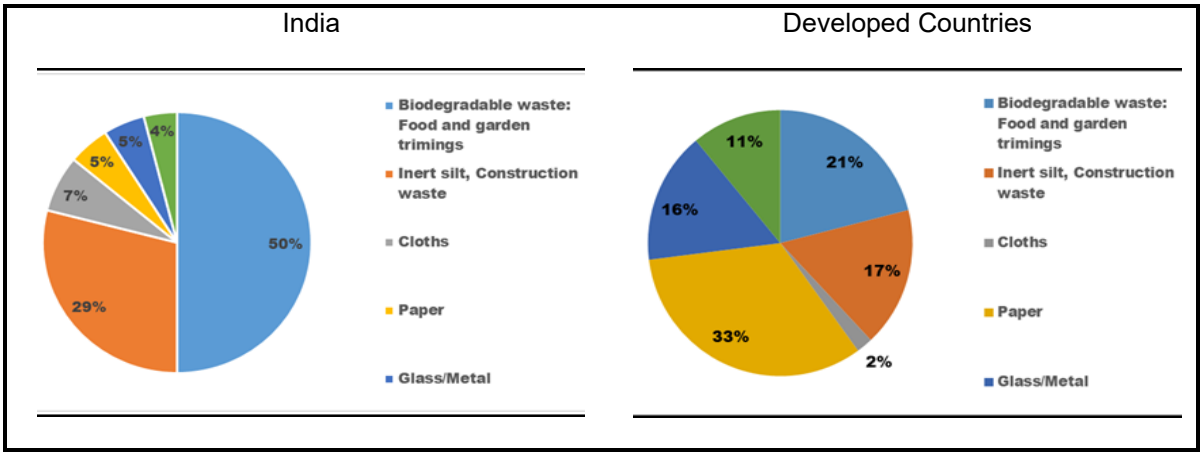

Figure 1.2: A comparison of MSW composition in India (Ahluwalia & Patel, 2018) and developed countries (Kaza et al., 2018)

The variation in the composition of MSW, problems associated with its segregation, treatment and lack of wholehearted public participation have made the situation more complex (**Hasan, 2004**). Despite numerous attempts to address MSWM related issues, most Indian cities continue to collect mixed waste and an adequate treatment system has not been implemented (**Joshi & Ahmed, 2016**). Lack of funding, use of obsolete and inefficient technologies, inadequate public awareness and training, insufficient infrastructure, and finances, have resulted in this inadequate and inefficient MSWM (**Yukalang et al., 2017**; **Ogundele et al., 2018**).Consequently, the majority of ULBs are in despair because they do not adequately assess the MSWM systems and strategies before planning and implementing the related projects (**Arora et al., 2017**).

1.2.2 MSW Segregation

The MSW segregation is defined as and activity for separating the waste into different elements, particularly dry and wet waste (**Zhu et al., 2021**). The MSW can be reduced by reusing thereof and bringing such products in some other usage, but this requires waste segregation at the source. The wet MSW materials comprise organic waste which is generally household kitchen waste, food waste from restaurants and hotels, etc. (**Girotto,**

Alibardi, & Cossu, 2015). The dry waste materials include paper, wooden materials, glass, metallic objects, and old clothes etc. The sustainable MSWM is a major social and environmental challenge because ineffective and inefficient waste management leads to a high amount of negative influence upon the environment in the form of air pollution and pollution of soil and water, and public health problems because of the diseases associated with different forms of pollution. MSW segregation at source is essential for reuse and recycling which is a foremost method for sustainable MSWM, on the contrary its improper disposal can have dangerous consequences. If the waste is segregated at source i.e. at household level, it is less contaminated, and also improves transportation and treatment mechanisms for MSW (**Desai & Shah, 2018**). The segregation at household level depends on continuous participation and association of the residents. MSW segregation is compulsory in the developed countries (Denmark, Germany, France, etc.) wherein around 90% of collected MSW is recycled for some other usage, but a good number of developing and under-developed countries undertake MSW disposal in landfills, leading to serious environmental deterioration (**Mazzanti & Zoboli, 2008**). In India, about 80% of the collected waste is made to be dumped in landfill sites thus polluting soil, air, and water (**CPCB, 2017**). Compared to about 100% efficiency in the developed countries, the MSW collection efficiency in India is around 70%; the remaining is scattered or put into the low-lying areas or dumps (**Sharholy et al., 2007**; **Zagozewski et al., 2011**). As per World Bank Report 2012, people in developing and under-developed countries dispose of their un-segregated MSW, leading to dangerous consequence. In a study of the metropolitan city of Bangaluru in India, it was revealed that about 93.8% of residents disposed of their household waste in community bins without its segregation (**Kumar & Nandini, 2013**; **Mintz et al., 2019**).

According to **Zaman (2010)**, MSW should not be treated as garbage without any value, but it must be taken as a good resource, now a days and resource recovery is a major objective of MSWM. In case, the MSW is segregated into its various components, i.e., organic, and inorganic, 80% of the total MSW can be recycled or reused for another use (**Nandan et al., 2017**). Public participation can be increased in waste segregation, but it is possible only by relying upon a several or a group of methods, as single method does not give good results (**Martin et al., 2006**). Compulsory recycling provides better results of public participation, as compared to recycling being adopted voluntarily (**Noehammer & Byer, 1997**). In the same way, most reliable schemes give better results because of firm implementation, i.e. through education, economic motivation, and socio-economic issues suitable for lawful behaviour (**Everett & Peirce, 1993**). There is a sort of mistrust, which is a major hurdle in MSW segregation for recycling because of having no transparency in recycling systems (**Welfens, Nordmann, & Seibt, 2016**).

The studies on MSW segregation mainly focus on four components: ways and means for segregation, efficient recycling process and programs, the various associations of stakeholders and mainly behaviour of individuals towards MSW segregation. The usefulness of policies and plans e.g., curbside recycling and perception has also been studied by some of the researchers (**Grazhdani, 2016**).

1.3 Values, Attitude and Waste Segregation Behaviour

Human thinking and decision-making are influenced by two distinct systems: the intentional and the automatic system, hence we should have a better knowhow of, how individuals enact their deep mental constructs (**Krueger et al., 2011**). The triad of perception, cognition, and action is conceptualized as embodied cognition (**Jaswal, 2016**).

1.3.1 Values

The values are underlying principles that apply to any situation or action, a more general concept that motivates action (**Bergman, 1998**). Though everyone has their own set of values that have been molded by various influences they have faced, **Schwartz & Bilsky (1990)** created a theory of individual values that proposes a simple, universal framework for personal value dimensions. **Schwartz (1992)** concentrated on the motivating component of topics, based on previous works, and established different motivation dimensions along which, his research's values are organized. These are characterized as "Openness to change against Conservation" wherein “Openness to change” is the first component of the relationship between open-mindedness to start changing and experiencing new things. The second phrase "Self-enhancement against Self-transcendence" encapsulates the contradiction between concern for one's own acts, and compassion for others, respectively (**Ebreo & Vining, 2001**; **Tajeddini et al., 2022**). This continuum had ten essential human values in the initial formulation, but the number increased to nineteen values in the amended formulation (**Schwartz et al., 2012**). **Schwartz (1992)** believes that fundamental value boundaries are formed arbitrarily and that the worth space can be partitioned suitably. Values that are next to one another have cognitive and functional similarities and share motivational aims. In a later work, **Schwartz et al. (2012)** proposed a systematic classification of values into nineteen core values. Figure 1.3 depicts the pattern of interactions of multiple types of values, while Table 1.3 lists concepts and theories for the 19 essential human values.

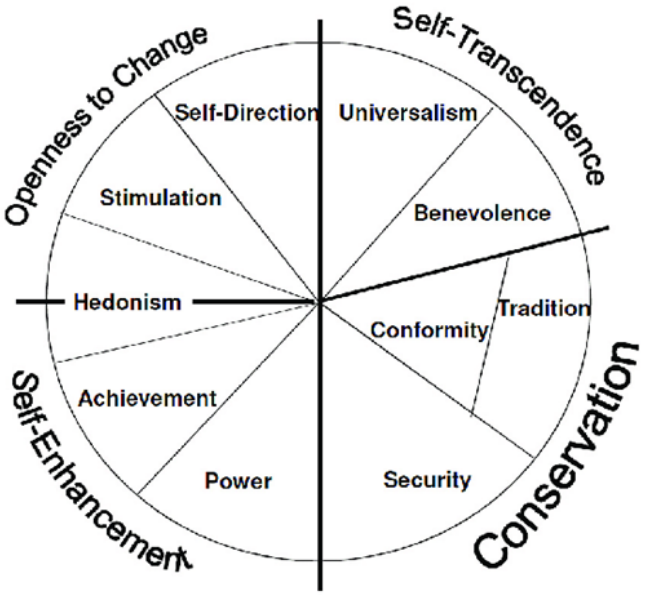

Figure 1.3: Essential human values' motivational continuum (Schwartz et al., 2012)

The current research investigates the function of Self-Transcendence Values (STV) and Self-Enhancement Values (SEV) in the behaviour, because STV which is a combination of altruism and biosphere value (**Boer & Fischer, 2013**), makes focus of individuals upon others' interests and that of environment and is typically and significantly linked to both pro-environmental thoughts and behaviours. It represents an individual's experience of expansion, both forward and backward, while feeling connected to mankind, earth, and nature (**Cloninger, Svrakic, & Przybeck, 1993**) and comprises two values, namely Universalism and Benevolence. 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 motive of individuals' welfare, including humanity. For the present study, the Benevolence value was considered as it represents preserving and improving the well-being of those who are in contact (**Kluckhohn, 1951**) and emphasizes voluntary concern for others' welfare.

Table 1.3: Conceptual definitions for 19 human values

Value	Conceptual Definition in terms of Motivational Goals
1. Openness to Change:	
Self- Direction- Thought	Freedom to develop own ideas and competence
Self-Direction- Action	Competence to decide one's own prerogatives
Stimulation	Excitement, innovation, and change
Hedonism	Pleasure and sensuous contentment
2. Self Enhancement (SEV):	
Achievement	Accomplishment according to collective standards
Power-Dominance	Power by exercising command over people
Power-Resource	Power by control upon material and community resources
Face	Maintaining image in public and avoiding embarrassment
3. Conservation:	
Security-Personal	Protection in one's nearby environment
Security-Societal	Protection and stability in the overall society
Tradition	Maintenance and protection of cultural, family, or religious custom
Conformity-Rules	Adherence towards rules, laws, and formal responsibilities
Conformity-Interpersonal	Prevention of upsetting or harming other people
Humility	Recognizing own irrelevance in the overall environment
4. Self-Transcendence (STV):	
Benevolence-Dependability	Being a dependable and reliable member of the in-group
Benevolence-Caring	Faithfulness to the welfare of in-group members
Universalism-Concern	Dedication to fairness, justice, and safekeeping of all people
Universalism-Nature	Protection of the natural environment
Universalism-Tolerance	Acceptance of others, who are different from oneself

SEV is a multifaceted source of motivation that spans the spectrum from enhancing oneself to protecting oneself from harmful thoughts and feelings (**Alicke & Sedikides, 2009**). SEV comprises Power and Achievement values. Out of these two, 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. The Power value's driving force is the expectation of control upon other individuals and resources, which is diametrically opposed to the altruism and compassion that underpin the other two values (**Hansla et al., 2008**). Power differential in the form of socio-economic level, occupation, and educational qualifications is mainly experienced in India than there in many other countries across the world, as the power distance index of India is 77, which is exeptionally higher than the average index of the world 59 (**Hofstede, 2001**). Furthermore, drawing upon research in cross-cultural management, National Institution for Transforming India (NITI) Aayog-2021, an apex public policy Commission and a think tank of GOI, proposed collectivism, power distance, and uncertainty avoidance as three cultural dimensions for a better understanding of attitude and behaviour, in respect of waste segregation. In contrast, the communities with low power distance, which intend to consider that all members are equal, people in high power distance communities are more likely to agree that there is a group of some powerful people, and these people are entitled to special benefits (**Laor et al., 2018**). This study also intends to examine whether this power differential has an impact on waste segregation behaviour in the context of India, having much higher power distance index than the global average.

1.3.2 Attitude

Attitude refers to an internal psychological disposition, a propensity to observe a certain object or respond with a positive or negative degree of preference (**Ajzen, 1989**). Attitude depicts a set of feelings, thoughts, and behaviour towards a specific person, object, an

article, or an action. The idea of attitude has been employed by academics with a focus of extensive theoretical and empirical development since the 1920s (**Allport, 1935**). Research defines the attitude impression as an inner psychological tendency defined by the assessment of an institution with a particular favour or disfavour (**Eagly & Chaiken, 1993**; **Hoornweg & Bhada-Tata, 2012**). According to **Altmann & Gray (2008)**, attitude can be defined in terms of its three characteristics: state of mind, faith or feelings, and the predisposition to behaviour. As defined by **Ajzen (2002)**, attitude denotes an individual's or group's general feeling of favour or disfavour for a concept. In their renditions (**Zelezny & Schultz, 2000**; **Chen & Chai, 2010**), they use attitude to refer to the inherent concept in a person's life that includes a knowledge of the degree of attachment to one's environment (**Hossain et al., 2011**).

Attitude comes out of an experience or upbringing, having a dominating influence upon behaviour as they could notably predict behavioural intentions (**Pakpour et al., 2014**). Attitude serves as a significant prelude to behavioural intent, which is defined as the degree of favorable or unfavorable assessment of the behaviour under investigation (**Wang et al., 2015**). **Ajzen & Fishbein (2000)** further underlined the importance of a positive attitude toward behaviour in bolstering the purpose to engage in that behaviour. Individuals can also be indeterminate as they simultaneously keep positive and negative approaches to that attitude. **Desa et al. (2011)** has observed that the individuals' attitude and the behaviour towards waste decide that some of the items which are termed as waste materials are otherwise usable.

1.3.3 Behaviour towards Waste Segregation

Ecological behaviour is stated to be benevolent (**Dunlap & Van Liere, 1978**; **Kent, Dame, & Fazio, 1991**) or generous (**Hopper & Nielsen, 1991**; **Stern, Dietz, & Kalof, 1993**), as the quality of the environment is mainly dependent upon human behaviour systems (**Steg & Vlek, 2009**). The most efficient way to reduce MSW is to deal with it

at source and the understanding of waste minimization behaviourism is a key to achieve this success (Corral, 2003); the projects which are examined through cognitive psychology can contribute towards the reduction of MSW (**Maycox, 2003**; **Ma & Hipel, 2016**). According to **Timlet & Williams (2008)**, several ways and means can be adopted to change individuals' behaviour and encouraged for the promotion of waste segregation. This should be started with a good approach, so that the people become eager to join waste segregation. The behaviour of urban households towards MSW segregation leads to efficient recycling, which is an important part of the MSWM, for reduction of MSW's disposal in landfill sites (**Feiyu & Hong, 2019**).

1.4 Research Objectives

This research work aims to establish the relationship between the cognition and environmental behaviour of urban citizens in context of waste segregation practice, and broadly meant to investigate the research questions: How and to what extent do cognitive constituents (personal values, attitude) of individuals affect their MSW segregation behaviour in the context of the environment? The following research objectives were developed to accomplish the same:

- To study the influence of individuals' values upon their attitude towards waste segregation at source (household level)
- To analyze the influence of a person's attitude towards waste segregation, at source, on his or her waste segregation behaviour
- To examine the mediation of attitude towards waste segregation on the values-behaviour relationship
- To determine how the demographic factor i.e. gender, influences the relationship between a person's values and behaviour towards MSW segregation.

1.5 Organization of the Thesis

The remaining of thesis is organized as below:

Chapter 2 (Literature Review, Conceptual Model and Hypotheses Development): This chapter includes a nearly exhaustive study of the literature at the interface of individuals' cognition and their environmental behaviour. The chapter goes on to explore various gaps for the present research work. This chapter also discusses the theory used in the research. Following that, the conceptual model and hypotheses development is undertaken. Finally, this chapter discusses the research's reasoning.

Chapter 3 (Research Method): This chapter examines the various approaches used during the research. It describes the methodologies used to conduct an empirical examination into the effect of cognitive factors such as individuals' values and attitude on their waste segregation behaviour.

Chapter 4 Results: This chapter examines the data analysis results, including (a) descriptive statistics for respondents, (b) statistics on model fit measures of measurement and causal model, and (c) statistics on mediation and moderation analysis.

Chapter 5 Discussion and Study Implications: This chapter covers the primary findings of the empirical study and compares them to the findings of past research conducted by scholars at various times and in various circumstances. It also discusses the study's theoretical contribution and ramifications for both professionals and researchers.

Chapter 6 Conclusion, Study Limitations, and the Directions for Future Research: This chapter summarizes the study's conclusion, and illustrates the limitations, as well as the directions for future research.

CHAPTER 2

LITERATURE REVIEW, CONCEPTUAL MODEL AND HYPOTHESES DEVELOPMENT

This chapter presents the literature review that forms the foundation of this research and provides us with insights regarding the variables employed in the study, for enabling us to investigate the subject of study and determine the research gaps in existing literature is discussed in this chapter. The relevant introduction for these variables is presented in the preceding chapter.

In addition, it also provides a greater understanding of the domain, and assists in developing the study objectives and research questions, and hypotheses for the thesis. These specifics are described in the following section of this study. This chapter also provides background information on the Value Attitude Behaviour Theory (VABT) employed as a theoretical foundation for this research in the theoretical background section. This chapter begins with describing the research regarding the situation concerning MSWM in India.

2.1 Municipal Solid Waste Management

Human activities generate waste, which generally increases in volume as the desire for a greater quality of life grows (**Ngoc & Schnitzer, 2009**). **Mazzanti and Zoboli (2008)** also asserted that MSWM is one of the main concerns in environmental issues, as the production of garbage and its disposal are problems that are receiving a growing amount of attention in the environmental sphere. According to **Das et al. (2019)**, MSWM is a crucial element of any environmental management system; several economic and life cycle assessment replicas have been created to help in selection of acceptable MSWM methods and evaluation of their eventual performance.

With urban population continuing to increase and consumption habits shifting, MSWM has become a growing global challenge. Practice of dumping waste into the environment has given way to considering and attempting to adopt an Integrated MSWM (ISWM) strategy (**Karim et al., 2017**; **Seadon, 2006**). According to **Paul et al. (2019)**, ISWM is an activity for the application of proper technological and management systems for waste reduction at source and a proper management of the remaining waste, it is a thorough process of waste reduction, recycling, and its processing. **Pires, Martinho, & Chang (2011)** examined the pros and cons of MSWM methods in every European Union member state and provided a detailed literature review of models and tools that shed light on potential areas of overlap in waste management practices across Europe and concluded that MSWM systems in Europe had complex and multifaceted trade-offs between several technical alternatives, economic instruments, and legal constraints. **Memon (2010)** investigated ISWM, which is based on the 3Rs (Reduce, Reuse, and Recycle) method to enhance the effectiveness of MSWM by involving all interested stakeholders. All around the world the governing bodies are having a big challenge for successful MSWM in urban areas, and in this concern MSW segregation at the source by the generator is recognized as an effective solution for reducing, reusing, and recycling the household waste (**Pakpour et al., 2014**).

Zurbrugg et al. (2012) observed that most experts agree, to ensure the performance of any MSWM program, efficient and holistic MSWM must not only be prioritized, but should also contain many important factors of sustainability. The efforts made to integrate socio-economic concerns for a healthy future for the community and ascending environmental issues in the real sense, are the efforts towards sustainability (**Wakkee et al., 2019**). Finding sustainable solutions requires first selecting measures for improving MSWM in low- and middle-income nations and then gaining a knowledge of

how a particular decision choice will fit into and have an impact on a local context as the MSWM in the nations having low and intermediate income has a significant amount of untapped potential for improvement (**Zurbrugg et al., 2014**). **Bashir et al. (2018)** observed that the amount of MSW that is produced in Malaysia has increased dramatically and much of the solid trash that is produced is composed of organic materials; therefore, the separation of trash and composting of organic material can provide a suitable answer to the problem of minimizing MSW, to be disposed of in landfill sites (**Srivastava et al., 2021**).

Joseph (2002) studied MSWM entailing the planning, execution, administration, financial, and legal factors of activities relating to the generation, stockpiling, gathering, transfer, transport, processing and disposal of MSW in an environmentally friendly manner, using motto of economy, aesthetics and energy conservation, etc. **De Bercegol, Cavé, & Nguyen (2017)** examined diverse situations of coexistence, integration, and resistance between the informal recycling system in Hanoi in Vietnam, Delhi in India, and Surabaya in Indonesia; though these three fastly growing cities are extremely diverse in terms of population and geography, yet they face similar issues in dealing with large amounts of waste. According to **Kumar & Agrawal (2020)**, India's unsolved MSWM problem in cities has been made worse by its rapidly growing population, high urban density, diverse culture, and change in eating habits and living styles. One of the potential threats of landfilled MSW includes contamination of groundwater by generating leachates. It may also result in emission of harmful GHGs which finally leads to environmental damage (**Vrijheid, 2000**). The liquid that percolates through municipal solid waste in a landfill; and includes several contaminants, including pathogens, heavy metals, and organic and inorganic chemicals is termed as leachate (**Singh et al., 2023**). According to International Solid Waste Association (ISWA) Report-2017, the dumpsites

globally receive 40% of the waste generated worldwide and pose a serious health and environmental emergency, as around 750 individuals perished in the first half of 2016 due to poor waste management at dumpsites.

Agrawal (2017) studied impediment concerning MSWM in the city of Indore (India) and found that the Municipal Corporation of the city treats MSW primarily through landfill and composting. **Arumugam et al. (2017)** investigated an experiment designed to manage post-consumer waste in an environmentally beneficial manner. Their study suggests that composting of MSW is a viable approach for recovering high levels of nitrogen, phosphorus, and carbon, if enough paper cup waste and cow dung were mixed with the bio-inoculant, a good amount of vermicompost would be made, and the amount of MSW sent to landfills would be significantly reduced. Considering the deplorable status of and related issues in MSWM, it is crucial for developing countries like India to establish formal recycling industrial sectors and build decentralized solid waste treatment centers in metro cities and towns (**Joshi & Ahmed, 2016**), for which waste segregation at source is an essential precondition.

Hashimoto (2016) studied the social impact of trash management methods such as social businesses and municipal-oriented Public-Private-Partnership (PPP) mode projects in Pune (India), with the help of a waste pickers' cooperative and the local community. The concept, prospects, potentiality, organization, shared value creation, and recent innovations of the social business model were also examined (**De Groot & Steg, 2008**). According to **Ohri and Singh (2010)**, the trash storage and collection in Varanasi (India) was insufficient and unplanned. **Chandra and Devi (2009)** determined the challenges and potential of MSW in Mysuru, India and observed that MSW is collected in a variety of ways from various sources and establishments and consists of garbage generators

depositing rubbish in round reinforced cement concrete and masonry bins, but the current MSWM system was not giving fruitful results.

2.2 Values-Attitude-Behaviour Hierarchy: A Theoretical Background

The values play an extensive role in every aspect of human life, which has inspired researchers for empirical studies in various fields of social sciences (**Rokeach, 1968 & 1973**). Researching the influence of values on behaviour, behaviour can aid in concentrating upon encouraging more sustainable practices, and supporting a massive change toward conservation principles that result in the implementation of renewable behaviour patterns and adherence to environmental policies (**Young et al., 2010**; **He et al., 2016**). There is proof that individuals' values are linked to their environmental problems and activities (**Axelrod & Lehman, 1993**). Most of this field's research is based on Schwartz's identity values, such as universalism, empathy, self-enhancement ideals (**Boer & Fischer, 2013**; **Zibenberg & Kupermintz, 2016**).

Social psychologists have created a variety of models to describe how attitudes predict behaviour. **Homer & Kahle (1988)** 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 (**Shim, Warrington, & Goldsberry, 1999**). Values impart necessary guidelines to the individuals about which situations to enter and how to handle such circumstances. In this manner the impact flows from the abstract values to attributes and to the specific behaviours, this chronology can be termed as value-attitude-behaviour (VAB) hierarchy. It is based on the premise that the VAB hierarchy influences potentially, go from fundamental values to intermediate attitudes and then from perspectives to concrete behaviour; moving from broad and conceptual to more specific tangible action in the form of behaviour (**Schultz & Oskamp, 1996; Lanfranchi, 2020**).

According to the logical hierarchy model of **Homer & Kahle (1988)**, 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, and affect attitudes and behaviours (**Bardi & Schwartz, 2003; Tan, 2011**).

Figure 2.1: Theoretical model: Value-Attitude-Behaviour
(Claudy & Peterson, 2014)

This VAB framework explaining the causality behind a particular behaviour has been employed as a theoretical [illegible] this research. To the best of our understanding, no other research [illegible] VABT to the domain of householders' cognition and its relationship to MSW segregation behaviour. Employing VABT as theoretical underpinning, this research tries to understand what facilitates/impedes the behaviour concerning MSW segregation at the household level.

2.3 Theoretical Framework and Hypothesis Building

Homer & Kahle (1988) attempted to combine the research of the interactions between values, attitudes, and behaviour by a causal element on the effect amongst them using a model that indicates a layered effect of values, attitude, and behaviour on one another. The model has been employed and evaluated in several different spheres. They discovered that the influence of values upon behaviour is indirect, along with attitude helping to negotiate the connection of values and behaviour in a more thorough assessment of an individual's values, attitudes, and behaviour. In such a circumstance, the effect supposedly begins with values and progresses to attitudes and, finally, to

specific behaviour patterns. This sequence of events is referred to as the values to attitude to behaviour hierarchy. The proposed study would make use of this framework to investigate the values, environmental attitudes, and behaviour of participants.

This study uses VABT as a theoretical framework to check for the associations as given in Figure 2.2, for doing the same, Benevolence (BE) a form of STV and Power (PO), a form of SEV, were examined to determine the impact of these values on MSW segregation behaviour through the mediation of attitude towards this behaviour and impact of Gender (GEN) as a demographic variable. The values are described in detail in the subsequent sub-sections.

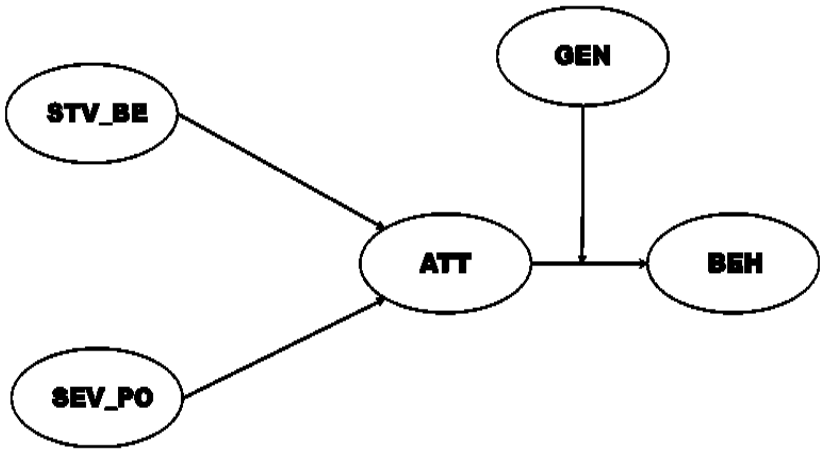

Figure 2.2: Hypothesized framework

2.3.1 Values and Attitude towards Waste Segregation

With the goal of characterizing and critically examining the research literature on the social angles of MSWM in terms of exposure, public involvement, individuals' attitude and behaviour, and policy, a literature review was undertaken. The values are not context-specific; they are underlying principles that apply to any situation or action, a more general concept that motivates action (**Bergman, 1998**). Values are connected with a wide range of results, including attitudes, beliefs, worries, and personality traits, as well as political actions, purchase history, and other categorization; the current study draws

on Schwartz's theoretical framework to perform this research (**Parizeau, von Massow, & Martin, 2015**). It was observed that it is critical to search out the effect of values upon waste segregation since they refer to fundamental beliefs and guiding principles that serve as stable, meaningful, supervisory coherent frameworks in people's lives (**Stern, Dietz, & Guagnano, 1995**; **Rohan, 2000**). In recent studies, it has been observed that along with socioeconomic factors and family conditions, individuals' values influence their participation in MSWM activities (**Barr, 2007**). A broad range of human values converge with the attainment of sustainability imperatives and may provide significant contribution towards the adoption of sustainable behaviour.

In the value–attitude–behaviour paradigm of value–motivated behaviour, values serve as the source of motivation and Value-related attitudes act as a bridge between beliefs and behaviour. Values are major life goals or criteria, which are distinct formulations of the desirable that guide behaviour and attitudes; values as an edifice lead to attitudes and behaviours, as values govern individuals' cognitive designs and guide the behaviour (**Scott & Willits, 1994**). The notion that attitudes are expressions or secondary repercussions of values, is a key component of the proposed value–attitude-behaviour relationship (**Ponizovskiy et al., 2019**). While **Schwartz (1994)** did not explicitly include preservation values, his environment value was considered to fall inside the "universalism" motivational type, which matches with strong self and openness to adapt. Human values, as expressed in the literature, can substantially contribute to sustainability research (**Novacek, 2013**). Thus, a nuanced appraisal of the sustainability difficulties that we confront, is possible with in-depth knowledge of human values and their impact on behaviour.

As attitude is a speculative construct originating from an internal set of values and beliefs (**Jung, 1971**), **Maio & Olson (1995)** showed that manipulating "value-

expressiveness" in an experimental setting can influence the intensity of the value–attitude relationship for identity. While certain attitudes, unmistakably express values, for example, one's attitude toward healthcare coverage is almost tied to the value of security, others are less so (**Maio & Olson, 1999**; **Vinti et al., 2021**). Literature focuses on the significance of recognizing how one's own values shape one's perspective on a certain behaviour (**Bhatt & Ghuman, 2023**; **Briggs, Peterson, & Gregory, 2010**). Understanding attitude-behaviour interaction requires placing attitudes within the context of relevant psychological factors such as values. **Homer & Kahle (1988)** argue that abstract mental constructs known as "values", underpin all sorts of different perspectives.

In this research, Schwartz values, namely Benevolence (STV) and Power (SEV) have been examined as they may influence individuals' attitudes toward waste segregation. The study chose these values because these have been associated with attitudes and behaviour of individuals towards sustainability initiatives, energy saving and waste management (**Dietz, Kalof, & Stern, 2002**).

STVs of individuals are positively associated with their attitudes concerning the environment, i.e., positive attitudes towards environmental issues (**Potocan et al., 2016**), and devotion towards environment related projects. Our important considerations in life guide our attitudes, i.e., by our values, and the values which are particularly important for the welfare of others, fairness, social concerns and which are defined as issues having social relevance. The motivational goal of benevolence as STV is the protection and enhancement of welfare of the individuals having a regular and personal contact by way of help, loyalty, forgiveness, honesty, responsibility, good friendship, and mature love (**Schwartz, 1992**). Benevolence as STV of individuals has a significant relationship with their attitude toward sustainability issues like environmental management, environmental concerns commitment towards environmental projects e.g., MSWM. The individuals

who place a premium on STVs are more likely to participate in environment friendly program like MSW segregation because they see them as crucial for sustainable development (**Lindenberg & Steg, 2013**). Keeping in view of the above discussion, it is hypothesized that:

H1a: *STV (Benevolence) has a significant positive association with attitude towards waste segregation at the household level*

Various studies suggest that SEVs represent a negative relationship with environment associated attitudes, i.e., negative attitudes towards environmental tasks (**Potocan et al., 2016**). The Power as a SEV of an individual has a negative association with pro-environmental attitudes, attitude toward environmental management, environmental concerns, and waste management (**Yu et al., 2021**). 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 (**Dung, Mankilik, & Ozoji, 2017**). It has been found that those with higher SEVs are less likely to support environmental regulations because they view them as a barrier in the achievement of their goals (**Fukukawa, Shafer, & Lee, 2007**), hence it is hypothesized that:

H1b: *SEV (Power) has a negative association with attitude towards waste segregation at the household level*

2.3.2 Attitude-Behaviour Relationship

The behaviour of individuals is based upon factors, such as attitudes towards behaviour (**Ajzen & Fishbein, 1980**). The attitude and behaviour jointly represent and reflect the people's contribution towards environmental concerns, having a favorable or unfavorable propensity towards a behavioural action (**Ali & Yusof, 2018**). A positive attitude toward the activity at hand, influences a person's desire to act upon it (**Kumar & Varkkey,**

2018), 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 (**Tonglet, Phillips, & Bates, 2004**; **Norazah & Norbayah, 2016**). **Isa (2016)** observed that participants' attitudes were positively associated with their plans to segregate waste; as one's attitude determines their actions, a change in one's attitude will inevitably result in new behaviour. Attitude as an analytical factor impacts the behaviour of individuals towards MSW segregation (**Zhang et al., 2021**) and proves to be a significant variable in knowing about an individual's segregating actions (**Wan et al., 2015**). Thus, examining the attitude-behaviour relationship concerning household waste segregation is important. As per the discussion above, it is hypothesized that:

H2: *Individuals' attitude toward waste segregation positively influences their waste segregation behaviour at the household level*

2.3.3 Mediation of Attitude

Attitude is a mediating variable that shows a crucial role in interpreting human behaviour. It has been suggested in seminal works that studying how attitude mediates motivations of choice in each context can shed light on the underlying mechanisms at work (**Westaby, Probst, & Lee, 2010**; **Aschemann-witzel & Niebuhr Aagaard, 2014**). Individuals' attitude towards behaviour helps them to adjust to their environment and influence the intended behaviour in the presence of other psychological factors like values (**Thapa, 2010**). Literature has investigated the interactions amongst values, attitudes, and behaviours via a causative aspect on the effect between those, 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. According to **Majumder, Plotkina, & Rabeson (2023)**, values are positively related with

environment friendly attitudes, which further influence the pro-environmental behaviours (**Chen et al., 2018**).

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 most populous country, and globally one of the biggest generators of MSW. This study proposes the following hypotheses regarding the potential mediating effect of attitude between individuals' personal values (Benevolence and Power) 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 at the household level*

H3b: *Individual's waste segregation attitude totally mediates the adverse association between SEV (Power) and waste segregation behaviour at the household level*

2.3.4 Impact of Gender as Demographic Variable

As per World Economic Forum's Gender Gap Index (2018), India is ranked 108 out of 149 countries, having one of the lowest scores. The study of gender in MSW segregation is relevant to know that how gender as demographic variable makes an impact upon the process. 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 waste segregation (**Corral, 2003**). Gender, peer influence, the size of the household's land and its location, membership in an environmental organization, all contribute to the explanation of household waste segregation behaviour (**Abamecha, Godesso, & Girma, 2013**). Variables like gender, educational level, marital status, and family income contribute to the households' MSWM practices (**Mamady, 2016**). According to **Sahoo**

et al. (2020), the household individuals including men, can ensure that for segregation, each family member reflects a comparable level of responsibility, as a result, more gender-specific capacity-building training would be extremely advantageous in the future.

Even though the research found that women engage themselves more in recycling as compared to men, multi-group analysis has shown no significant difference in trash segregation behaviour across gender (**Chen & Tung, 2010**; **Kumar & Nandini, 2013**). The current study participates in this debate by proposing the following hypothesis, which is based on the literature and findings:

H4: *Gender of an individual moderates the correlation between an individual's attitude toward waste segregation and waste segregation behaviour at the household level*

2.4 Research Gap and Rationale for the Research

The quantity of MSW produced by households is rapidly increasing and posing a severe environmental problem for the present and for the times to come. The ULBs are attempting to address the MSWM problem and are looking for viable answers for sustainably coping with this problem because of associated challenges, such as MSW collection, segregation, transport, and its disposal. MSW segregation at source can provide a vital help in the MSWM by providing segregated waste for recycling and reuse thus minimizing its dumping at landfill sites.

MSW reduction at the source, efficient recycling, re-use of materials, and a long-term MSWM plan, can all assist ULBs, for having a sustainable MSWM system (**Lingan & Poyyamoli, 2014**). According to **Kumar & Nandini (2013)**, though segregation of waste at source is of prime importance, around 93.8% of households in Bangaluru (India) were found to be disposing it off in the community bins without any segregation, and

observed that, further research could enrich the behaviour model and enhance understanding of the barriers regarding the same. Though there are few studies emphasizing the effect of different aspects on the attitude, purpose, and behaviour towards MSW segregation, there is a shortfall of studies in respect of India, the most populous country, and globally one of the largest generators of MSW. **Ling, Xu, & Xiang (2017)** also observed that waste segregation at source was not fully successful because of lesser participation of the residents, therefore, to overcome this gap it is important to examine and to know the driving forces and bottlenecks behind the households' waste segregation behaviour. **Fischer (2017)** too proposed that it would be worthwhile to study if the values mediate the exploratory priming effect on behaviours; investigating the values and behaviour relationship in different cultural settings could be a beneficial approach for future structured research. **Rathore & Sarmah (2020)** opined that the GOI should prepare suitable strategies and proper policies that impact the individuals' attitude and behaviour towards segregation of MSW but doing that requires a better understanding of elements which makes an impact upon the attitude and behaviour of individuals. The individuals' behaviour towards MSW segregation can be considered at a proper level and more research is required to study the impact of MSW segregation at household level (**Selvakumaran & Wahid, 2022**).These research gaps identified because of the literature evaluations were added in the formulation of the research topic for the proposed study. Based on the stated research gaps, this study seeks to contribute to the literature at the interface of cognition and MSW segregation behaviour of individuals in the context of implementing the MSW segregation initiatives for sustainable MSWM.

During the review of literature, no study was found which has applied VABT for examining the waste segregation behaviour of individuals in the Indian context. Hence,

this study applying VABT for understanding the MSW segregation behaviour of individuals at the household level in the urban areas extends the application of VABT to the domain of MSWM.

Thus, this study will bridge the research gaps discussed above by highlighting and pinpointing the driving cognitive factors that can contribute towards or influence individuals' waste segregation behaviour at the household level. In addition, this study will also establish the hierarchical relationship of values, attitude and behaviour and their influence upon the waste segregation process at source for a sustainable MSWM system. By examining the moderating role of gender, this study will also bring out how the gender as a variable, impacts MSW segregation at source.

Government policymakers, marketers of private organizations, above all ULBs, and MSWM projects' executing agencies, including those executing such projects on PPP mode would be able to make use of these findings to encourage responsible waste management by directing their communication in such a manner that it impacts the cognitive and demographic factors that can further influence the behaviour of individuals for the attainment of a cleaner and sustainable environment.

For doing the same, the study tries to bring out the answers of the following broader research questions (RQs) through empirical investigation: How and to what extent do cognitive elements (for example, individuals' values and their attitudes) influence their MSW segregation behaviour at the household level?

2.5 Research Model

Human behaviour is guided by universal principles, such as values and attitude. Specific ways in which values are enacted vary as per the cultural and historical context. In this respect it is imperative to investigate the basis of value-behaviour effects in directing value-expressive behaviour. A critical yet integrative interaction of cognitive factors has

been examined in this study to accomplish this objective. The research model as detailed above in Figure 2.2 presents the causal relationships that were empirically tested in this study.

2.6 Research Questions

The study seeks to search out the answers for the research questions (RQs) as below:

i. **RQ 1:** How does the value of an individual impact his/her attitude towards MSW segregation?

ii. **RQ 2:** How does an attitude impact his/her MSW segregation behaviour?

iii. **RQ 3:** How does attitude mediate the relationship between an individual's values and MSW segregation behaviour?

iv. **RQ 4:** What is the influence of gender as the demographic factor upon the relationship between one's attitude towards waste segregation and waste segregation behaviour?

CHAPTER 3

RESEARCH METHODOLOGY

The research techniques that were employed to answer the RQs, as proposed in the previous chapter, are described in detail in the subsequent sections in this chapter. The answers for RQs were found by conducting a survey-based empirical study to examine the impact of the values of a person and his or her attitude towards waste segregation, mediation of attitude between the individual's values and waste segregation behaviour relationship. In addition, the influence of an individual's gender as a demographic factor on attitude towards waste segregation and waste segregation behaviour has also been examined. The methodology for this empirical study examining these aspects is discussed as follows:

3.1 Research Design

A quantitative research design was used in this investigation to empirically test the causality between the identified variables. Deductive reasoning was applied in this research to analyze the quantitative data and test the hypotheses concerning the research problem.

3.2 Research Instrument

Pre-validated and well-established values, attitude, and behaviour scales were used in this research study. VABT (**Dunlap, Gallup Jr, & Gallup, 1993**; **Schultz & Zelezny, 1999**) was employed as theoretical background to test the causality between the below mentioned variables that were measured using the scales with established reliability and validity across geographies and domains.

Q. 1: Waste separation behaviour at source (Behaviour) (**Razali et al., 2020**)

Within the past two weeks,	Strongly disagreed (1)	Disagree (2)	Neither agree nor disagree (3)	Agree (4)	Strongly agree (5)
I usually separate my household waste					
I regularly separate certain parts of my household waste by putting them inside the recycling bins					
I am involved in waste separation activities					
I have practiced waste separation for some time					

Q. 2: Attitude toward waste segregation at source (Attitude) (**Razali et al., 2020**)

Rate the following statements	Strongly disagreed (1)	Disagree (2)	Neither agree nor disagree (3)	Agree (4)	Strongly agree (5)
I am interested in separating my household waste					
For me, waste separation at source is useful					
Source separation is sensible and rewarding					
Waste segregation at source is good for the environment					
It's a good activity to segregate household waste					

Q. 3: Values (**Schwartz, Breyer, & Danner, 2015**)

Higher level value	Values	Original statement	(1) Very much like me	(2) Like me	(3) Some-what like me	(4) A little like me	(5) Not like me	(6) Not like me at all
Self Transcendence Value (STV)	Benevolence (BE)	It's very important to him/her to help the people around him/her. He/she wants to care for their well-being						
		It is important to him/her to be loyal to his/her friends. He/she wants to devote herself to people close to him/her						
Self Enhancement Value (SEV)	Power (PO)	It is important to him/her to be rich. He/she wants to have a lot of money and expensive things						
		It is important to him/her to be in-charge and tell others what to do. He/she wants people to do what he/she says						

Academic specialists in the fields of sustainability, operations, and organizational behaviour were consulted to review the questionnaire and offer suggestions for improving the study's validity and reliability. To improve face validity, the experts recommended small changes to the item framing, which were added to the instrument.

3.3 Sampling Design

The various aspects with regard to sampling for the conduct of present study have been outlined below under different sub-headings:

Population/Universe

The aggregate of all the units relating to a study is termed as population or universe. In a statistical analysis, the set of all the items or observations related to the investigation is called the universe or population. In the present study, it refers to all the households in the urban areas of the state of Punjab. The ULBs are characterized in this study as the urban population of the state.

Sampling Type

The data for the study was collected by employing stratified non-random sampling. The State of Punjab is socio-culturally divided into three regions i.e., Majha, Malwa and Doaba. Majha region comprises 23 ULBs, whereas Malwa and Doaba have 112 and 34 municipalities respectively. Majha, Malwa and Doaba have 22%, 60% and 18% of the state's population living in the urban areas, respectively. The standardized questionnaire was sent to the urban households in all the regions in the State of Punjab, by keeping in mind the principle of proportionate allocation to ensure representative demographic coverage.

The state of Punjab was chosen as it has 169 ULBs comprising both small towns with a population of 7,000 as well as large cities with a population up to and more than 2 million, which also include migratory population from other states of India.

Sampling Unit

The study was conducted at the level of the urban households, i.e., one respondent from each of the selected households filled in the questionnaire. These households included a wide range of demographics, including male and female, professionals, teachers, students, and retirees, as well as a variety of ages and income brackets. Thus,

the study reached a representative audience from whom the researcher could get their responses on various aspects regarding their MSW segregation behaviour.

Sample Size

Hair et al. (2014) used 10 times the number of items criterion to get the minimum sample size. At the final stage of the data collection phase, 498 valid samples were collected for analysis.

3.4 Data Collection

Primary information was gathered from MSW-generating households in the cities and towns of Punjab (India). The standardized questionnaire was sent online through email and WhatsApp to the urban households in all the regions in the State of Punjab, by keeping in mind the principle of proportionate allocation to ensure representative demographic coverage. The final questionnaire had 4 variables and 13 items; the details are presented above in section 3.2.

Since it was intended to elicit answers from all over the state, the study did not look upon any specific city or town while collecting the data. Respondents were informed about the study's academic goal and the research aims prior to their participation. Participants also had the option to quit at any time during the process if they felt the need to do so because participation was entirely voluntary. No reward was given to the respondents in exchange for their participation. In the end, 498 individuals provided valid responses, which were analyzed using various statistical tools.

3.5 Data Validity and Reliability

The first step in data analysis was data cleaning, which involved removing unfinished and disengaged response samples having 498 valid samples for further examination.

KMO (0.776) and Bartlett's Test of Sphericity (chi-square = 3815.779; df = 231; Sig. = 0.000) results showed that the sample size was adequate, and that factor analysis was therefore appropriate (**Habibi, Yusop, & Razak, 2020**).

The results of the questionnaire's measurements showed the expected degrees of reliability. As a result, it shows that the measurements are appropriate for capturing the quantitative essence of the theoretical notion (**Kelley et al., 2003**). Table 3.1 shows the latent variables together with their measurements and reliability ratings.

Table 3.1: Research instrument for the empirical study

Measure	Items	α	CR	Scale
Waste segregation behaviour (BEH)	I typically separate my garbage	.919	0.969	5-point LS
	I recycle specific portions of my household garbage on a regular basis	.867		
	I am engaged in waste sorting activities	.819		
	I've been practicing waste separation for a while	.800		
Attitude toward waste segregation at source	I am considering segregating my household waste	.673	0.898	5-point LS
	I find waste separation at the source to be beneficial	.876		
	Source separation is rational and profitable	.794		
	Source-separation of waste is beneficial to the environment	.762		
	It is beneficial to separate household waste	.748		
Benevolence (BE)	It is crucial for him/her to assist those around him/her. He/she is concerned for their welfare	.882	0.966	5-point LS
	It is essential for him/her to be loyal to his buddies. He/she desires to devote herself to family and friends	.861		
Power (PO)	Being wealthy is vital to him/her. He/she desires wealth and luxury possessions	.886	0.893	5-point LS
	It is essential for him/her to be in charge and instruct others. He/she desires that others do as he/she instructs	.867		
Demographic Factor	Gender			

3.6 Data Analysis

The study used AMOS 26 for structural equation modeling and SPSS 25 for statistical analysis (SEM). Six unique clusters were produced by the exploratory factor analysis (EFA), with factor loadings for the variables greater than 0.50 (Table 3.2). The results of factor analysis reveal that sufficient convergent validity is present. Since there is little evidence of significant cross-loading between the variables in the factor correlation matrix, discriminant validity is suggested.

Table 3.2: Exploratory factor analysis of the variables

Variables	Cronbach alpha			
	0.885	**0.816**	**0.723**	**0.735**
ATT4	.919			
ATT2	.867			
ATT5	.819			
ATT3	.800			
ATT1	.673			
BEH3		.876		
BEH2		.794		
BEH4		.762		
BEH1		.748		
ST_BE2			.882	
ST_BE1			.861	
SE_PO2				.886
SE_PO1				.867

Additionally, following the advice of influential literature, a two-step technique was used for additional analysis. CFA was first performed to fit a measurement model to the data and establish the convergent validity, discriminant validity, and reliability of the

utilized components. SEM was then used to obtain (a) the causal model's model fit metrics and (b) the potency and importance of the predicted routes. Table 3.3 provides examples of the various parametric thresholds considered in the study.

Table 3.3: Parametric threshold value

Parameter	Threshold Value	Reference
Composite reliability	CR ≥ 0.6	**Bagozzi & Yi, 1988** **Fornell & Larcker, 1981** **Bhatt & Ghuman, 2022** **Hu & Bentler, 1999**
Average variance extracted	AVE ≥ 0.5	
Ratio of chi-square to degree of freedom	$(x^2/df) \leq 0.6$	
Root Mean Square error of approximation	RMSEA ≤ 0.10	
Comparative fit index	CFI ≥ 0.9	

To assess the proposed mediation effect, the study additionally employed bootstrapping with 2000 bootstrap samples and 90% bias-corrected confidence intervals (**Mooney & Duval, 1993**). The study has examined any potential Common Method Bias (CMB), albeit certain safeguards were put in place to lessen it during the data collection phase (**Podsakoff, Mackenzie, & Podsakoff, 2012**). The study used Harmon's one-factor test to test for CMB (**Podsakoff et al., 2003**). A substantial chi-square difference test between a zero-constrained and unconstrained model revealed that considerable CMB was found in our model. Finally, by evaluating variance inflation factors (VIFs), the study examined each variable for multicollinearity (**Hair et al., 2009**). The range of our calculated VIF was 1.06 to 1.51. Since these values fall within the range given in the literature (**O'brien, 2007**), multicollinearity problems were not noticed. The results of the study's testing of the hypotheses developed in chapter 2 are highlighted in chapter 4.

CHAPTER 4

ANALYSIS AND RESULTS

Results from the empirical study are presented in this chapter. This chapter illustrates,

i) descriptive statistics of the profile of the respondents,

ii) model fit measure of the measurement model and the SEM,

iii) mediation and moderation analysis and

iv) the findings of hypothesis testing.

4.1 Descriptive Statistics

Table 4.1 presents demographic information of the respondents which shows that in educational qualification most respondents have master's degree (43%), whereas 34% are having bachelor's degree, 18% of them have PhD, and only 5% are having diploma level of education. Income level of respondents shows that majority of respondents (59%) have income level between 3.5 to 17 INR (Lac/year), 23% of the respondents have an income level of below 3.5 INR (Lac/year), and only 18% of the respondents have income level above 17 INR (Lac/Year). 44% of the sample population are female while 56% of them are male.

Table 4.1: Demographic profiles of respondents

Demographic Parameter	Classification	Percentage
Educational qualification	Diploma	5%
	Bachelor's degree	34%
	Master's degree	43%
	PhD	18%
Income level (INR Lacs)	Below 3.5 INR (Lac/year)	23%
	Between 3.5 to 17 INR (Lac/year)	59%
	Above 17 INR (Lac/Year)	18%
Gender	Female	44%
	Male	56%

4.2 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) were also shown in (Table 4.2).

At the conclusion of EFA, variable factor loadings were greater than 0.687%. Consequently, this indicates a sufficient level of composite reliability and convergent validity. Table 4.2 displays the obtained discriminant validity (**Fornell & Larcker, 1981**) as the square root of the AVE is found to be more than the interrelationship between the two variables.

Table 4.2: Validity and Reliability of study variables

	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**

4.3 Structural Model

The SEM analysis produced the expected model fit ($\chi 2/df = 2.35$, CFI = 0.943, SRMR = 0.051, RMSEA = 0.055, P Close = 0.164). The model explains 8% of the diversity in individuals' attitudes, and 15% in conduct toward waste segregation at source (Figure 3). Table 4.3 displays which hypotheses pertaining to the direct relationships are found to be supported.

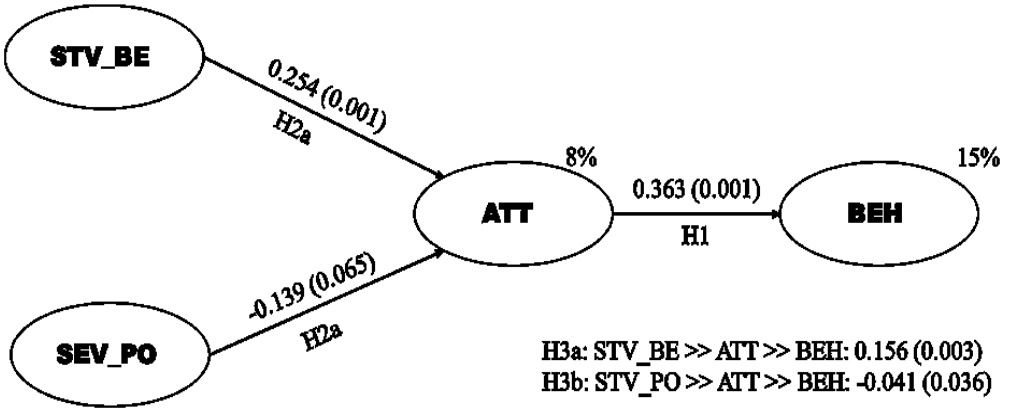

Figure 4.1: Results of SEM

Table 4.3: 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

4.4 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 4.4, attitude significantly mediates the association between personal values, namely Benevolence, and Power and the waste segregation behaviour. If the influence of the attitude toward waste segregation was discovered to be beneficial for the Benevolence value, it was detrimental for the personal value of Power.

Table 4.4: Hypotheses test results (In-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

4.5 The Impact of Gender: A Demographic Factor

The study analyzed the role of gender in households' waste segregation by examining how gender as a variable moderates the attitude towards waste segregation and the waste segregation behaviour relationship by performing multi-group analysis.

4.5.1 Multi-group Analysis

The multi-group analysis examined the relationship between attitude towards waste segregation and waste segregation behaviour of male and female respondents. The results illustrated in Table 4.5 show that the model applies equally to both genders.

Table 4.5: Multi-group analysis

Model	DF	CMIN	P
Structural weights	20	27.825	.114

In conclusion, the study found that STV (Benevolence), and SEV (Power) have a substantial impact on individuals' attitudes towards waste segregation and the waste segregation behaviour. The attitude towards waste segregation was found to mediate the value-behaviour relationship. If the influence of the attitude toward waste segregation was discovered to be beneficial for the Benevolence value, it was detrimental for the personal value of Power. The role of gender as a moderator, between attitude towards waste segregation and actual waste segregation behaviour, was not found to be significant, as the model applies equally to both male and female respondents. These findings illustrate the complexity of connections and their impact on the MSWM behaviour of respondents towards MSW segregation. The study also gives a comprehensive view by examining the effect of individuals' personal values, attitude, behaviour and their gender as a demographic factor towards MSW segregation at the household level. Chapter 5 covers the findings and discusses the study implications.

CHAPTER 5

DISCUSSION AND STUDY IMPLICATIONS

5.1 Discussion

MSWM is generally taken as an indicator to measure urban governance, MSWM practices have become symbols of urban health and good administration. For the fulfillment of necessities of individuals, products are produced and consumed. However, as a result, this creates problems for the MSW generation and its management. As per the World Bank Report – 2018, MSW generation at the world level will be enhanced by 70% by 2050; and at present merely 13.5% of daily waste is recycled and only 5.5% is composted. As per United Nations Environment Program (UNEP) – Report 2022, segregation of MSW at the source is a basic and sacrosanct condition for sustainable MSWM, only through efficient MSW segregation at source the cities have been able to process their MSW scientifically and lessen the dumping of MSW in landfill sites; prevent land, water, and air pollution; and realize monetary benefits from processing of MSW.

The study of people's behaviour towards this eco-friendly initiative is an emerging field. It is vital to examine the role of factors which affect individuals' pro-environmental behaviour (**Nigbur, Lyons, & Uzzell, 2010**). The major objective of the study was to investigate the impact of cognitive variables upon MSW segregation at the source i.e. at the household level. The role of human values influencing attitude towards waste segregation was examined and further its impact was studied upon the waste segregation behaviour of individuals at the household level. The role of gender too was also analyzed regarding its influence on attitude-behaviour relationship. STV (Benevolence) and SEV (Power) were the two values for which these relationships were studied. The study framework establishes a causal relation between Values, Attitude, and Behaviour.

The social environment, which includes values as a constituent, is one of the major influences on the attitude; individuals who adhere to social elements such as values adhere to tradition to sustain group uniformity. Previous literature observed the positive relationship between values and attitude; **Schwartz (1992)** refers to linkage with a wide range of results, including attitudes and personality traits. **Shwartz (1994)** did not explicitly include preservation values, as environment value was considered to fall inside the "universalism", motivational type. In accordance with the seminal literature, our study too found that both the values benevolence (STV) and Power (SEV) have an influence on the attitude under study.

Though **Ros (2021)** did not find STV (Biosphere, Altruism) to be the determinant of trash separation practice, our study found STV (Benevolence) to be positively influencing attitude towards segregation (**Razali et al, 2020; Xu et al., 2017**). This may be on account of difference in the values or the setting of the two studies. Benevolence as STV of individuals was found to have an important relationship with the attitude towards the environmental issues (**Potocan et al., 2016**).

On the other hand, the Power as a SEV of an individual has been observed to have a negative approach towards environment friendly attitudes, attitude towards environmental concerns and MSWM (**Wu et al., 2021**). In our study too, it was observed that individuals' SEV (Power) negatively influences attitude towards MSW segregation.

As STVs and SEVs are reported to be in direct competition with one another in the previous literature, similarly the influence of STV (Benevolence) and SEV (Power) was found to be in opposite directions. If STV (Benevolence) was positively related to the attitude towards waste segregation, then SEV (Power) was found to be negatively related to the attitude towards waste segregation. These findings complement the previous research, as per which SEV tends to have a negative association with environmental

concerns (**Schultz, 2001**). Hence, the conventional effect of values on attitude was also found to be considerable in the present investigation with regards to MSW segregation.

Previous studies have suggested that attitude is a mediating variable with a crucial role in interpreting human behaviour. The substantial link between attitude and behaviour is compatible with the findings (**Friedkin, 2010**). The proponent of the VABT contended that behaviour of an individual is decided by one's attitude toward it. If a person has a favorable attitude toward a phenomenon, he or she will display favorable behaviour, and vice versa.

The involvement of the community is an important factor for success of MSWM programs, it also brings changes in the attitude towards MSWM and a desire to take up major amount of responsibility to take care of the habitat. As per UNEP's International Environment Technology Center (IETC) 2022- Report, a well-designed MSWM, sensitive to local cultural issues can look deeply into the collective spirit to yield immediate and transformative change in attitudes. Our findings also establish that values influence attitude, which further shapes an individual's behaviour towards an activity.

It has been observed in the present study that the gender of individuals does not make any noteworthy difference in the impact of attitude upon the waste segregation behaviour of individuals.

5.2 Study Implications

The findings of the study can have significant implications for the researchers, institutions, companies involved in waste management, policymakers in state and central governments. This research has academically established a value-attitude-behaviour relationship at the household level for MSW segregation. The researchers in future would find the findings to be beneficial as they can guide them in developing their research proposal. In addition to contributing to the existing literature, the results will have

significant implications for different stakeholders, which are described in detail in the subsequent sub-sections.

5.2.1 Theoretical Contribution

This research provides a rich contribution to the body of scholarly literature as to the best of our understanding and knowledge, this is the first attempt to apply VABT to investigate how individuals' values affect their attitude towards waste segregation, and further the waste segregation behaviour in the Indian context.

The study also establishes the impact of STV (Benevolence) and SEV (Power) values on the attitude and behaviour concerning MSW segregation at the household level. Establishment of these causal relationships through an empirical investigation make a worthwhile addition to the existing literature.

The study also confirms that the demographic factor i.e., gender plays no significant role with regard to attitude-behaviour relationship towards MSW segregation.

5.2.2 Implication for Policymakers

Managing MSW carries a vital importance for both human health and the environment. A larger population, higher rates of urbanization and higher per capita income all contribute to severe MSWM issues. Because the most of the ULBs in the Indian context find it difficult to deal with the massive amounts of MSW, the situation has escalated to a crisis level. Due to the serious consequences for public health resulting from improper MSWM, it has emerged as a top priority for ULBs. Every nation must take comprehensive steps for MSWM as part of its plan to safeguard the environment and as part of its efforts to maintain the people's health. Earth Summit linked MSWM with Sustainable Development, whereas the Stockholm Conference endorsed suggestions and criteria for MSWM in its Chapter 21 of Agenda 21.

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 behavioural changes for encouraging waste segregation at source. These guidelines also compliment the results of our study wherein the attitudinal changes are recommended for implementing and strengthening individuals' behaviour towards MSW segregation at household level. The guidelines further corroborate that effective messaging can reduce MSW segregation problems because of attitude-behaviour gaps and miscalculation of consequences of waste littering. Though the guidelines by NITI Aayog advocate for Information, Education and Communication (IEC) messaging, but they do not provide the necessary detail 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 (**Yadav et al., 2022**).

Thus, the specific factors upon which focus is to be laid for enabling behavioural changes towards MSW segregation is not provided in the policy framework, formed by NITI Aayog of GOI. 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. Hence, it is evident that the outcome of this research can guide policymakers by bringing in fresh insight regarding underlying cognitive factors that play an important role regarding the MSW segregation at source. In this manner, this study adds significant value providing specific information for policymakers and designers of communication and messaging for the required behavioural change. This study based upon empirical tests has established that for behavioural changes of individuals towards MSW segregation, we cannot ignore the impact of cognitive factors, specifically values and attitude.

In spite of a number of policies and initiatives formulated and notified by the CPCB, Ministry of Environment, Forest and Climate Change, GOI concerning MSWM, for instance, SWM Rules 2016 (**CPCB, 2016a**), Construction and Demolition Waste Management Rules 2016 (**CPCB, 2016b**), Plastic Waste Management Rules 2022 (**CPCB, 2022a**), e-Waste Management Rules 2022 (**CPCB, 2022b**), MSWM Manual 2016 (**CPHEEO, 2016**) by Ministry of Housing and Urban Affairs, policy on promotion of city compost by Ministry of Chemicals and Fertilizers, Tariff Policy 2006 by Ministry of Power making it compulsory for State governments to buy power from Waste-to-Energy plants, the Swachh Bharat Mission Urban, launched by GOI in 2014, and MSW being accorded the top priority in Swachh Sarvekshan, with the highest weightage of 55%, in spite of all these initiatives launched by GOI, its NITI Aayog's policy guidelines-2021 (**NITI, 2021**) has reported that India faces a huge challenge of MSW and its management.

In the developing countries, MSWM is the most expensive and usually the single largest budgetary provision of ULBs' annual budgets (UN Habitat Report - 2010). Most of the cities in India are grappling with insufficient funds and inadequate infrastructure to collect, treat and dispose of MSW properly. It is assessed that while 70-95% of MSW is collected in the big cities, it may be as low as 50% in the small towns and cities. At the time of the formation of rules, regulations, and policy guidelines by GOI and the State Governments, they should acknowledge that values and attitude of citizens play a vital role in MSWM behaviour towards MSW segregation at source, i.e., household level.

5.2.3 Implications for Practitioners

The major stakeholders in MSWM systems are ULBs, State Governments, households, resident welfare association, rag pickers and the executing agencies including those who undertake such projects on PPP mode. The results of this research are highly beneficial

for all these stakeholders. The findings are required to be acknowledged and be given a practical shape by all these practitioners for MSW segregation for an efficient and sustainable MSWM.

An awareness campaign to spread the findings of this research should be carried out for the knowledge of all the stakeholders. 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 predominant values and attitudes. Social media analytics provide 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. All the practitioners can take the advantage from findings of this study to inculcate such values having an impact upon the attitude for behavioural changes of households, individuals, and the public at large so that they adopt MSW segregation at source for their own benefit in specific and for a better environment in general. This will help to embrace the MSW segregation practices at household level for efficient and sustainable MSWM systems in India and also in the other developing countries across the world.

CHAPTER 6

CONCLUSION, LIMITATIONS, AND DIRECTION FOR FUTURE WORK

6.1 Conclusion

To conclude, MSW segregation at source i.e. at household level, is an important prerequisite for an effective and sustainable MSWM, and it is the best available method for the promotion of recycling of household waste, it is also a major source to achieve harmlessness, minimization, and proper utilization of waste. For an effective, efficient, and sustainable MSWM, waste segregation is one of the topmost requirements (**Chung & Poon, 1999**). As per NITI Aayog guidelines-2021 any mediation to change behaviour of individuals would not be supportive if it does not match with the coresponding realities. In the context of the study, it would be prudent to emphasize the citizens' values and attitudes towards MSW segregation at source, which is the key goal of this study.

Accordingly, this study analyzed the cognitive factors pertaining to urban residents' waste segregation behaviour through quantitative research and developed a model describing their causal relationship regarding their MSW segregation behaviour. This work makes a substantial contribution and emphasizes the role of cognitive factors of individuals, it establishes the causal relationship between these variables. Benevolence as STV of individuals was found to be having a positive relationship with the attitude towards MSW segregation, the Power as a SEV of an individual has been observed of having a negative relationship with environment friendly attitudes. In this respect STVs and SEVs are reported to be in direct competition with one another, similarly the influence of STV (Benevolence) and SEV (Power) was found to be in opposite directions. If STV (Benevolence) was positively related to the attitude towards waste segregation,

then SEV (Power) was found to be negatively related to the attitude towards waste segregation. It has further been observed that an attitude of individuals toward MSW segregation entirely mediates the positive association between STV (Benevolence) and waste segregation behaviour at the household level. But a person's waste segregation attitude totally mediates the adverse association between SEV (Power) and waste segregation behaviour.

It has also been observed that gender of individuals as a moderator between attitude and behaviour does not make any significant impact upon their waste segregation behaviour of individuals at the household level.

6.2 Limitation and Directions for Future Work

The research was conducted using well established research practices; however, like any other study, this study too had its share of limitations. The focus of the research is on cities and townships in Punjab in India. Since the study confirms a previous premise concerning the impact of cognitive factors *viz.* Values-Attitude-Behaviour, in the context of MSW segregation, leaves out intermediation of some other cognitive constituents, which can be studied in future research. Furthermore, a cross-sectional research design was used, but a longitudinal design, randomized trials, or natural experiments can also be used to confirm the causal relationship between values, attitude, and behaviour towards the MSWM, specifically towards the MSW segregation. Triangulation of data is an approach that could be used in future studies to have a more meticulous view of the topic. Finally, this study only included two types of values, STVs and SEVs, while additional values may be considered in future studies. For this reason, it would be highly desirable for future research into this field to examine additional values that may influence the behaviour of individuals. This study considered the role of only gender as moderator between an individual’s attitude towards waste segregation behaviour; future

researchers can examine the impact of other demographic variables like educational qualification, marital status, and income of the households, etc.

In this study a questionnaire, as a research instrument was used to collect data from different individuals of urban areas of the State of Punjab, in future, studies can be undertaken by way of any other tools, namely, experiment, ethnographic observation or through any quasi-experiment. Another limitation which is observed in this study is, that it has used self-reported data about past behaviour of individuals and has not taken data from any independent source or from a third party. Keeping this in view, future studies can be undertaken by considering other modes of data collection. Despite these limitations and caveats, the present study contributes significantly to the literature on MSW segregation, and individual cognition by providing important insights relevant to academics, policymakers, and practitioners.

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