Solid Waste Source Separation Behaviour and it's Association with Demographic, Socio-Economic, and Local Authority (Involvement Factors at the Household Level in Sri Lanka)

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Abstract

Effective solid waste source separation behavior at the household level plays a pivotal role in modern societal scenarios. Understanding situational and socio-psychological factors, including knowledge, inconvenience, experience, awareness, attitudes, subjective norms, and perceived behavioral control, is critical in improving practical waste separation practices. This study investigated the relationships between demographic, socio-economic and situational and socio-psychological factors on solid waste source separation behavior among households in Sri Lanka. The study was conducted within the positivist paradigm using the deductive method approach. The data were collected by distributing the structured questionnaire to 428 households selected under the cluster sampling strategy in the Western Province. The study revealed significant connections between situational and socio-psychological factors, such as knowledge, convenience, experience, attitudes, subjective norms, and perceived behavioral control on households' solid waste source separation behaviors. The study also identified significant associations between situational and socio-psychological factors and demographic and socio-economic factors. The findings implied that space for an integrative effort for households' solid waste source separation behaviors and its association with demographic, socioeconomic, and local authority

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engagement is a pre-requisite arrangement for implementing on-bound solid waste management techniques in the country's development regime. This suggests the need for effective solid waste source separation behavior among households for improving sustainable development policies and strategies, particularly in developing countries like Sri Lanka, which can be achieved through collaborative and participatory approaches. The study provides valuable insights for policymakers, government agencies, and other stakeholders to improve solid waste management practices and promote sustainable development targets.

1. Introduction

Solid waste generation and management have emerged as critical global issues, intensifying due to rapid population growth. This problem is driven by various human activities, impacting both developed and developing countries. Although considerable efforts have been made to tackle this challenge, persistent generative and managerial issues continue to prevail in rural, estate, and urban sectors. Urban areas, characterized by limited space and numerous industries, contribute significantly to the production of solid waste, exerting adverse effects on socioeconomic activities and the environment (Pongpunpurt, 2022; Kalyanasundaram et al., 2021). In Sri Lanka, at the attempt of waste management, solid waste is classified into degradable and non-degradable waste, with ongoing efforts to recycle and reuse non-degradable waste while drawing insights from successful waste disposal and management practices in other countries (Soysa et al., 2022; McAllister, 2015).

Accordingly, responsible authorities should collaborate with societal communities to find sustainable solutions for managing solid waste generation, including proper disposal and recycling of nondegradable waste (Eshete, Desalegn, & Tigu, 2023). This approach helps local governments reduce waste disposal and recycling costs while promoting systematic waste collection and segregation (Doaemo et al., 2021). Implementing modern recycling strategies can effectively manage solid waste in various areas, and community involvement is crucial in this process (Soysa et al., 2022). To

improve waste management, authorities should conduct studies and raise awareness about waste generation, collection, segregation, and recycling (Kihila, Wernsted, & Kaseva, 2021). Understanding factors affecting waste generation and separation is essential for sustainable waste management (JICA, 2016), and a path-driven approach can guide authorities in efficiently managing solid waste (Noufal et al., 2020; Alhassan, Kwakwa, & Owusu-Sekyere, 2020).

However, despite efforts to promote source separation, disposal, and recycling strategies, most countries face challenges in managing solid waste (Basnayake & Visvanathan, 2014; Fei et al., 2022). Sri Lanka experiences significant socioeconomic and environmental impacts due to solid waste management issues (A Khanal, Giri, & Mainali, 2023). Understanding the effects of demographic and socioeconomic factors on waste separation at the household level is crucial, and new factors need exploration. A comprehensive strategy that involves research, education, and public engagement is necessary to improve waste management attitudes and practices (Mmereki, 2018). Addressing the hidden gap in demographic, socio-economic, and local authority involvement in waste separation is vital to manage solid waste generation effectively.

Local government authorities play a crucial role in solid waste management by recognizing public concerns, knowledge, and behavior and providing necessary infrastructure facilities (Babaei et al., 2015). Understanding situational and socio-psychological factors affecting waste source separation intention is vital for successful waste management and achieving a qualitative improvement in people's livelihoods (Soysa et al., 2022; Eshete, Desalegn, & Tigu, 2023). Public participation in waste management, particularly domestic waste separation, is essential for effective waste disposal and environmental protection. A comprehensive study linking demographic, socio-economic, and local authority involvement characteristics with situational and socio-psychological factors at the household level is necessary to support this endeavor (Gudmann et al., 2021).

2. Research Context

Local government entities in Sri Lanka are responsible for household solid waste management, but they face challenges due to budget constraints and high operating costs (Kumara & Pallegedara, 2020). Over 60% of municipal

waste consists of biodegradable and organic waste, but only a portion is collected daily (Arachchige et al., 2017; Basnayake & Visvanathan, 2014; Central Environmental Authority, 2018). Improper waste disposal practices, such as dumping and burning, are widespread, leading to public health concerns and the spread of diseases like dengue (Fernando, 2019; Abeyewickreme et al., 2012). Despite the National Waste Management Policy's efforts, local governments still struggle to manage household waste, particularly in rural areas (Kumara & Pallegedara, 2020), resulting in environmental hazards like landfill collapses (Geosrilanka, 2017).

The objective of this study is three-fold: firstly, to measure the relationship between situational factors and socio-psychological factors on solid waste source separation behavior at the household level in Sri Lanka, secondly, to measure the association between demographic and socio-economic factors and situational factors on solid waste source separation behavior in the same research context, thirdly, to compare the associations between demographic and socio-economic factors and socio-psychological factors on solid waste source separation behavior within the same context, in order to suggest coping strategies for minimizing the adverse environmental impact of household source separation behavior. This study holds significance as Sri Lanka, a developing country, faces a severe challenge of solid waste management, and research on household behaviors regarding source separation and the influence of demographic and socio-economic factors is lacking in existing studies (Kumara & Pallegedara, 2020).

In the remainder of this paper, a brief literature review, the materials and methods, results and discussion, conclusions and policy implications, and limitations and future research agenda are successively presented.

3. Literature Review

Source separation, the practice of separating solid waste for collection, is not extensively implemented in Sri Lanka, but some efforts exist at the municipal level. Studies from other developing countries shed light on factors influencing public participation in waste management. Ma, Hipel, & Hanson (2017) found situational factors and individual attitudes to be major predictors of behavioral intention regarding solid waste management in China. Zhang et al. (2017) observed varying separation rates among college students in China, with higher success in food waste separation but lower rates for waste electricity, batteries, textiles, and drugs. They also noted that female students were more aware of and willing to act on the consequences of waste

mismanagement. Ghani et al. (2013) found positive attitudes to be the best predictor of food waste separation intention in Malaysia. Similarly, Ma et al. (2018) found that individual attitudes and situational factors significantly influenced behavioral intention for solid waste source-separated collection. Perceived behavioral control and intention also played a role in this behavior (Ma et al., 2018).

Wang, Dong, & Yin (2018) found that behaviors of others, moral obligations, and facility conditions significantly influence household solid waste (HSW) separation and collection intentions in China. Age, government policies, and perceptions of results were the main factors influencing willingness to pay. Fan, Yang, & Shen (2019) discovered that general and specific environmental motivation and habitual factors significantly affect solid waste sorting behavioral intentions in Shanghai and Singapore, with contextual factors moderating the behavior. Alhassan et al. (2018) identified education level, total income, and occupation type influencing households' HSW separation intentions in Ghana. Convenience, space, availability of a formal source separation system, information, experience, subjective norm, and attitude also influenced HSW separation intentions Ghana. In a related study, Alhassan, Kwakwa, & Owusu-Sekyere (2020) found that monetary incentives, income, service provider type, attitude, and gender, significantly influenced households' source separation behavior in Ghana, while age, employment, household size, housing type, and gender predicted source separation behavior at the household level.

Loan et al. (2017) found that moral norms, trust in local authority, attitude toward sorted waste, and situational factors significantly influence households' behaviors toward organic waste separation in Vietnam. Sarbassov et al. (2019) discovered that 24% of respondents in Kazakhstan had developed a habit of sorting household solid waste despite the absence of a formal separation system. Adzawla et al. (2019) identified solid waste management education characteristics, house type, and location as significant factors affecting households' decision to adopt a particular waste disposal system in Ghana. Padilla & Trujillo (2018) found that households in high socio-economic categories put more effort into solid waste separation in Colombia, while attitudes toward separation were influenced by education level, homeownership, internet use, and affiliation with environmentalist organizations for households in lower socio-economic categories. Kumara & Pallegedara (2020) found that wealthier households in urban areas with older,

more educated heads were more likely to use municipal waste collection arrangements in Sri Lanka while burning and dumping waste were more preferred by households in different socio-economic subgroups, except for those located in urban areas.

Based on the literature review, the researchers developed the conceptual framework shown in Figure 1. The questionnaire for collecting data for the study was designed following the developed conceptual framework. The conceptual framework of the study can be illustrated as follows.

Figure 1: Conceptual framework of the study
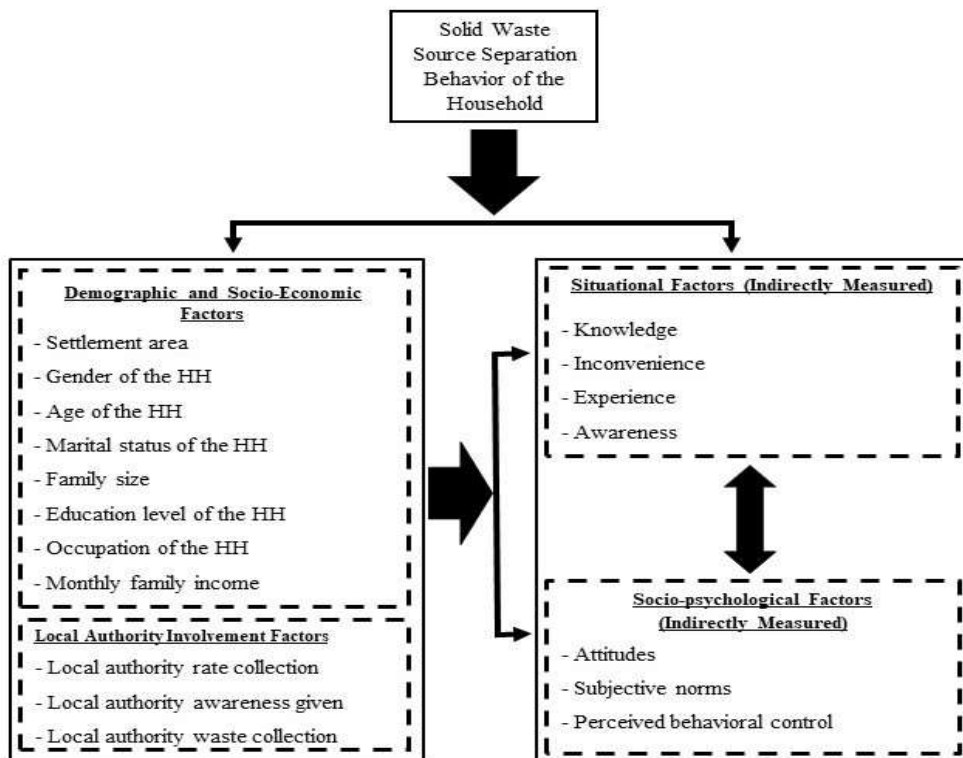
Source: Created by the researcher

3. Materials and Methods

The study was conducted within the positivist paradigm using the deductive method approach. As the main constituent of the study was purely quantitative, a method was applied to investigate the relationships and associations between demographic and socio-economic factors and situational and socio-psychological factors on the behavior of source separation of solid

wastes at the household level. The most problematic area regarding solid waste generation in Sri Lanka is the country's Western Province. As such, Colombo, Gampaha, and Kalutara Districts of the Western Province were selected on a judgemental basis. These districts are good residential areas that represent both urban and rural areas have faced the serious issue of solid waste management over the years. These three districts have the highest residential population, good geographical and climatic conditions with a minimum impact of natural hazards, and also benefit the interventionist actions of the government. Thus, these districts were deemed appropriate for the study. For the sampling procedure, two main approaches were adopted: keeping control of the household group identified based on a cluster sampling strategy to distribute the hard copies of the questionnaire and reaching households using Google form through the social media contact links adjusting to the Covid-19 pandemic and time restrictions for completing the main survey. The survey strategy of these two approaches was to cover the sampling population to represent households in urban areas and rural areas. Further, researchers made every possible effort to keep the randomness in sampling units with different demographic and socio-economic characteristics as these attributes are reported to influence households' behavior of solid waste source separation. Additionally, the representation of households was aligned with the total sample size of the study. Applying Krejchie and Morgan sample selection formula (Krejchie & Morgan, 1970), the minimum sample size of 385 was obtained by assuming a 5% sampling error, 95% confidence interval, and a standard population proportion of 50%.

However, the sample size was increased by 5% households to allow for more general inferences about the population (Cohen, 1992) and to carter for households that may not corporate during the survey. Therefore, the survey covered a sample size of 404 representing households in both rural and urban areas. The chart of the sampling procedure and map of Western Province (the area of this study) are presented in Figure 2.

Figure 2: Map for Western Province with Districts and Sampling Area with Response Units
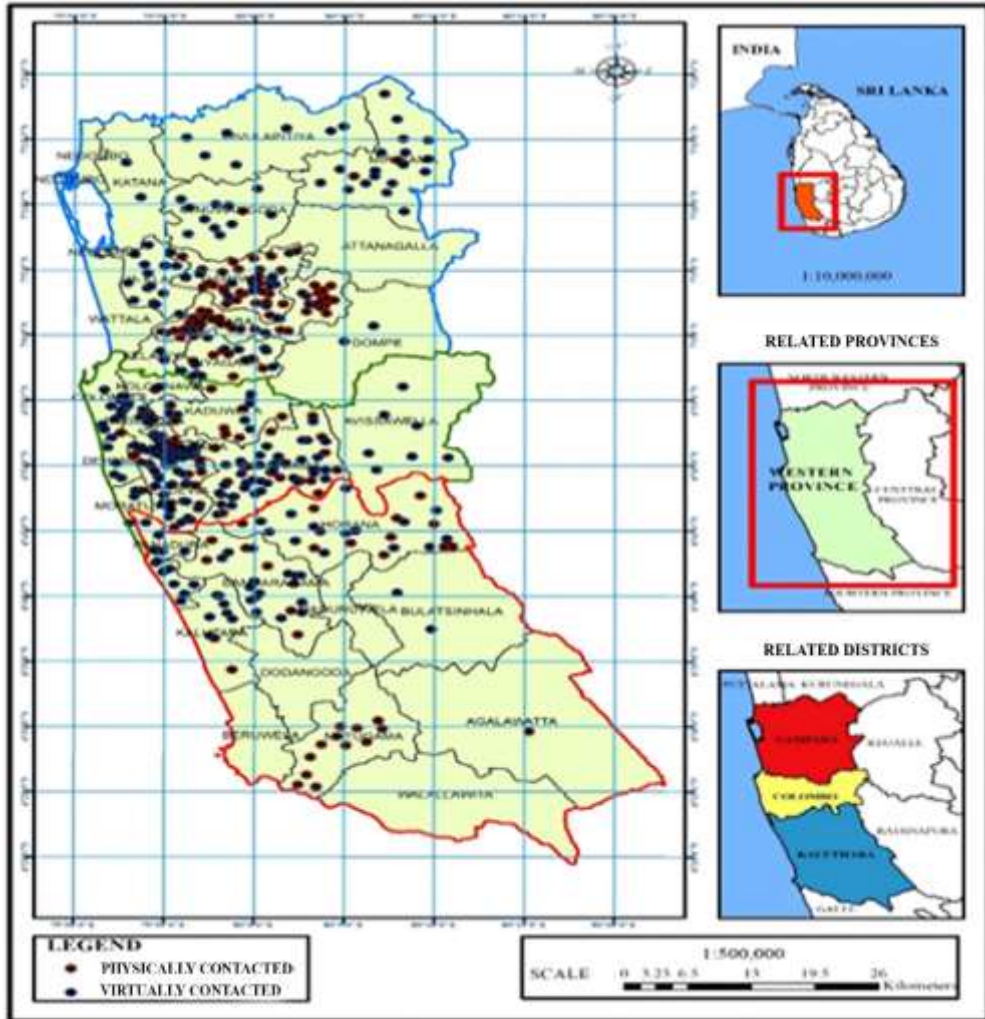
Source: Created by the researcher

For this study, both primary and secondary data were collected. A structured questionnaire was developed as the main instrument to gather the primary data related to solid waste source separation behavior at the household level. Full details of the questionnaire are shown in Table 1.

Table 1: Details of the variables of the study

Variable	Description	Measurement
Solid Waste-Related Measures (Response Variables)		
SWSSIH	Solid waste source separation intention of the household	3 if the household source separates regularly, 2 if the household source separates sometimes, and 1 if not
Solid Waste Generation at Household (The source of generating solid wastes Mostly)		
WSWGM_KT	Kitchen	Rank values from 1 to 4 numbers
WSWGM_GD	Garden	
WSWGM_GO	Goods brought from the outside	
WSWGM_OT	Other	
Demographic and Socio-economic Factors		
AHH	Age of the head of the household	Number of years
MSHH	Marital status of the head of the household	3 if other, 2 if the household head is not married, 1 if the household is married
GHH	Gender of the head of the household	2 otherwise, 1 if the household head is male
ELHH	Education level of the head of the household (Human Capital)	Measurement of an ordinal scale
OHH	Occupation of the head of the household	Measurement of a nominal scale
NPH	Number of persons in the household	Number of persons
MIH	Monthly income of the household	Amount in rupees
Solid Waste Management Actions of Local Authority		
WRCLA	Whether rates (Assessment Tax) will be charged	2 if not charged, 1 if charged
NOWMHL	Regarding the need for waste management at the household level	2 if not make people aware by the local authority,1 if Make

		people are by the local authority
CSWLA	The collection of solids waste by the local authority is occurred or not	2 if not occurred, 1if occurred
Geographical Location (Settlement Area) as the Moderator Variable		
SAH	The residential sector of the household (Urban-all areas governed by either Municipal Council or Urban Council) (Rural- all areas which do not belong to the urban sector or estate sector)	1 if Urban 2 if Rural
Situational Factors on Solid Waste Source Separation (SWSS)		
IKHH_SWSS - Information on knowledge of the head of the household on SWSS	Head of the household's knowledge on solid waste source separation at household	Measurement of a seven-point Likert scale
IHH_SWSS - Inconvenience of the head of the household on SWSS	Head of the household's perception about the condition that makes it challenging to adopt solid waste source separation at household	Measurement of a seven-point Likert scale
EHH_SWSS - Experience of the head of the household	Head of the household's experience with solid waste source separation at household	Measurement of a seven-point Likert scale
IAHH_SWSS - Information on awareness of the head of the household	Head of the household's knowledge and awareness on environmental and related laws and policies on solid waste source separation at household	Measurement of a seven-point Likert scale

Socio-psychological Factors on Solid Waste Source Separation (SWSS)		
AHH_SWSS - Attitudes of the head of the household on SWSS	Head of the household's perception about the attitude towards solid waste source separation at household	Measurement of a seven-point Likert scale
SNHH_SWSS - Subjective norm of the head of the household on SWSS	Head of the household's perception about the ability to perform the subjective norm on solid waste source separation at household	Measurement of a seven-point Likert scale
PBCHH_SWSS - Perceived behavioral control of the head of the household on SWSS	Head of the household's perception of the ability to perform behavioral control on solid waste separation at household	Measurement of a seven-point Likert scale

Source: Constructed by the researcher

In this study, IBM Statistical Package for Social Sciences (SPSS) version 22 was used to analyze the respondents' answers. Descriptive statistics were used to explore the basic information. Actual counts, relative percentages, and means were used in the descriptive analysis to illustrate the sample's characteristics. Next, the Likert scaled data were used to discover variables related to solid waste source separation behavior (situational factors; knowledge, inconvenience, experience, and awareness) and socio-psychological factors; attitudes, subjective norm, and perceived behavioral control of households. The descriptive statistics, Pearson correlation, and χ^2 test were applied to determine relationships and associations between demographics and socioeconomic factors and situational and socio-psychological factors on households' solid waste source separation behaviors. At a significance level of less than 0.10, the Chi-square and Pearson tests were applied to investigate the relationship and associations between demographic and socioeconomic variables and situational and socio-psychological factors on households' source separation behavior.

4. Results and Discussion

This section aims to discuss the demographic, socio-economic characteristics of the respondents and local authority characteristics as well as the results of the associations between source separation behavior of the household and

demographic, socio-economic, and local authority involvement in solid waste source separation related to a sample of 428 households represented by both the urban and rural sectors as 182 from urban settlement and 246 from a rural settlement.

4.1 Demographic and Socio-Economic Characteristics (DSECs) of the Respondents

Table 1: Respondent's (Household's) Demographic and Socio-Economic Characteristics

Settlement/Residential Area		Urban		Rural	
		N	%	N	%
Gender of the	Male	165	90.7	207	84.1
household head	Female	17	9.3	39	15.9
Age of the	Less than or equal to	37	20.3	41	15.8
household head	Greater than 40 to 50	62	34.1	78	31.7
	Greater than 50 to 60	50	27.5	92	37.4
	Greater than 60 years	33	18.1	35	14.2
Overall Mean = 50.36, Overall SD = 10.309		Mean = 50.09, SD = 10.90		Mean = 50.56, SD = 9.87	
Marital status of	Married	166	91.2	224	91.1
the household head	Unmarried	16	8.8	22	8.9
Education level of	Up to lower secondary	29	15.9	56	22.8
the household	Secondary or	69	37.9	105	42.7
head	Tertiary or equivalent	29	15.9	41	16.7
	Postgraduate degree or equivalent	55	30.2	44	17.9
Occupation of the	Retired/Pension holder	32	17.6	29	11.8
household head	Private sector	45	24.7	45	18.3
	Public sector employee	74	40.7	100	40.7
	Employer/Entrepreneur	16	8.8	48	19.5
	Other	15	8.2	24	9.8
Number of persons	Less than or equal 2	17	9.4	18	7.3
in the family	Greater than 2 to 5	71	39.0	122	49.6
(Family size)	More than 5	94	51.6	106	43.1
Overall Mean = 4.55, Overall SD = 1.48		Mean = 4.61, SD = 1.49		Mean = 4.50, SD = 1.47	

Monthly family	Less than Rs.30000.00	6	3.3	23	9.4
Income	Rs.30000.00-Rs.100000.00	50	27.5	98	39.8
	Greater than Rs.100000.00	126	69.2	125	50.8

Source: Constructed by the researcher

Table 2 illustrates respondents' demographic characteristics based on their settlement. Irrespective of the settlement, the majority of the sample consisted of household heads as male respondents, accounting for 90.7% and 84.1% from urban settlements and rural settlements. When considering respondents' age, most are from the mid-age group between 40-60 years old. More importantly, 91.2% of the urban and 91.1% of the rural settlements' household heads in the sample were reported to be married.

Table 2 also shows that 37.9% and 42.7% of the respondents have a secondary or equivalent education level, 30.2%, and 17.9% have a postgraduate degree or equal education, while 15.9% and 22.8% have below lower secondary education in the urban settlement and the rural settlement, respectively.

As shown in Table 2, household heads occupation takes a similar percentage of 40.7 for both urban and rural as the majority. 8.2 and 9.8 respectively, from urban and rural occupied in other categories, while 17.6 from urban and 11.8 from rural are retired household heads. Further, most of the families have a monthly income greater than Rs.100,000, accounting for 69.2% in the urban area and 50.8% in the rural area. However, urban families have a slightly higher monthly income than rural families.

4.2 Local Authorities Involvement in Solid Waste Management

As shown in Table 3, 85.7% of the urban residents are charged with assessment tax compared to 45.5% of the rural residents. A mere 53.8% of the urban residents are provided required knowledge of waste management at the household level. In contrast, 67.9% of rural residents are unaware of the given matter. Almost all the urban residents (91.8%) waste are collected by the local authority. On the other hand, 39.8% of residents from rural areas have access to waste pickup services from the local authority, while 60.2% of residents are deprived of such services.

Table 3: Local Authorities Involvement in Waste Management

Settlement/Residential Area		Urban		Rural	
		N	%	N	%
Rates collection	Do	156	85.7	112	45.5
	Not do	26	14.3	134	54.5
Awareness	Provided	98	53.8	79	32.1
	Not provided	84	46.2	167	67.9
Waste collection	Do	167	91.8	98	39.8
	Not do	15	8.2	148	60.2

Source: Constructed by the researcher

4.3 Respondents' Solid Waste Source Separation (SWSS) Behaviour at Household Level

Residents from both settlements habitually separate solid waste at the household level, 48.4% and 46.3% in urban and rural areas, respectively. However, 26.4 of the urban and 23.2 of the rural are not conducting waste source separation at the household level (Table 4).

Table 4: Solid Waste Source Separation Practice at Household Level

Settlement/Residential Area		Urban		Rural	
		N	%	N	%
Solid waste source separation at the household level	Do not	48	26.4	57	23.2
	Do sometimes	46	25.3	75	30.5
	Do regularly	88	48.4	114	46.3

Source: Constructed by the researcher

4.4 Level of Situational and Socio-Psychological Factors (SSPFs) on SWSS among Households

The situational and psychological factors among households include seven factors, namely; knowledge, inconvenience, experience, awareness, attitude, subjective norm, and perceived behavioral control. The highest level reported in each factor with its respondents' score group, mean value and standard deviation is; knowledge (good: 26-35, 28.8, and 5.375), inconvenience (high, 25-35, 15.43, and 9.168), experience (high: 25-35, 27.73, and 5.866), awareness(good: 25-35, 20.56, and 8.380), attitude (positive: 26-35, 31.96, and 4.442), subjective norm (high: 26-35, 23.64, and 8.450), and perceived behavioral control(low: 26-35, 29.5, and 6.787). Overall, more than 60% of

total respondents are in a good /high level of situational and psychological factors among households, namely; knowledge, inconvenience, experience, awareness, and subjective norm, while 94.2% of respondents are in the positive level of attitudes among households and 82.9% of total respondents are in the low level of perceived behavioral control among households. Table 5 shows the levels of each situational and socio-psychological factors with its frequency of respondents, their score groups, overall mean and standard deviation, and individual factor mean, and standard deviations as follows.

Table 5: Level of Situational and Socio-Psychological Factors

Level of SSPFs	Respondent's score group	Frequency (%)
Level of knowledge		
Good	26-35 (Mean: 30.86 SD: 2.592)	350 (81.7)
Moderate	16-25 (Mean: 21.79 SD: 2.353)	61 (14.3)
Low	6-15 (Mean: 11.53 SD: 2.478)	17 (4.0)
Mean: 28.80 SD: 5.375		
Level of inconvenience		
High	25-35 (Mean: 29.53 SD: 2.769)	258 (60.3)
Moderate	15-24 (Mean: 19.93 SD: 3.532)	70 (16.3)
Low	5-14 (Mean: 8.74 SD: 2.368)	100 (23.4)
Mean: 15.43 SD: 9.168		
Level of experience		
High	25-35 (Mean: 29.89 SD: 2.521)	356 (83.2)
Moderate	15-24 (Mean: 21.30 SD: 2.858)	43 (10.0)
Low	5-14 (Mean: 10.66 SD: 2.636)	29 (6.8)
Mean: 27.73 SD: 5.866		
Level of awareness		
Good	25-35 (Mean: 28.49 SD: 3.108)	177 (41.4)
Moderate	15-24 (Mean: 20.66 SD: 2.505)	123 (28.7)
Low	5-14 (Mean: 9.51 SD: 2.453)	128 (29.9)
Mean: 20.56 SD: 8.380		
Level of attitudes		
Positive	26-35 (Mean: 32.86 SD: 2.279)	403 (94.2)
Neutral	17-25 (Mean: 22.38 SD: 2.755)	13 (3.0)
Negative	8-16 (Mean: 12.25 SD: 2.491)	12 (2.8)
Mean: 31.96 SD: 4.442		

Level of subjective norm		
High	26-35 (Mean: 30.00 SD: 2.701)	224 (52.3)
Moderate	16-25 (Mean: 22.31 SD: 2.535)	115 (26.9)
Low	6-15 (Mean: 9.35 SD: 2.825)	89 (20.8)
Mean: 23.64 SD: 8.450		
Level of perceived behavioral control		
Low	26-35 (Mean: 31.56 SD: 2.802)	355 (82.9)
Moderate	16-25 (Mean: 22.55 SD: 2.948)	42 (9.8)
High	6-15 (Mean: 9.19 SD: 3.177)	31 (7.3)
Mean: 29.05 SD: 6.787		

Source: Constructed by the researcher

4.4 Association between DSECs and SSPFs

Pearson Chi-Square testing method was used to find out the associations between DSECs and SSPFs with the levels of significance set at 1% (Highly Significant), 5% (Significant), and 10% (Marginally Significant).

Table 6: Association between DSECs and Knowledge of SWSS

Demographic Socio-economic characteristic	Situational Factor - Knowledge		
	Pearson Chi-Square	df	P-value
1. Settlement	5.408	2	0.067
2. Gender	0.542	2	0.763
3. Age	5.988	6	0.425
4. Marital Status	1.756	2	0.416
5. Education	7.086	6	0.313
6. Occupation	35.475	8	0.000
7. Family size	0.68	4	0.954
8. Family income	2.767	4	0.598
9. Local authority rate collection	0.411	2	0.814
10. Local authority awareness	3.775	2	0.151
11. Local authority waste collection	4.179	2	0.124

Source: Constructed by the researcher

The results of the associated DSECs and SSPFs are presented and described. Table 6 shows the associations between DSECs and the knowledge under SSPFs. The results indicate that the occupation under DSECs has a highly significant association with knowledge at a 1% (p=0.000) significance level. In addition, the settlement (urban/rural) under SSPFs has a marginally significant association with knowledge at a 10% (p=0.067) significance level.

Further, the results show that other SSPFs except occupation and settlement, had no statistically significant associations (P>0.1) with knowledge (gender – p = 0.763, age – p=0.425, marital status – p = 0.416, education – p = 0.313, family size – p = 0.954, family income – p = 0.598, local authority rate collection p = 0.814, local authority awareness – p = 0.151, and local authority waste collection – p = 0.124).

The results indicated that the knowledge is highly significant with the occupation at a 1% (P = 0.000) level of significance for the solid waste source separation behaviour of HH. This result is consistent with the findings of Laor et al. (2018); Babaei et al. (2015) emphasizing that public-sector employees were more knowledgeable than retired, private-sector employees and employers /entrepreneurs. However, the results of the study are not consistent with those of the study by Laor et al. (2018) that was conducted in Thailand, which recorded significant relationships between knowledge and age/education. According to Wang et al. (2020), knowledge reported a significant relationship with education. Based on the results of the present study, other demographic factors did not affect the knowledge and include gender, age, marital status, education, family size, family income, local authority rate collection, local authority awareness, and local authority waste collection. However, people who have more knowledge and tracking background on perfect married life, equitable gender, well education, balanced family size sustainable family income, well aware of rating, waste management, and regulation awareness and waste collection by the local authority are key factors for the society to maintain sustainable waste management with maintaining their solid waste source separation intension of HH, and positive attitudes, having a standard family status and perceived behavioral control. Without approaching knowledge generation on household waste management, any country or its subsidiaries are not in a position to frame a consistent policy for proper waste management policy (Almasi et al., 2019). Therefore, knowledge of solid waste management relating to these DSECs is crucial to formulate and implement sustainable development programs, including strategic environmental management programs.

Table 7 shows the associations between DSECs and the inconvenience under SSPFs. The results indicate that the settlement and local authority waste collection under SDCs have highly significant associations with

inconvenience at a 1% (p = 0.001, p = 0.000) level of significance. In addition, the local authority rate collection has significant associations with inconvenience at a 5% (p=0.014) level of significance. Also, the DSECs, local authority awareness, and education have marginally significant associations with inconvenience at a 10% (p = 0.058, p = 0.059) significance level. The results show that other SSPFs with the exception of those that have significant associations had no statistically significant associations (P>0.1) with inconvenience (Gender – p = 0.947, Age – p = 0.931, Marital Status – p=0.138, Occupation – p = 0.897, Family size – p = 0.816, and Family Income – p = 0.467).

Table 7: Association between DSECs and Inconvenience on SWSS

Demographic Socio-economic characteristic	Situational Factor - Inconvenience		
	Pearson Chi-Square	df	P-value
1. Settlement	24.033	2	0.000
2. Gender	0.109	2	0.947
3. Age	1.876	6	0.931
4. Marital Status	3.964	2	0.138
5. Education	12.115	6	0.059
6. Occupation	3.53	8	0.897
7. Family size	1.557	4	0.816
8. Family income	3.575	4	0.467
9. Local authority rate collection	8.568	2	0.014
10. Local authority awareness	5.681	2	0.058
11. Local authority waste collection	15.151	2	0.001

Source: Constructed by the researcher

Results indicate that inconvenience is highly significant with a 1% (P = 0.000) significance level for the solid waste source separation intention of HH. Also, local authority rate collection and local authority waste collection have higher significant relationships at a 1% (p = 0.014, p=0.001) level of significance for the solid waste source separation behaviour of HH. Education and local authority awareness also have marginally significant relationships with inconvenience at a 10% (p = 0.059, p = 0.058) level of significance for solid waste source separation behavior. Out of these eleven DSECs, other relationships between inconvenience and DSECs, gender, age, marital status, occupation, family size, and family income were not significant for HH's solid waste source separation intention. Generally, in waste management, there are

many problems that both authorities and the community face many inconveniences due to improper waste generation, collection, and transport as well as disposal issues on its situational approach. In that sense, authorities may find it challenging and would find it difficult to make the policies and their aligned strategies to mitigate the waste management issues, so it may be inconvenient to look into the proper waste separation intention of HH as well as in the societal context (Chen et al., 2017) as per the situational basis. However, well-educated people than others (in urban or rural areas having favorable attention to their rate structure and enforcement and technical awareness on waste management, and their economic, social, cultural, and esteem family background) have a higher level of waste separation behavior to maintain a threatless sensitive natural environment.

Table 8 shows the associations between DSECs and the experience under SSPFs. The results indicate that there was no statistically significant association between DSECs and the respondents' experience on SWSS, for which settlement (p = 0.472), gender (p = 0.609), age (p = 0.312), marital status (p = 0.951), education (p = 0.697), occupation (p = 0.574), family size (p = 0.326), family income (p = 0.428), local authority rate collection (p = 0.762), local authority awareness (p = 0.868), and local authority waste collection (p = 0.979) were also tested.

Table 8: Association between DSECs and Experience on SWSS

Demographic Socio-economic characteristic	Situational Factor - Experience		
	Pearson Chi-Square	**df**	**P-value**
1. Settlement	1.503	2	0.472
2. Gender	0.991	2	0.609
3. Age	7.097	6	0.312
4. Marital Status	0.099	2	0.951
5. Education	3.852	6	0.697
6. Occupation	6.653	8	0.574
7. Family size	4.638	4	0.326
8. Family income	3.125	4	0.428
9. Local authority rate collection	0.544	2	0.762
10. Local authority awareness	0.283	2	0.868
11. Local authority waste collection	0.043	2	0.979

Source: Constructed by the researcher

Moreover, the results indicated that all relationships between experience and DSECs were found to be not significant. Here, the experience on solid waste source separation intention is to be gained by educating especially on general education plus technical context and being properly aware, by referring to the updated information on legitimation, practicing, and standardization of waste management content. Though the findings of this study indicated an insignificant relationship with experience, it is not consistent with the findings of Pongpunpurt (2022). The results show that the higher experienced people (mature people, with higher awareness upper social and living standards, married with happy and enjoyable family members, wealthy economic background) living in the local authorities' areas (LAs who implement effective waste management programs) show an intention for referring to an effective waste separation. Furthermore, Pongpunpurt et al. (2022) emphasized that the local authorities should make policy changes to refer to the people well and refer to people making a real effort to a healthy environment by adding economic value to their living society.

Table 9: Association between DSECs and Awareness of SWSS

Demographic Socio-economic characteristic	Situational Factor – Awareness		
	Pearson Chi-Square	df	P-value
1. Settlement	7.867	2	0.020
2. Gender	1.124	2	0.570
3. Age	7.283	6	0.295
4. Marital Status	2.052	2	0.358
5. Education	2.699	6	0.846
6. Occupation	11.678	8	0.166
7. Family size	14.734	4	0.005
8. Family income	1.36	4	0.851
9. Local authority rate collection	2.271	2	0.321
10. Local authority awareness	4.58	2	0.101
11. Local authority waste collection	1.43	2	0.489

Source: Constructed by the researcher

Table 9 shows the associations between DSECs and awareness under SSPFs. The results indicate that the family size under DSECs has a highly significant association with awareness at a 1% (p = 0.005) significance level. Also, the settlement under SSPFs has a significant association with awareness at a 5% (p = 0.020) significance level. Then, local authority awareness under SSPFs

has a marginally significant association with awareness of SWSS at 10% (p = 0.101). Further, the results show that other SSPFs except occupation, family size, settlement, and local authority awareness, had no statistically significant associations (P>0.1) with awareness (gender – p = 0.570, age – p = 0.295, marital status – p = 0.358, education – p = 0.846, occupation, p = 0.166, family income – p = 0.851, local authority rate collection p = 0.321, and local authority waste collection – p = 0.489).

Further, in terms of waste separation behaviour through awareness, three DSECs influenced the awareness, namely, family size, settlement, and local authority awareness, which recorded high significance, significance, and marginal significance at 1% (p = 0.005), 5% (p = 0.020), and 10% (p = 0.101) respectively. These findings agree with Akil et al. (2015) indicating that well-educated and experienced people are increasing their awareness of legitimate, subjective, and technical content on waste management. In the Sri Lankan context, most people in urban areas than rural areas, in local authorities are more aware of waste management than others. If the local authorities implement internationally well-designed and standardized waste management programs, it would be better to create an intentional, positive and open psychological effect among the people for creating a best-practiced waste management culture in the society. Furthermore, according to Bruvoll, Halvorsen, and Nyborg (2002), waste disposal with a positive waste separation intention in households can be successfully implemented by referring to well-educated, experienced, and highly aware people sacrificing their time and the fullest effect of all DSECs.

Table 10 shows the associations between DSECs and the attitude under SSPFs. The results indicate that there was no statistically significant association between DSECs and the respondents' attitudes on SWSS, for which settlement (p=0.448), gender (p = 0.861), age (p = 0.748), marital status (p = 0.704), education (p=0.627), occupation (p = 0.198), family size (p = 0.423), family income (p = 0.423), local authority rate collection (p = 0.759), local authority awareness (p = 0.977), and local authority waste collection (p = 0.472) were also tested.

Table 10: Association between DSECs and Attitudes on SWSS

Demographic Socio-economic characteristic	Situational Factor - Attitudes		
	Pearson Chi-Square	df	P-value
1. Settlement	1.605	2	0.448
2. Gender	0.3	2	0.861
3. Age	3.473	6	0.748
4. Marital Status	0.703	2	0.704
5. Education	4.369	6	0.627
6. Occupation	11.058	8	0.198
7. Family size	3.168	4	0.53
8. Family income	3.878	4	0.423
9. Local authority rate collection	0.55	2	0.759
10. Local authority awareness	0.047	2	0.977
11. Local authority waste collection	1.5	2	0.472

Source: Constructed by the researcher

The results indicated that all relationships between attitudes and DSECs were found to be not significant. However, these results are consistent with the findings of Azmin et al. (2022). However, Yaziz and Rahman (2015) found that their sampled (16.2%) respondents aged 17 years old were more likely to have a good attitude than others, contributing to their successful willingness to participate in solid waste separation intension and disposal, especially for recycling. Further, (Almasi et al., 2019) found that attitudes were significantly related to waste management context. However, the present study's findings show that awareness programs in the Sri Lankan waste management scenario are somewhat at a moderate level. Some local government institutions and their associated bodies implement successive solid waste management and disposal programs with a higher weight on awareness, whereas other bodies implement waste management with a little considerable mandate. Further, in Sri Lanka, there are enough legal proceedings as well as governing mechanisms and facilitating infrastructure up to a certain extent. But, it is still not at a satisfactory level, which is evident by the opinions that were expressed by the respondents expressed in the data collection process. Considering the matters, furthermore, Pongpunpurt et al. (2022) emphasized that the local authorities should give the fullest attention, again and again, to refer to the people well and to make a real effort adhering to the necessity of being aware of the effective solid waste management and its core contribution to the

country's economy with an emphasis of maintaining a sustainable environment by adding an economic value to their living society.

Table 11 shows the associations between DSECs and the subjective norm under SSPFs. The results indicate that there was no statistically significant association between DSECs and the respondents' subjective norm on SWSS, for which settlement (p = 0.159), gender (p = 0.151), age (p = 0.844), marital status (p = 0.426), education (p = 0.500), occupation (p = 0.533), family size (p = 0.208), family income (p = 0.703), local authority rate collection (p = 0.241), local authority awareness (p = 0.659), and local authority waste collection (p = 0.182) which were also tested.

Table 11: Association between DSECs and Subjective Norm on SWSS

Demographic Socio-economic characteristic	Situational Factor - Subjective Norm		
	Pearson Chi-Square	df	P-value
1. Settlement	3.681	2	0.159
2. Gender	3.78	2	0.151
3. Age	2.711	6	0.844
4. Marital Status	1.709	2	0.426
5. Education	12.607	6	0.500
6. Occupation	7.036	8	0.533
7. Family size	5.882	4	0.208
8. Family income	2.181	4	0.703
9. Local authority rate collection	2.844	2	0.241
10. Local authority awareness	0.835	2	0.659
11. Local authority waste collection	3.406	2	0.182

Source: Constructed by the researcher

Additionally, the results of the present study indicated that the subjective norm have no significant association with DSECs for solid waste source separation behavior of HH in Sri Lanka. The subjective norm in the sense of waste management is the motive to visit places according to their willingness and economic strength, to purchase their goods, consume to fulfill their requirements, and other fulfillments with aspirations that would positively or adversely affect their lives, which people use to manage their lives. However, people wish to fulfill their requirements according to societal standards and they are expected to practice such norms without disturbing other societal members. The subjective norm varies according to each DSECs in this study. Especially, high-income families in urban areas, evidenced in the Sri Lankan

context practicing their norm, several instances were found where the activities on their lifestyle and waste generation were adversely as well as negatively affected in managing solid waste source separation as well as disposal up to a certain extent.

Table 12 shows the associations between DSECs and the perceived behavioral control under SSPFs. The results indicate that gender under DSECs has a highly significant association with perceived behavioral control at a 1% (p = 0.000) significance level. Also, marital status under SSPFs has a significant association with perceived behavioral control at a 5% (p = 0.046) level of significance. In addition, the age under SSPFs has a marginally significant association with perceived behavioral control at a 10% (p = 0.072) level of significance. Further, the results show that other SSPFs with the exception of gender, marital status, and age, had no statistically significant associations (P>0.1) with perceived behavioral control (settlement – p = 0.951, education – p=0.743, occupation – p = 0.583, family size – p = 0.522, family income – p = 0.849, local authority rate collection p = 0.204, local authority awareness – p = 0.370, and local authority waste collection – p = 0.174).

Table 12: Association between DSECs and Perceived Behavioral Control on SWSS

Demographic Socio-economic characteristic	Situational Factor – Perceived Behavioral Control		
	Pearson Chi-Square	df	P-value
1. Settlement	0.101	2	0.951
2. Gender	0.728	2	0.000
3. Age	11.565	6	0.072
4. Marital Status	6.179	2	0.046
5. Education	3.508	6	0.743
6. Occupation	6.573	8	0.583
7. Family size	3.217	4	0.522
8. Family income	1.372	4	0.849
9. Local authority rate collection	3.178	2	0.204
10. Local authority awareness	1.989	2	0.370
11. Local authority waste collection	3.503	2	0.174

Source: Constructed by the researcher

According to Cheng et al. (2020), perceived behavioral control is a highly considerable socio-psychological factor in the case of solid waste separation

intention of HH. Further, this is related to self-mental control in the daily practice of solid waste separation. This emphasizes the community's sensitivities regarding whether they can demonstrate their behavior and how easily it is demonstrated in their lives. Matching these sensitivities or perceptions in a socio-psychological context affects the practice for building up a motive to encourage solid waste source separation. Integrating other situational and socio-psychological factors would create a paradigm shift by controlling their mental integrity to perform their waste separation without having no more prolonged difficulties or inconveniences. The results of the present study show that perceived behavioral control has a highly significant relationship with gender for solid waste source separation intention at a 1% (p = 0.000) level of significance. It emphasized that the women are handling the domestic work rather than men, separating their waste to disposal in the Sri Lankan context, then, marital status is another significant factor, having reported a significant relationship (p = 0.046) with this. Also, the age is marginally significant (p = 0.072) with perceived behavioral control. These results suggest that most mature and married women in Sri Lanka are more capable of solid waste source separation behavior of HH than men. Furthermore, the effect of additional DSECs exists in the separation process to make it effective and demonstrates how simple it is to exhibit their lives in an environmentally sensitive manner.

After discussing the results of the associations between DSECs and SSPFs, the Person Correlation analysis (r) in pairwise was used to find out the mutual relationships between situational and socio-psychological variables towards solid waste source separation behavior of households. The level of significance is set at 1% (p=0.01), in this context, there are three types of relationships that were found to have mutual relationships between SSPFs among situational factors, among socio-psychological factors, and between situational and socio-psychological variables. Table 13. shows the mutual relationships of SSPFs by indicating their pairwise correlations.

Table 13: Relationship between SSPFs of Respondents on SWSS

Settlement Area	Relationshi	Urban		Rural	
Variables		**PCC (r)**	**P-value**	**PCC (r)**	**P-value**
Knowledge and Inconvenience		-.072	.333	-.154*	.016
Knowledge and Experience		.362**	.000	.504**	.000
Knowledge and Awareness	1	.340**	.000	.185**	.004
Inconvenience and Experience		-.098	.189	-.162*	.011
Inconvenience and Awareness		-.028	.711	.092	.152
Experience and Awareness		.289**	.000	.282**	.000
Attitudes and Subjective Norm		.092	.217	.115	.073
Attitudes and Perceived Behavioral Control	2	.468**	.000	.387**	.000
Subjective Norms and Perceived Behavioral Control		.122	.102	.269**	.000
Knowledge and Attitudes		.538**	.000	.516**	.000
Knowledge and Subjective Norm		.136	.068	-.031	.629
Knowledge and Perceived Behavioral Control		.279**	.000	.225**	.000
Inconvenience and Attitudes		-.084	.261	-.118	.065
Inconvenience and Subjective Norm		-.037	.622	.157*	.014
Inconvenience and Perceived Behavioral Control		-.180*	.015	-.033	.608
Experience and Attitudes	3	.388**	.000	.388**	.000
Experience and Subjective Norm		.197**	.008	.010	.877
Experience and Perceived Behavioral Control		.297**	.000	.321**	.000
Awareness and Attitudes		.187*	.011	.037	.562
Awareness and Subjective Norm		.155*	.037	.194**	.002
Awareness and Perceived Behavioral Control		.161*	.030	.067	.294

Source: Constructed by the researcher

1% - *, 5% - ** level of significance

In PCC - Pearson's Correlation Coefficient

1 - Among situational variables

2 - Among socio-psychological variables

3 - Between situational and socio-psychological variables

Firstly, the mutual relationships among situational factors were found. There are six pairwise mutual relationships which were calculated for both urban and rural sectors. The results identified a highly significant relationship between knowledge and experience (p = 0.000) with a positive correlation coefficient (r = 0.362) in the urban sector. Also, there is a highly significant relationship

between knowledge and experience (p = 0.000) with a positive correlation coefficient (r = 0.504) in the rural sector. The relationship between knowledge and awareness was highly significant (p = 0.000, p = 0.004) with positive correlation coefficients (r = 340, r = 185) in both urban and rural sectors. Likewise, the results identified a highly significant relationship (p = 0.000) between experience and awareness with positive correlation coefficients (r = 289, r = 0.282) for both urban and rural sectors. However, the results indicated a significant relationship between knowledge and inconvenience (p = 0.016) with a negative correlation coefficient (r = -0.154) in only the rural sector. Also, there is a significant relationship (p = 0.011) between inconvenience and experience with a negative correlation coefficient (r = -0.162) in the rural sector. Other mutual relationships among situational factors in both urban and rural sectors (knowledge and inconvenience, inconvenience and experience for urban sector, inconvenience and awareness for both urban and rural sector) were found to be insignificant among situational factors for SWSS.

Secondly, mutual relationships among socio-psychological variables were found. There are three pairwise mutual relationships which were calculated for both urban and rural sectors The results identified a highly significant relationship between attitude and perceived behavioral control (p = 0.000) with a positive correlation coefficient (r = 0.468) in the urban sector. Then, a highly significant relationship exists between attitude and perceived behavioral control (p = 0.000) with a positive correlation coefficient (r = 0.387) in the rural sector. Also, the relationship between subjective norm and perceived behavioral control was highly significant (p = 0.000) with a positive correlation coefficient (r = 269) in the rural sector. However, the results indicated an insignificant relationship between attitude and subjective norms in both urban and rural sectors. Also, the results indicated an insignificant relationship between subjective norms and perceived behavioral contro1 in the urban sector.

Finally, the mutual relationships between situational factors and socio-psychological factors were found. There are 12 pairwise mutual relationships which were calculated for both urban and rural sectors The results identified the highly significant relationships between knowledge and attitude, knowledge and perceived behavioral control, experience and attitude, and experience and perceived behavioral control (p = 0.000) with the positive correlation coefficient in both urban and rural sector (r = 0.538, r = 0.516; r = 0.279, r = 0.225; r = 0.388, r = 0.388; and r = 0.297, r = 0.321). Also, there is

a highly significant relationship between experience and subjective norm (p = 0.008) with a positive correlation coefficient (r = 0.197) in the urban sector. Also, the relationship between awareness and the subjective norm was highly significant (p = 0.002) with a positive correlation coefficient (r = 0.194) in the rural sector. In addition, the results identified the significant relationships between; inconvenience and perceived behavioral control, awareness and attitude, awareness and subjective norm, and awareness and perceived behavioral control (p=0.014, p = 0.015, p = 0.011, p = 0.037, p = 0.030) with positive correlation coefficients (r = -0.180, r = 0.187, r = 0.155, r = 0.161) for the urban sector and significant relationship (p = 0.014) between inconvenience and subjective norm is reported with a positive correlation coefficient (r = 157), for the rural sector. Other mutual relationships except the significant relationships reported between situational and socio-psychological factors in both urban and rural sectors (knowledge and subjective norm, inconvenience and attitudes, inconvenience, and subjective norm, inconvenience and perceived behavioral control, experience and subjective norm, awareness and attitude, and awareness and perceived behavioral control) were found to have no significant relationships between situational and socio-psychological factors for SWSS.

Finally, Pearson's pairwise correlation matrix revealed statistically high significant associations among situational factors, knowledge and experience, knowledge and awareness, and experience and awareness with a positive significant correlation for both urban and rural sectors. Also, the results revealed a high association (among socio-psychological factors) between attitudes and perceived behavioral control with a positive significant correlation for both urban and rural sectors. Also, there are statistically and highly significant associations between situational and psychological factors; knowledge and attitudes, knowledge and perceived behavioral control, experience and attitudes, and experience and perceived behavioral control with positive significant correlations for both urban and rural sectors. Among socio-psychological factors, the results revealed a highly significant association between subjective norms and perceived behavioral control with a positive significant correlation only for the rural sector. Also, there is a significant association between experience and subjective norms with a positive significant correlation, and there is a significant association between awareness and subjective norms with a positive significant correlation for

urban and rural sectors, respectively. Between situational and socio-psychological factors, there are statistically significant associations, awareness and attitudes, awareness and subjective norms, and awareness and perceived behavioral control with a positive significant correlation only for the urban sector. Further, there is a significant relationship between inconvenience and subjective norms with a positive significant correlation. However, there is a statistically significant association between inconvenience and perceived behavioral control with a negative significant correlation only for the urban sector. However, these associations proved that well-knowledgeable and experienced people were fully aware of quality living standards and perceptions. have the utmost intention of separating solid waste sources in the Sri Lankan context.

5. **Conclusion and Policy Implications**

This study delved into the relationship between Demographic, Socio-Economic Characteristics (DSECs), and Situational and Socio-Psychological Factors (SSPFs) concerning solid waste source separation behavior in both urban and rural households within the Sri Lankan context. The findings expanded on the work of Azmin et al. (2022) and highlighted moderately significant relationships between DSECs and SSPFs in the urban and rural sectors. The results underscored the importance of situational factors, such as knowledge, experience, inconvenience, and awareness, alongside socio-psychological factors like attitudes, subjective norms, and perceived behavioral control. Notably, positive significant correlations were evident among most situational and socio-psychological variables, indicating their impact on solid waste source separation behaviours.

The overall results of this study indicated that urban and rural residents with higher knowledge levels, better educational backgrounds, greater experience, heightened awareness, and reduced inconvenience displayed more favorable attitudes, subjective norms, and perceptions of improved living standards. These factors contributed to a stronger inclination towards solid waste source separation. Furthermore, the study revealed the interplay of various factors that contribute to wider mental integrity in promoting and sustaining solid waste source separation behavior in Sri Lanka's urban and rural areas. Local authorities' involvement was found to be vital in facilitating waste source separation practices, highlighting the significance of their contribution to effective societal waste management.

The findings of this study hold practical implications for local authorities and waste management organizations in Sri Lanka. It underscores the need for an integrated approach encompassing solid waste source separation and disposal behaviors, while considering demographic, socioeconomic, and local authority factors. The findings presented here can ultimately inform policymakers, governments, administrative units, international/national funding agencies, project-driven organizations, and other stakeholders in crafting sustainable development policies and strategies. By adopting a collaborative participatory approach, one can improve the effectiveness of solid waste source separation intentions among the population, contributing to the economic and social sustainability of the country.

6. Limitations and Future Research Agenda

There are several limitations that should be acknowledged. The study's focus on the Sri Lankan context surely limits the generalizability of the findings to other regions or countries with different socio-cultural, and economic backgrounds, institutional capabilities. Consequently, comparative analysis with countries sharing close socio-cultural, economic background, and institutional capabilities with Sri Lanka would enhance the robustness of the results. Moreover, replicating the research framework of this study in diverse settings would also enhance the robustness of the results. The study solely employed a quantitative approach, which may overlook qualitative insights and in-depth understanding of individual behaviors and motivations. Future studies could incorporate qualitative methods, such as interviews or focus groups, to gain richer insights into the factors influencing waste source separation behavior. Additionally, the sample size of 428 households did not fully represent the vast population of urban and rural households in Sri Lanka. Therefore, expanding the sample size would improve the study's statistical power and allow for better government policies and accurate awareness campaigns capable of influencing urban and rural households to engage in efficient solid waste source separation.

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