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"Waste Is Wealth": Circular Economy Strategies from Media Persuasion to Utilization

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Abstract: Circular economy strategies encompassing "Waste is Wealth" (also known as "Waste is Gold") policies in Thailand have been popularised through various media. This study focused on a community of people in the central north of Thailand and their "return waste for money" practices, with 403 participants surveyed in mid-2022. The analysis of their responses, using descriptive and inferential statistics, identified the factors contributing to the gap between the available information in the media regarding the existence of regulations and policies addressing the recycling and reusing of waste and people's responses to that information. Residents' knowledge and understanding of proper waste management, derived from the media, were essential elements in educating communities. The collection and disposal of garbage were handled very differently between the rural and urban communities, with different municipalities making different provisions for residents' waste disposal. Our analysis showed that a holistic approach was needed, particularly including the publication of comprehensive and understandable information on government policies and regulations, the differentiation of waste material types, garbage and waste collection, and disposal methods, including returning, recycling, and reuse, which were identified as being necessary for effective and efficient waste disposal and encouraging recycling and reuse. It was shown that without valid information available via social media and the mass media, peoples' attitudes and behaviours will not change and the recycling of plastic waste materials will be limited, even with the promise of Waste is Wealth.

Keywords: waste management; recycle; upcycle; persuasive communication

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1. Introduction

Waste is still seen as a problem rather than as having value in the circular economy. Numerous researchers have shown that the circular economy (CE) policy encompasses the idea of returning waste for money, which is seen as both essential and practical, given the huge volume of petroleum-based plastics that has been produced since the Second World War, with 9.2 billion tonnes of plastic produced between 1950 and 2017 and more than half of that produced since 2020 [1]. The European Union (EU) launched several successful waste recycling programs which resulted in the collection of an estimated 29.5 million metric tonnes of post-consumption plastic waste across the EU, Norway, Switzerland, and the United Kingdom—a good start, but still a very small amount compared to the volume produced over the same period. Of this total, 36.6% was recycled in three cities: Valencia in Spain, Utrecht in the Netherlands, and Alba Iulia in Romania [2].

The modern "consumer economy" is fed by this huge expansion in the production of low-cost, plastic-based consumer goods. This has led to a massive expansion in the volume of post-consumer waste and, consequently, dumping. The term "cosmetic obsolescence" refers to consumers frequently updating their various devices to the latest design, concerned more with the aesthetics of the new product, demanding the latest technology, and giving rise to the term "throw-away economy", all of which contribute to a huge growth in household waste [3].

Many scholars have indicated that variable charging (VC) programs such as the Pay-As-You-Throw (PAYT) and the volume-based waste fee (VWF) system are noted for their

effectiveness in waste reduction [4–8]. VC programs are noted for their sustained effects and have been adopted in South Korea and other countries as well. Japanese studies show reductions continuing for ten years or longer. US studies calculated a reduction of up to 17% with up to 11% rerouted for recycling.

Several reports, in both academia and the mainstream media, suggest that plastic waste will increase to over 700 million tonnes worldwide over the next 20 years [1]. These predictions may vary between commentators, but the extent of the problem is clear. Possible partial solutions to this problem may be repurposing objects where they can be adapted and applied to different uses. The renovating of items would enable them to be resold as "second-hand" products. Another option would be the salvaging of components and recycling them as raw material for new uses. Various solutions have been proposed to reduce the amount of waste that enters landfills without using the terms VWF, VC, etc. [9]. These reuse measures can create a more sustainable consumer society, reducing the volume of new products being purchased, as well as reducing the volume of new raw materials needed.

Waste management plans promulgated by the Thai government have a target of reducing household and industrial waste by 10% year-on-year and increasing the recycling of plastic waste by 10% year-on-year to 2026. It is suggested that, for these aims and objectives to be achieved, waste management attitudes and the behaviour of the Thai people must change and their cooperation and participation in such programs must be gained. This study focused on adopting the Reuse, Reduce, and Recycle (3Rs) policy in local areas. The 3Rs policy is based on the proposition that to create a sustainable economy, we need to revamp how we reduce, reuse, and recycle products to create less waste [10–12]. Residents consume a lot of plastic products, and the waste products have no intrinsic value in them, but in some cases, there is a potential monetary value if the waste objects are returned in exchange for money. To achieve the desired outcomes, comprehensive but easily understood information must be available on social media and in the mainstream media. Waste can therefore be valuable, especially if it is turned into useful objects appropriate to the requirements and uses of urban and rural communities.

Sustainable waste management presents a critical global challenge, necessitating the development of strategies for waste reduction and enhanced recycling. This study explores the impact of promoting sustainability in Thailand's waste management by surveying the attitudes and behaviours of residents in rural and urban communities regarding waste management and disposal, particularly regarding plastic waste. How the residents' attitudes and behaviours were impacted and formed by the regulations, policies, and practices of local government organisations, and information from social media and mass media, were analysed.

2. Materials and Methods

This study was undertaken in mid-2022 in Phitsanulok and Sukhothai provinces which are located in the lower northern region of Thailand. These provinces were selected because of the innovative policies and practices in place regarding the upcycling of plastic waste produced in those provinces.

2.1. Data Collection and Variables

This study was divided into 2 stages: The first stage used qualitative content analysis to collect and analyse waste management information from the traditional media and online media. The second stage used quantitative content analysis to collect and analyse waste information. The data were collected using questionnaires distributed to all participants, and personal interviews were conducted with some respondents who were unable to read and understand the questionnaire to ensure valid responses. After gathering all the data needed from the participants, the data were analysed for significant factors, tabulated, interpreted, and inferences drawn based on the results.

2.2. Method

The objective of the research design utilized in this study was to facilitate reproducibility by providing a detailed account of the methodology employed. The primary research instrument collected data from online sources using specific keywords pertinent to this study's objectives. These keywords included "waste sorting", "recycle", "reduce", "reuse", "repair", "recovery", "3Rs", "5Rs", and "waste management", all queried in the Thai language. The data collection period of five months spanned from August 2022 to December 2022. The abbreviation "5R" is an extension of the 3Rs concept that adds two extra practices: repurpose and recycle. Alternative terminology is suggested by other authors and waste disposal organizations [10–12].

To acquire pertinent data, searches were conducted across diverse online platforms, including general interest websites and online media outlets, utilizing qualitative analysis software NVivo (version 14.23.0). The search process yielded a substantial corpus of 17,300,000 articles in response to the specified keyword queries.

The evaluation criteria employed in the analysis involved the assignment of interval scores ranging from 1 to 5. These scores were determined based on the extent to which the retrieved articles addressed key themes related to waste management, including environmental impact, health implications, climate change, and sustainable development. A score of 5 indicated comprehensive coverage of these themes, while a score of 1 denoted minimal or no discussion of relevant details.

The range shows the meaning of the fractions in each level over the range from 1.00–1.80 at the smallest level to 4.22–5.00 the greatest degree, indicating how well the media represents the contents of waste management as an environmental impact or a health problem, climate change, or sustainable development.

$$\text{Range} = \frac{\text{Maximum} - \text{Minimum}}{\text{Number of intervals}} \quad (1)$$

The second stage instrument used was a four-part questionnaire. This was tested for reliability and validity as determined by professors familiar with the topics addressed. The internal consistency of the data were calculated using Cronbach's alpha test as in Equation (2) [13]

$$\alpha = (\mathrm{N} \times \bar{\mathrm{c}}) / [\bar{\mathrm{v}} + (\mathrm{N} - 1) \times \bar{\mathrm{c}}] \quad (2)$$

where the coefficient of (α = 0.952) was consistent with the rule of thumb value for interpreting α for the Likert scale questions of $\alpha > 0.9$, indicating validity at an excellent level.

2.3. Sample and Sampling Techniques

The selected study areas included an urban area where waste management has been contracted out to a private company. The contract had been awarded by the local municipal administration. In the rural area, conventional garbage collection and disposal methods were extant. Following Taro Yamane's sample formula, as referenced [14], the sample size for this study was determined to be 392 individuals, ensuring a 95% confidence level to enhance precision, with a margin of error set at 5%. Subsequently, a cohort comprising 403 participants from Phitsanulok and Sukhothai provinces was selected to serve as a representative sample of the lower northern region of Thailand. This decision was made in consideration of budgetary constraints and the utilization stage of the research process, with the participation method identified as the subsequent procedural step.

Response options on the Likert scale questions ranged from 1 (strongly disagree) to 5 (strongly agree). The data were analysed with Statistical Package for Social Sciences (SPSS) version 27. The data were tested for normality to determine where parametric or non-parametric tests are needed for descriptive and inferential statistics (mean, standard deviation, factor analysis, Pearson correlation coefficient, and multiple regression), except for the missing data imputation.

This research was conducted based on the Ethics Certification of Human Research by the Human Research Committee IRB No. P2-0086/2565 from 5 July 2022–5 July 2023.

2.4. Exploratory Factor Analysis (EFA)

Both descriptive statistics for social economic status data and referential statistics were used for the exploratory factor analysis model: EFA and multiple regression with a preliminary agreement for accepting variables for the composition analysis where they are continuous variables or have values in the interval and ratio scales, and where the correlation is at a high level, between r = 0.30–0.70 as linear regression.

The sample size needs to be at least 5–10 times larger than the number of variables, or at least 3 cases per variable. The number of variables used for factor extraction in this study was 68 variables × 3 cases = 204 people. Therefore, the responses from 403 people were appropriate and within the specified criteria.

EFA was performed by the principal components method with varimax rotation, and the indices used were the Kaiser–Meir–Olkin (KMO) index and Bartlett's test of sphericity. The KMO index indicates sampling adequacy and sufficient sample size to perform factor analysis. The value of this index is between zero and one, and the acceptable value for the KMO is 0.891, which is greater than 0.5. Bartlett's sphericity test, which measures the significance of the data analysis, was used to ensure the appropriateness of the data and resulted in a significance level of 0.95. The three key indicators of eigenvalues, the ratio of explained variance, and the scree plot were used to examine the amount and nature of the questionnaire factors. In accordance with statistical criteria, items exhibiting factor loadings of 0.4 and above were retained for further analysis within each respective component.

3. Results

3.1. Preliminary Statistics

The form and language style of rhetoric used when promoting the concept in the various media is shown in Table 1. The Reuse, Reduce, and Recycle (3Rs) concept is often promoted academically, and the language used is of an academic style. Waste management is categorized in four ways: (i) sorting, disposing, and upcycling according to the 3Rs policy to achieve zero waste; (ii) environmental impact; (iii) public health impact; and (iv) marketing the slogan "Waste is Gold". In Thailand, the purpose is to persuade people of the real value of waste with a persuasive marketing strategy.

The rhetoric form was also analysed in terms of the academic tone or style, whether articles were from opinion leaders or published by academics and researchers, whether the content identified and discussed waste as a problem, the writers' purpose for improving waste management, and content confirmation by practitioners. Persuasive techniques include fear messages, animations, reality documentaries, prevention measurement, and legal language enforcement. Table 1 shows these categories and outcomes.

Other forms of waste such as paper can pose problems, especially if dumped in large quantities. It can cause problems as it may take a long time to break down and there is also the problem posed by ink, kaolin, and other material substances that are used in the manufacturing and printing processes. Paper is also a hazard in that it can catch fire if the downgrading process generates heat. Better waste disposal techniques are needed to solve the many problems posed by waste disposal.

The 3Rs concept, as mentioned previously, is an attempt to solve these problems that continue after the disposal of plastic waste material, such as the long timeframe needed for that material to break down and the release of dangerous gases from that process.

Implementing the 3Rs principle resulted in changes in how waste is treated before disposal [15]. This allows for more waste to be recovered and reused, thus changing the way waste is disposed of and reducing the consumption of virgin resources in manufacturing processes, thereby yielding commendable outcomes. Moreover, waste management practices have been implicated in climate change dynamics, with chemical seepage into the environment exacerbating atmospheric degradation. Instances such as landfill fires

pose additional concerns, as the resultant emissions of smoke and diverse chemical compounds have the potential to further compromise atmospheric integrity and may also have a negative impact on public health.

Table 1. Analysis of rhetorical contents of sampled media.

	Form of Rhetoric (Top 10 Popularity in the Media)	**Waste Management Content Categories ($\bar{x}$)**			
		Sorting/3Rs and Upcycle Plastic Waste/Zero Waste	**Environmental Impact/Climate Change**	**Health Impact**	**Waste Is Gold/ Marketing**
1.	Academic tone/style	(4.8) Greatest	(4.89) Greatest	(4.48) Greatest	(1.27) Small
2.	Opinion leader/academician	(4.20) Greatest	(4.8) Greatest	(4.89) Greatest	(0.00) Smallest
3.	Maintain waste problems	(4.12) Greatest	(1.48) Small	(0.42) Smallest	(4.48) Greatest
4.	Improved waste management	(4.89) Greatest	(5.00) Greatest	(2.32) Average	(4.88) Greatest
5.	Confirmation by practitioners	(4.98) Greatest	(1.06) Smallest	(1.20) smallest	(4.92) Greatest
6.	Fear messages	(4.35) Greater	(4.97) Greatest	(4.90) Greatest	(0.58) Small
7.	Animation	(3.58) Great	(4.31) Greatest	(0.00) Smallest	(3.88) Great
8.	The Reality of Life documentary	(4.68) Greatest	(4.18) Greater	(3.09) Average	(2.12) Small
9.	Prevention measurement	(4.11) Greater	(4.13) Greater	(4.93) Greatest	(0.00) Smallest
10.	Legal language	(0.87) Smallest	(0.66) Smallest	(0.23) Smallest	(0.00) Smallest

In response to these challenges, numerous scholars and commentators have employed fear-inducing messages and documentary-style presentations as strategies to disseminate awareness of the ramifications of waste disposal practices and plastic utilization.

The advocacy for recycling initiatives and the propagation of the "Waste is Gold" ideology have significantly mitigated the volume of waste deposited into the natural environment. Individuals have increasingly recognized the efficacy of delivering waste to designated processing and recycling facilities, thereby curbing indiscriminate disposal practices. Furthermore, innovative methodologies have emerged for the extraction of metals, including gold, from the electronic components of consumer appliances. Additionally, techniques have been devised for the recovery of chemicals from plastic materials and vehicle tyres, facilitating the reclamation and reprocessing of pollutants.

An aspect that needs to be considered is that of laws regulating the management of waste. Many European countries have strict laws regulating the environment and disposal of waste. These laws are strictly enforced with punitive measures ranging from fines to imprisonment. They also regularly stop cars for random checks of their exhaust emissions. A vehicle is labelled as unroadworthy if its engine is too dirty; however, the result of this is that illegal dumping is considerably reduced and dirty car engines are few.

In persuasive communication, individuals may wield influence and sway over others by employing rhetorical strategies to articulate their opinions. This conceptual framework categorizes these influential figures as opinion leaders, particularly within social media, where they are commonly referred to as influencers. Their media exposure significantly impacts the perceptions and behaviours of participants, as alluded to in [16] as the principle of evaluating the attributes of data concerning causality and consequentiality, holding paramount significance, encompassing ethos, logos, and pathos. Waste management can be influenced by various factors, including familial influence, interactions with neighbours, self-persuasion, endorsements from celebrities and political figures, and directives from governmental authorities.

3.2. Waste Management Influencers

Figure 1 illustrates the media perception effect was evident in participants' media exposure. Participants had received information about waste management from family members (35.2%); from their neighbours (28%); by self-persuasion (20.6%); a famous actor, actress, or singer (7.9%); a politician (3.5%); or from government authorities (2%).

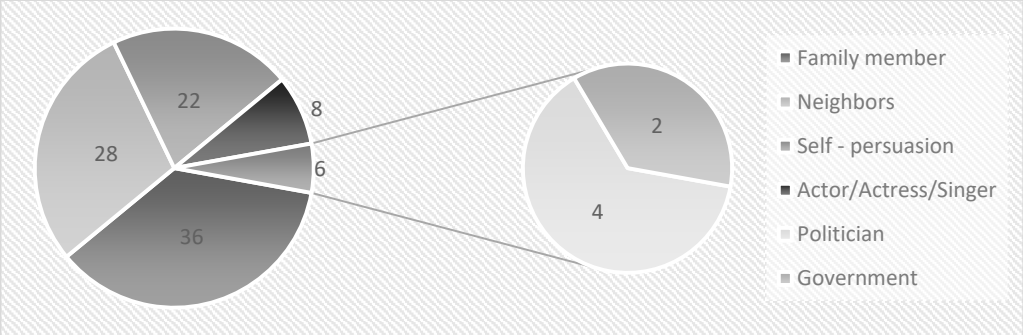


Figure 1. Type of waste management influencers.

In considering the above, it is worthwhile noting that family members are very important influencers for people, especially as most families have a "way", i.e., things that they do together as a family. They are likely to follow their family practices regardless of neighbourhood opinions. Neighbours could be important influences, especially if they are important in the community for some reason, such as wealth or education, or are the personal friends of the individual.

Table 2 shows the descriptive analysis, using average, frequency, and percentage with standardization to explain each of the socio-economic status variables of the sample cohort of 403 people. The cohort included 208 females (51.6%) and 195 males (48.39%) in the age range of 12 to 82 years old, with an average age of 45 years. The occupations were farmers (27%), government officials (25.6%), general labourers (20.1%), merchants (12.2%), and unemployed and students (3.5%). The educational levels of the respondents included primary school-level education (34.7%), finished junior high school (17.4%), finished high school (21.3%), graduated with a bachelor's degree (19.4%), and 4.7% held a master's degree, with 2.5% having little or no formal education.

Table 2. Socio-economic status of respondents.

Socio-Economic Status	Number	Percentage
Gender		
Female	208	51.61
Male	195	48.39
Occupation		
Farmer	109	27.0
Government officer	101	25.1
General labourers	81	20.1
Merchants	49	12.2
Retired/Unemployment	49	12.2
Student	14	3.5
Education		
Primary school	140	34.7
High school	86	21.3
Bachelor's degree	78	19.4
Junior high school	70	17.4
Undergraduates	19	4.7
No formal education	10	2.5

Table 2. *Cont.*

Socio-Economic Status	Number	Percentage
Age 12–82 years	Average 45 years	
Media Exposure		
TV	243	60.3
Application	80	19.96
Social network	35	8.58
Radio broadcast	28	6.98
Total	403	100.0

3.3. Hypothesis Testing

Hypothesis 1 (H1): *There is no difference in socio-economic status between the level of media exposure and waste management and disposal behaviours.*

Hypothesis 2 (H2): *There is no statistical relationship between the level of knowledge about waste management and recycling and individuals' attitudes towards waste management practices and waste disposal behaviours.*

Table 3 provides an overview of the variables used in the analysis. Socio-economic status includes education, occupation, and media exposure. After excluding outliers, all waste management and disposal behaviours analysed were normally distributed ($p < 0.05$ for all normality tests performed except the education variable, $p > 0.05$). ANOVA analysis revealed significant differences between sex, occupation, and media exposure in waste management behaviours. Media exposure ($p < 0.001$) and occupation ($p < 0.05$) had highly significant main effects. The education variable did not show statistical significance ($p > 0.05$). These results indicate that there are differences in waste management and disposal behaviours associated with sex, occupation, and media exposure.

Table 3. The socio-economic status difference between media exposure level and waste management and disposal behaviours.

Socio-Economic Status	Waste Management and Disposal Behaviours	
	F	***p***
Sex	0.880 **	0.000
Education	1.26 *	0.180
Occupation	1.88 *	0.006
Media Exposure	2.178 **	0.001

Note: * $p < 0.05$; ** $p < 0.001$ or greater.

It was noticed that well-educated and wealthier people are more likely to discard their waste and are unlikely to sort it or redeem it for recycling. In contrast, poorer people, who are usually less well-educated, are more likely to sort their waste and redeem it for money to supplement their often low incomes (see Figure 2). They collect and sort waste materials such as plastic as well as glass and other recyclable materials. Other electronic parts as well as mechanical parts are collected, repurposed, and reused. Food waste and bio-waste are turned into compost and used in gardening.



Figure 2. Poorer people collect plastic waste to supplement their income in Thailand.

Whether or not knowledge of waste sorting is related to the return price of the waste was tested. The average score was 2.08 (maximum score 10), with the highest score of 8 achieved by 12 respondents (2.97%) and 0 points scored by 126 respondents (31.26%), with 193 respondents scoring 1, 2, or 3 points (47.89%) and 72 respondents scoring between 4 and 7 points (17.86%). No respondent scored the full number of points available.

The result from the correlation showed that there was no statistically significant relationship between the level of knowledge about waste management and recycling. This finding correlates positively with individuals' attitudes toward waste management practices and disposal behaviours.

As indicated, Table 4 describes respondents' knowledge level that was significantly, and positively, associated with waste management and practices. The results show interesting relationships between the return prices paid for plastic utensils and the knowledge of plastic materials made from the different foam types in reusable packaging such as PS ($r = 0.239$, $p < 0.001$), the return of used milk bottles related to their plastic material of HDPE ($r = 0.210$, $p < 0.001$), drink bottles made from PET ($r = 0.278$, $p < 0.001$), and bags/sacks made from LDPE ($r = 0.263$, $p < 0.001$). All variables had a significant positive correlation: a positive correlation between knowledge of and attitudes toward waste management and recycling behaviours. Knowledge showed a significant correlation with waste management and recycling behaviours of 0.001 and attitudes showed a correlation of 0.002.

Table 4. Effect of the price of returned plastic waste on sorting behaviour.

Price for the Return of Waste Plastics	Return—Price (Baht per Kilogram)	Correlation		Meaning
		r	*p*-Value	
K_1 Plastic spoons and forks are provided in reusable polystyrene (PS) packaging	0.50	0.239 **	0.002	Positive correlation
K_2 Shampoo and milk bottles made from high-density polyethylene (HDPE)	1.50	0.210 **	0.004	Positive correlation
K_3 PET milk and soft drink bottles made from polyethylene terephthalate	2.50	0.278 **	0.007	Positive correlation
K_4 Bags and sacks made from low-density polyethylene (LDPE)	0.70	0.263 **	0.002	Positive correlation

Note: $p < 0.05$; ** $p < 0.001$ or greater. Source of return price information: https://wongpanit.com/ [15].

Based on this research framework, waste management and recycling policies are influenced by multiple underlying factors, specifically attitude, behaviour, and social responsibility.

4. Factor Analysis

Factor analysis was undertaken to predict the inter-relationships between factors of interest and their important contribution to the overall analysis. The factors included are outlined in Table 5.

Table 5 describes the factors related to waste management. The indices of media exposure include aspects such as attitude, behaviour, and social responsibility which were created by factor analysis using Varimax rotation to separate the individual responses of 55 distinct items. The analysis, which accounted for α = 92.0 variance in the 55 items, yielded a four-factor solution. Each item was loaded onto only 51 factors; thus, all items had a strong factor loading.

Waste Management Indicators

The KMO calculated as 0.891 is close to 1 point which shows that it could explain the knowledge of waste management and recycling factors that were developed for this study by adding all responses to items concerning viewpoints for F1 (where the municipality and local administration allocating a budget, dump area, and value-add by returning plastic waste in-kind and in-cash and raise awareness of residents' sustainable environment practices were indicated as an average ($\overline{x}$ = 3.52, σ^2 = 18.35%)), F2 (where the allocation of coloured bins in keeping with the compulsory 3Rs policy of the government, standardization, and enforced laws are indicated as averages ($\overline{x}$ = 3.41, σ^2 = 13.38%)), F3 (where awareness–raising is used to effectively prevent waste among people by promoting reduce, reuse, and recycle rhetoric, to create clear and appropriate messages, and to direct well-defined messages to target audiences were indicated as an average ($\overline{x}$ = 3.47, σ^2 = 12.86%)), and F4 (where self-persuasive, media, and personal media influences promoting waste management and recycling were indicated as sufficient ($\overline{x}$ = 2.9, σ^2 = 11.92%)), respectively.

Model 6: R^2 = 0.743 means 7.47 = 3% of coefficient determinism or factors of attitude, behaviour, and social responsibility indicate a strong positive and significant correlation ($p < 0.05$).

The model of the factors affecting waste management in Thailand is shown in Figure 3.

Table 5. Factors affecting and regression coefficient of the attitudes and behaviours toward waste management and recycling policy.

Variables	Mean	S.D.	Data Average Interpretation	Component	Variance (%)	KMO	Predicted Variables	B	Beta	t-Value	*p*-Value	R Square	Adjusted R Square	R Square
ATT1. Allocated dump areas in the community.	3.64	1.096	Agree	F1	18.346	0.891	Constant	0.187	−0.023	13.150	0.000 **	0.864	0.747	0.743
ATT2. Politics and politicians are ineffective in managing waste disposal problems.	3.18	1.382	Uncertain											
ATT3. Value of waste management and recycling in kind, cash, and environment.	3.75	1.721	Agree											
BH1. Local waste management and recycling services and allocation household dump area.	3.74	1.037	Agree	F2	13.381		BH1	−0.057	−0.241	−5.564	0.000 **			
SR1. Educate regarding the law and raise the awareness of people on their knowledge of waste management and recycling in school and household areas.	3.92	1.044	Agree	F3	12.820		SR1	0.048	0.205	4.782	0.000 **			
SR3. Promote the sorting of waste management in the media. Improving the knowledge of residents in the local area towards waste management and recycling.	3.52	1.092	Agree	F3	12.820		SR3.	0.047	0.198	4.579	0.000 **			
BH2. Difficulties in sorting contaminated waste.	3.04	1.320	Uncertain											
BH3. Remember the waste sorting colours.	3.44	1.156	Agree											
SR1. Educate regarding the law and raise the consciences of people on knowledge of waste management and recycling in schools and household areas.	3.92	1.044	Agree											
SR2. Waste returning prices need to be fair to make it worthwhile to collect waste. Insufficient waste in the community, nobody cares, and the cost of waste sorting management is too high.	2.97	1.484	Uncertain				SR2	−0.045	−0.095	−2.125	0.034 *			
SR4. Social response promotes recycling and utilizes knowledge of waste management and recycling in routine.	3.48	1.143	Agree				SR4.	0.104	0.161	3.695	0.000 **			
COM1. Media and personal media influence self-persuaded waste management.	3.62	1.319	Agree	F4	11.918		COM1.	0.035	0.149	3.456	0.001 **			

Note: 1.00–1.79 means strongly disagree level, 1.80–2.59 means disagree, 2.60–3.39 means uncertain, 3.40–4.19 means agree, and 4.20–5.00 means strongly agree. Extraction method: Principal component analysis. * $p < 0.05$; ** $p < 0.001$ or greater. The dependent variable is the waste management system. Independent variables are F1, F2, F3, and F4.

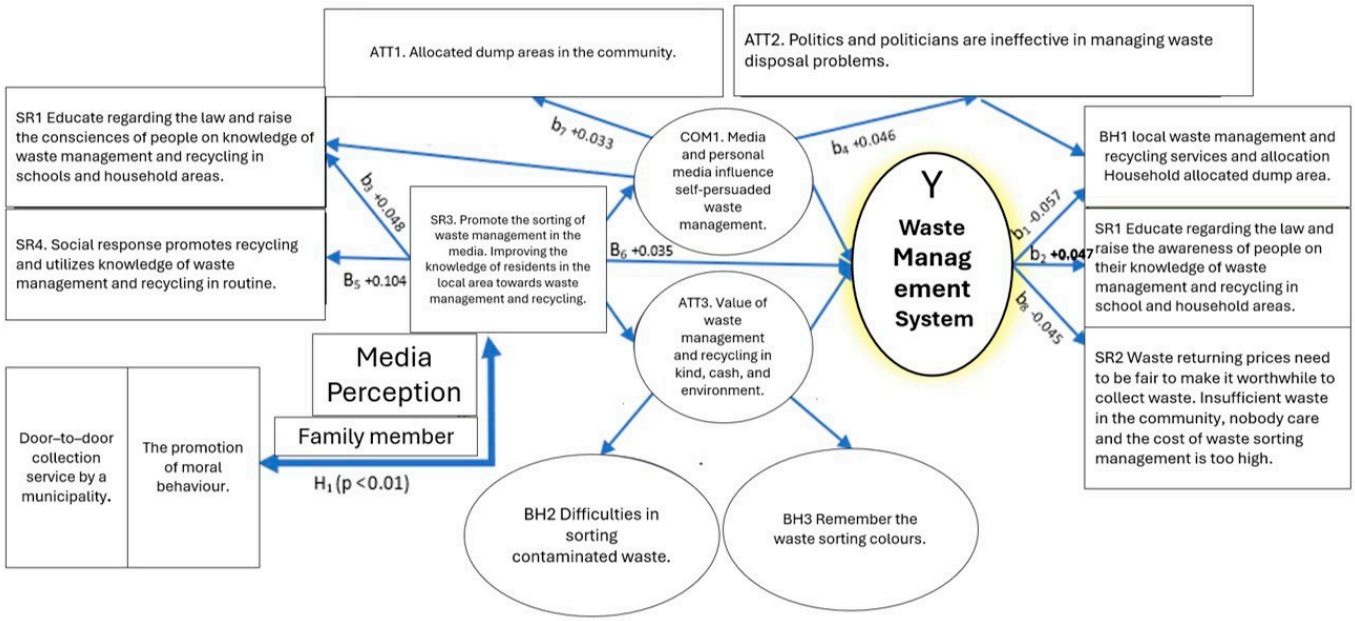


Figure 3. Model of factors affecting waste management in Thailand.

The majority of the 403 respondents in this study were female, with an average age of 45 years. Rural areas in Thailand predominantly consist of farmers and general labourers, alongside government officials, business owners, and some unemployed individuals. Respondents' levels of formal education ranged from the completion of primary school, junior high school, and high school to bachelor's and master's degrees, with a small minority having no formal education. It is noteworthy that rural populations typically exhibit an aging demographic profile, a phenomenon recognized by researchers [17,18], which influences pro-environmental behaviour.

Younger individuals tend to perceive environmental issues as significant and are more likely to access environmental and waste disposal information through various media channels, including television, radio, printed media, personal media, and the Internet. Conversely, older members of rural communities are less inclined to utilize the newer forms of media, particularly those accessible online.

Regarding the understanding and retention of waste management concepts, respondents scored between 0 and 8 points out of a total of 12, with no participants achieving the maximum score. The effective recycling of plastic materials, including drink bottles made from PET and bags made from LDPE, is associated with respondents' proficiency in sorting plastic waste materials.

5. Discussion

The rhetorical contents of the sampled media were analysed under the following categories: (i) sorting and the 3Rs, (ii) environmental impact/climate change, (iii) potential health impact, and (iv) the marketing strategy of "Waste is Gold".

In the context of waste management practices, the categorization of waste into distinct classifications including, but not limited to, plastic, paper, metal, glass, and food scraps, was undertaken. This systematic sorting process facilitated subsequent processing procedures tailored to the specific nature of the materials involved. The tenets of the 3Rs principle, Reduce, Recycle, and Reuse, were invoked to guide waste management endeavours where waste materials were directed towards reprocessing channels as opposed to indiscriminate dumping or dumping in landfills. It is imperative to acknowledge that dumping presents significant environmental concerns, particularly due to the potential effects of certain types of waste, such as plastics, due to their chemical composition.

Other forms of waste such as chemicals, medicines, and engine oil from motor vehicles are also a cause for concern as many are artificially-occurring chemicals that can be extremely hazardous if improperly handled and disposed of. As per Bloom's Taxonomy [19], respondents exhibit a spectrum of cognitive abilities ranging from basic comprehension to practical application, as evidenced by scores varying between 0 and 8 out of a potential 12 points, with none attaining the maximum score. The act of engaging in plastic waste recycling correlated with respondents' behaviours regarding the segregation of plastic materials, notably PET drink bottles and LDPE bags. A pronounced consensus among respondents emerged, underscoring the significance of the Reduce, Recycle, and Reuse principles, while also acknowledging a sense of individual accountability towards environmental conservation.

Various scholarly discourses that have explored these topics [2,10,11,17,18,20–22] extensively covered a broad array of perspectives sourced from diverse geographical regions including, but not limited to, the European Union, Taiwan, Hong Kong, Japan, and Indonesia.

The redemption of plastic waste bottles at local pay-as-you-throw establishments yields comparatively diminished returns in contrast to the substantially higher value attributed to metal and paper waste upon redemption. This discrepancy in valuation is reflective of prevailing market dynamics. Interested parties may refer to the current pricing information available on the provided link (https://wongpanit.com/, accessed on 26 May 2029) [15] for updated market rates.

Consequently, the return of plastic waste bottles is not routine amongst both urban and rural demographics. However, this practice holds significance for socio-economically-disadvantaged individuals, including impoverished populations, the unemployed, and the homeless, who may rely on it as a supplementary source of income. Several respondents attested to benefiting from the segregation of plastic waste, citing financial gains accrued from the redemption process.

Despite recent policy interventions implemented by numerous supermarket chains and convenience stores, such as the discontinuation of single-use plastic bags for customer purchases, significant shifts in behaviour among the Thai populace remain limited. This reluctance to alter habits is largely attributed to the inconvenience associated with providing multi-use shopping bags or utilizing alternatives to plastic utensils.

In the agricultural sector, farmers demonstrate a capacity to manage food waste by repurposing it as fertilizer for tree and plant cultivation, showcasing a localized approach to waste management. Conversely, students exhibit suboptimal waste disposal practices, with notable exceptions occurring during school-initiated recycling campaigns, underscoring the influence of institutional engagement on behaviour modification. What has been found in other countries is that these school, college, and university initiatives appear to be less effective until there is a "critical mass" (tipping point) among the overall population of people who are willing to cooperate with these initiatives. At this stage, the separation of waste for recycling becomes a normal part of social behaviour and no one thinks about it anymore—they just do it. Countries where this is the case are Austria and Switzerland, as well as several other middle European countries.

An overarching observation from this study highlights a prevailing lack of awareness or commitment among individuals to engage as partners in the 3Rs framework, further compounded by inadequate enforcement measures to regulate waste sorting and disposal, both in public spaces and households. Central to addressing this challenge is the imperative of fostering a collective consciousness regarding waste disposal as a social, economic, and environmental responsibility. Such efforts are deemed essential for navigating towards a sustainable resolution to the waste management conundrum.

6. Media Exposure and Information Perceptions

The general populace often lacks familiarity with the diverse types of plastics, contributing to challenges in effective waste management, given that certain plastics are not

recyclable. A recommended strategy to address this issue involves waste collection services, typically provided by municipalities, offering colour-coded bins and receptacles. This method has proven to be both convenient and effective in promoting waste sorting practices. However, communities must be adequately informed about this approach, necessitating the implementation of appropriate communication strategies. Despite the colour differentiation of bins, individuals often rely on visual cues, particularly pertinent for those with limited literacy skills. Therefore, comprehensive and easily understood information is essential for facilitating effective waste-sorting behaviours, as underscored by discussions outlined in the literature [12].

The influence of mainstream media on local communities is notable, particularly through regular television consumption. Even in contemporary rural settings, individuals typically have access to social media platforms such as Facebook, LINE, Instagram, WhatsApp, and online news sources which serve as channels for both information dissemination and entertainment. However, residents may tend to overlook messages from websites that offer authentic information from reliable sources, including local authorities such as village heads, mayors, governors, ministers, or prime ministers [23]. Instead, individuals often prioritize media consumption for the purposes of relaxation, social interaction, entertainment, and escapism from the routine challenges of daily life, engaging with content spanning news, drama, films, music, documentaries, sports, and culinary programs.

Individuals who actively seek information on waste management through mainstream media, social networks, community speakers, and radio broadcasts, particularly regarding the zero-waste policies implemented by national governments and local municipalities, are more inclined to adhere to such guidance. Contrary to the influence of traditional influencers such as celebrities, politicians, and government officials who advocate the 3Rs and zero-waste initiatives, rural populations tend to prioritize information disseminated by family members, personal acquaintances, and self-persuasion within their immediate social circles. This phenomenon has been extensively examined by various researchers [11,12,23–26].

Scholars have concentrated on elucidating the factors that influence individuals' comprehension of waste management and recycling, as well as their attitudes and behaviours toward environmentally friendly practices, food waste reduction, and sustainable development. Persuasive communication strategies that employ symbols and graphics, such as infographics, have proven effective in promoting better waste sorting practices, particularly in public spaces utilizing colour-coded bins, as presented in [27], which underscores the correlation between respondents' attitudes toward waste management and recycling and their level of familiarity with waste management practices, similarly presented in [28].

Moreover, media platforms can disseminate valuable information concerning waste management practices, including return prices for waste plastics and metals, as well as market insights on recyclable packaging materials such as glass, paper, cardboard, and plastic. By providing pertinent data, the media contribute to enhancing residents' understanding of waste management issues and fostering a broader awareness of the secondary materials market.

Local governments have initiated waste management projects aimed at educating communities about waste-sorting practices, analysing PAYT (Pay-As-You-Throw) projects implemented across various countries [29]. Legal measures, including punitive measures such as fines for illegal dumping, have proven effective in deterring environmentally harmful behaviours [28,30,31]. Collaborative efforts between municipal and local government organizations have further bolstered waste management endeavours by incentivizing waste collection, providing landfill facilities, implementing colour-coded waste sorting systems, and offering door-to-door collection services.

Government-led waste management plans, including budget allocations and the provision of landfill sites, are instrumental in emphasizing the value of waste as a resource and advancing the concept of environmental sustainability. Initiatives promoting recycling and embracing the "Waste is Gold" concept have contributed to waste reduction efforts

as individuals increasingly recognize the benefits of diverting waste to processing and recycling facilities. The circular economy (CE) principles leverage digitization technology in the context of the Fourth Industrial Revolution to optimize waste reduction strategies [4,29]. The integration of digitization into Municipal Solid Waste Management (MSWM) initiatives enables municipalities to augment public participation and streamline waste segregation processes by adopting the 5Rs framework (Reduce, Recycle, Reuse, Recovery, and Repair). These technological innovations are congruent with overarching policy directives, notably the aim to attain a 35% recycling rate for generated waste by 2030, thereby presenting a technologically-driven approach to addressing waste management complexities.

7. Conclusions

In conclusion, the notable disparity between rural and urban communities in waste management practices stems primarily from the presence or absence of regulations and policies governing recycling and waste reuse. Governmental institutions in rural areas generally lack such policies, highlighting the need for comprehensive regulatory frameworks to guide waste management practices effectively. Furthermore, residents' knowledge and understanding of the importance of proper waste management emerge as crucial determinants in narrowing this gap. The dissemination of information regarding waste management regulations and policies, particularly through social media and mass media channels, plays a pivotal role in educating communities. However, the efficacy of these efforts hinges on the establishment of robust and enforced regulations and policies.

Many challenges are faced when attempting to solve the waste management problem in Thailand. Importantly, there is a lack of factual and persuasive information on the problem generally and specifically in regard to the laws, regulations, and policies of the national government and local government institutions. Applying a comprehensive communications science approach to the publication of this information is one important part of the solution.

Practices such as waste differentiation and the implementation of colour-coded waste sorting systems are vital for effective waste management, particularly in urban areas. Conversely, rural municipalities often lack such initiatives, with residents typically provided only with black rubbish bins for waste disposal. Disparities in garbage collection and disposal methods further exacerbate the divide between rural and urban communities, with rural areas often lacking sorting mechanisms and resorting to landfill disposal.

Interestingly, rural residents are interested in recycling initiatives, particularly when incentives such as cash or kind returns for returned bottles and aluminium cans. However, such practices remain insufficiently widespread to yield a significant impact. In the past, most soft drinks were sold in glass bottles. Milk was also sold in glass bottles. The soft drink bottles could be returned to shops that sold them in exchange for a small amount of money. Children would often scour the area for such bottles and then return them to shops in exchange for a small amount of money. An afternoon spent thus was fun and the funds may be sufficient for a soft drink or a few sweets. The return of milk bottles came with a small reduction in the price of the milk. In both cases, the bottles were washed, relabelled, and reused. Bridging the attitude–behaviour gap between urban and rural areas necessitates a multifaceted approach, including the promotion of upcycled products as utility-maximizing opportunities rather than solely positioning them as pro-social solutions. Emphasizing the sustainability benefits of upcycling products and highlighting the role of waste management knowledge can enhance the effectiveness of environmental campaigns and education materials in fostering sustainable waste management behaviours. Ultimately, targeting highly knowledgeable consumers of upcycled products offers a promising avenue for promoting environmentally-responsible behaviours within communities.

In this study, there were limitations in terms of the respondent population, in that they were drawn from two provinces in the north of Thailand. Given this limitation, it may or may not be representative of the population of Thailand as a whole. In addition, there were

budgetary limitations as the researcher bore all the costs. There are limitations concerning time constraints as this study was completed in a matter of months.

Given the limitations of this study, it is recommended that further research be conducted on this topic in different parts of Thailand.

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