Classifying consumer zero-waste behaviours in South Africa: applying the 5R framework through discriminant analysis

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Abstract

Purpose - The purpose of this study is to identify zero-waste activities that drive zero-waste behaviour frequency among South African consumers, using the 5R (refuse, reduce, reuse, recycle and rot) framework and from a motivation-opportunity-ability (MOA) framework perspective.

Design/methodology/approach - A cross-sectional study was conducted among South African adults, using an online self-administered questionnaire distributed via a paid social media advertisement, which resulted in 486 respondents. Discriminant analysis was used to determine which zero-waste activities effectively distinguish consumers in relation to how often they engage in zero-waste behaviours as a whole.

Findings - Three components of the 5R framework were classifiers of zero-waste behaviour, namely, reduce, reuse and recycle. The findings of this study indicate a significant difference between the groups, based on 5 (of the 30) zero-waste activities in the 5R framework, which included avoiding using paper unnecessarily, separating recycling into different containers, using reusable products rather than disposable ones, repurposing items for alternative uses and buying smart (e.g. reusable, refillable and rechargeable products).

Originality/value - This study mainly contributes to understanding zero-waste behaviours among consumers from a 5R perspective. The findings also contribute to Sustainable Development Goal 12 (Responsible production and consumption) by focusing on the implementation of zero-waste practices. By applying the MOA framework, this study provides targeted strategies to guide policymakers, businesses, and marketing practitioners on the appropriate zero-waste activities to focus on to achieve maximum impact. This study also offers practical ideas for promoting zero-waste behaviours, ultimately creating positive brand perceptions and tapping into the growing demand for sustainable product alternatives.

Keywords: Zero waste, Waste management, Sustainability, Sustainable development goals, 5R framework, MOA framework

Introduction

Growing concern over consumerism and its associated environmental impact has prompted increasing calls for more sustainable consumption (De Wilde and Parry, 2022) and has led to the emergence of the zero-waste concept (Bogusz *et al.*, 2023). From a consumption perspective, "zero waste" refers to the practice of minimising waste by making thoughtful consumption and waste-disposal decisions (Zaman, 2022), such as refusing unnecessary products, reducing consumption wherever possible, reusing products as many times as possible, recycling and composting (Johnson, 2013).

The zero-waste concept helps to move the global economy from linear to circular practices (Meshram, 2024) and directly addresses Goal 12 (Responsible consumption and production)

of the United Nations' Sustainable Development Goals (SDGs) (United Nations, 2023a). There is an increasing call for marketers to work toward the SDGs and for marketing scholars to incorporate the SDGs into their research (Nangia *et al.*, 2024). Marketing researchers have a responsibility – and the skills – to contribute to sustainable development and the SDGs, with SDG 12 being particularly well-suited to consumer research (Mende *et al.*, 2024). One appropriate strategy for achieving such sustainability goals is zero waste (Henriques *et al.*, 2023). While implementing zero-waste practices primarily contributes to SDG 12, it could help to address as many as 10 SDGs and to attain 20 targets (Henriques *et al.*, 2023).

Besides the environmental benefits, zero waste promotes new business and economic opportunities (Zaman, 2022) and holds societal benefits, such as improving community relations and social equity. Furthermore, zero waste reduces consumers' reliance on municipal landfills, thus reducing waste management costs for local municipalities and governments (World Economic Forum, 2022).

The concept of zero waste is relatively new (Abumalloh *et al.*, 2024) and still poorly understood from a consumption perspective. While many previous studies have addressed zero waste at industry, municipal, and community levels (Zaman, 2022; Sang *et al.*, 2022), few have investigated zero waste from a consumer perspective (Sang *et al.*, 2022). Furthermore, many studies largely disagree on what constitutes zero-waste behaviours. Some researchers argue that the zero-waste concept comprises three components, or "3Rs" (reduce, reuse, and recycle) (Sang *et al.*, 2022; Martins Felix *et al.*, 2024; Kolli and Goala, 2023). Other academics take a 4R (refuse, reduce, reuse, and recycle) (Abumalloh *et al.*) or 5R (rethink, refuse, reduce, reuse and recycle) (Meshram, 2024) approach to investigating zero waste.

Embracing the zero-waste concept also holds many practical benefits. Sustainable product sales are growing significantly more than those of products that are not environmentally friendly (Am *et al.*, 2023). Consumers are also increasingly willing to pay more for sustainable products (Durand-Hayes *et al.*, 2024). Thus, brands embracing sustainability may outperform competitors that do not (Reichheld *et al.*, 2023). For organisations, having sustainability as part of their key strategy is essential to securing investor funding and meeting changing regulatory requirements (World Economic Forum, 2022).

This study broadens knowledge of consumers' zero-waste behaviours. Previous studies have investigated the drivers of the adoption of zero-waste products (Abumalloh *et al.*, 2024; Huda *et al.*, 2023; Prakash *et al.*, 2024), zero-waste practices and behaviours (Kolli and Goala, 2023; Mustafa *et al.*, 2023) and zero-waste lifestyles (Sajid *et al.*, 2023). Specifically, factors such as attitude, subjective norms (Botha and Wiese, 2024), perceived behavioural control, awareness of consequences (Sajid *et al.*, 2023) and self-identity (Mustafa *et al.*, 2023) have been investigated as predictors of zero-waste behaviours.

Researchers have also investigated how consumer groups differ in their reuse (Bigliardi *et al.*, 2022; Naini *et al.*, 2024), recycling (Nguyen, 2023) and rot (composting) behaviours (Rastegari Kopaei *et al.*, 2021). To date, however, no studies have applied a discriminant analysis to determine which zero-waste activities effectively distinguish consumers with respect to how often they engage in zero-waste behaviours as a whole. Conducting such a discriminant analysis would enable policymakers, businesses and marketing practitioners to predict whether an individual is likely to belong to the low or high zero-waste engagement group, based on their zero-waste activities. The findings would allow more effective communication and targeting of these groups (Mustafa *et al.*, 2023; Ekmekçioğlu and Ekmekçioğlu, 2024).

Furthermore, while Johnson's (2013) 5R framework has been used to investigate consumers' waste-reduction efforts (Ekmekçioğlu and Ekmekçioğlu, 2024) and zero-waste intentions (Botha and Wiese, 2024), no studies have used thisframework when investigating group differences based on zero-waste behaviour frequency.

In addition to the above, this study views zero-waste behaviours and the 5R framework through the lens of the motivation-opportunity-ability (MOA) framework (Rothschild, 1999). By viewing zero-waste behaviours through a behavioural lens, a deeper understanding can be gained of why certain zero-waste activities distinguish low from high-engagement groups, allowing more targeted zero-waste strategies for each group. By identifying which of the MOA elements may be weakest for a particular group, custom strategies can address these potential weaknesses, leading to effective encouragement of zero-waste behaviours. The MOA has been applied to the sustainable behaviour context less frequently than other behavioural theories (Davis *et al.*, 2015), despite this framework offering potentially valuable insights into what determines individuals' engagement in sustainable behaviours such as zero-waste behaviours.

It is evident that the zero-waste concept offers many environmental, economic and social benefits, but there are significant gaps in our knowledge of zero waste and how to promote it. To address this, this study aimed to expand knowledge of consumers' zero-waste behaviours by examining what determines zero-waste behaviour frequency among South African consumers. For this purpose, three research objectives were set: to identify which zero-waste activities distinguish those consumers who exhibit a low versus high frequency of zero-waste behaviour; to identify the relative importance of the relevant zero-waste activities for the respective groups; and to profile the zero-waste groups according to their demographic and socio-economic characteristics.

The remainder of this article is structured as follows. First, the relevant literature is discussed. Next, the methodology is outlined, and the results are presented. Finally, the implications of this study's results, this study's limitations and avenues for future research are discussed.

Literature review

Zero-waste activities

Zero waste is defined as the "conservation of all resources by means of responsible production, consumption, reuse, and recovery of products, packaging and materials without burning and with no discharges to land, water, or air that threaten the environment or human health" (Zero Waste International Alliance, 2018). Zero-waste living encompasses five key sets of behaviours that guide consumers in their everyday consumption and waste management behaviours (Johnson, 2013; De Wilde and Parry, 2022). These five key sets, which Johnson (2013) called the "5Rs", contribute to the overarching zero-waste goal by involving activities to "refuse what you do not need, reduce what you do need, reuse what you consume, recycle what you cannot refuse, reduce, or reuse; and rot (compost) the rest". Each of these five sets of behaviours (5Rs) consists of several individual activities, hereafter referred to as zero-waste activities.

Refuse refers to saying "no thank you" to things one does not need (Bogusz *et al.*, 2021). This includes refusing single-use plastics (e.g., disposable plastic bags and bottles), junk mail and other printed documents (e.g., newsletters and receipts) and free items and giveaways (e.g., hotel room toiletries and party favours) (Johnson, 2013; Vinkóczi *et al.*, 2023).

Reduce involves minimising consumption wherever possible (Johnson, 2013). These activities include reducing the number of things one buys, donating or selling unused items, reducing energy consumption, buying in bulk to use less packaging, reusing food waste, reducing car usage by biking or using public transport, printing less and engaging in fewer activities that prompt consumption such as watching TV and doing window shopping (Bogusz *et al.*, 2021; Johnson, 2013; Vinkóczi *et al.*, 2023).

Reuse refers to using what one has as many times as possible (Johnson, 2013). Reuse activities include reusing wrapping paper and boxes, using old glass jars to store food, fixing torn clothes, using reusable or refillable products as opposed to single-use ones, sharing (e.g. borrowing or loaning), buying second-hand (e.g. thrift stores and garage sales), buying smart (e.g. reusable, refillable, rechargeable and durable product alternatives) and extending products' lives by repairing them (Johnson, 2013; Vinkóczi *et al.*, 2023).

Recycle involves the collection, separation and processing of recyclable waste (T'ing *et al.*, 2020). Recycling activities include knowledge about the recyclability of different products and materials, having a recycling location in one's home, using separate containers for recyclable materials, recycling hazardous waste (e.g. batteries) and returning recyclable bottles to reverse vending machines (Johnson, 2013; Vinkóczi *et al.*, 2023).

Finally, *rot* (composting) encompasses composting organic waste such as kitchen scraps and garden refuse (Bogusz *et al.*, 2021). This includes being familiar with the importance and the benefits of composting and using compost to help care for your garden (Vinkóczi *et al.*, 2023).

While this study views zero-waste behaviours from a 5R perspective, it is worth noting that several zero-waste frameworks have been applied in different contexts. A 3R (reduce, reuse and recycle) framework has, for example, been used to investigate zero-waste municipalities (Alyka and Andari, 2025), construction industries (Liyanage *et al.*, 2022) and households (Dong, 2025). A 4R (reduce, reuse, recycle and recover) framework has been applied to investigate zero waste in higher education institutions (Rodríguez-Guerreiro *et al.*, 2024), and a 7R (rethink, refuse, reduce, reuse, repurpose, recycle and rot) framework has been applied to investigate zero waste at household level (Vinkóczi *et al.*, 2023). When it comes to the 5R framework, there are also discrepancies in what these Rs represent. For example, some studies view the 5Rs as encompassing reduce, reuse, repair, recycle and reject initiatives (Dong, 2025; Wijaya *et al.*, 2024), while others view the 5Rs as consisting of rethink, refuse, reduce, reuse and recycle initiatives (Meshram, 2024). This study uses Johnson's (2013) 5R framework, which encompasses refuse, reduce, reuse, recycle and rot (composting) initiatives. Because the framework's roots are in popular culture, limited studies have viewed zero waste from this perspective. However, given Bea Johnson's (2013) status as a leader in the zero-waste lifestyle movement and the applicability of the 5R framework to individuals (as opposed to municipalities, industries or institutions), this framework was considered a valuable lens through which to investigate consumers' zero-waste behaviours.

Zero-waste behaviours

"Zero waste behaviours" refer to behaviours aimed at limiting environmentally harmful consumption, minimising waste during the consumption process and managing post-consumption waste responsibly (Zaman, 2022; Martins Felix *et al.*, 2024) by engaging in zero-waste activities such as refusing, reducing, reusing, recycling and composting (Johnson, 2013). Different consumer segments engage in different sustainable behaviours, such as zero-waste

behaviours (Adam *et al.*, 2021; Bassi, 2023; Jaiswal *et al.*, 2021). In many instances, consumer groups can be distinguished by the specific sustainable behaviours they engage in (Bigliardi *et al.*, 2022; Naini *et al.*, 2024; Nguyen, 2023). Given that zero-waste behaviours are a subset of sustainable behaviour (Săplăcan and Márton, 2019), different consumer groups may also engage in different zero-waste behaviours and activities and to varying extents and frequency. Studies have also shown that consumer groups can be distinguished with respect to zero-waste behaviours such as reuse (Bigliardi *et al.*, 2022; Naini *et al.*, 2024), recycle (Nguyen, 2023) and rot behaviours (Rastegari Kopaei *et al.*, 2021). The same might be true for zero-waste activities and behaviours as a whole (the 5Rs), which are therefore the focus of this study.

Identifying the specific zero-waste activities that distinguish low from high engagement in zero-waste behaviours could help policymakers, businesses and marketing practitioners predict the zero-waste categories consumers belong to, allowing more effective communication and targeting of these groups (Ekmekçioğlu and Ekmekçioğlu, 2024; Mustafa *et al.*, 2023). This study's main objective is thus to identify the zero-waste activities that drive overall zero-waste behaviour. To address this main research objective, three secondary research objectives are set: to identify which zero-waste activities distinguish consumers who exhibit a low versus a high frequency of zero-waste behaviour; to identify the relative importance of the relevant zero-waste activities for the respective groups; and to profile the groups in respect of basic and socio-economic demographics.

Zero-waste behaviours through a behavioural lens

Zero-waste engagement is a multidimensional concept influenced by individual decision-making (Zaman, 2022) as well as deeper motivational, cultural and habitual elements (Sajid *et al.*, 2023; Ekmekçioğlu and Ekmekçioğlu, 2024). Most often, sustainable consumer behaviours are explained by theories such as the theory of planned behaviour (Ajzen, 1991), norm-activation model (Schwartz, 1977) and value-belief-norm theory (Stern *et al.*, 1999). Scholars have, thus, proposed an improved understanding by expanding the theoretical models used to explain individual sustainable behaviours (Concari *et al.*, 2020).

Theories such as the nudge theory (Thaler and Sunstein, 2009), self-determination theory (Deci and Ryan, 1985) and the diffusion of innovation theory (Rogers, 1962) have been widely used to explain various sustainable behaviours. The nudge theory (Thaler and Sunstein, 2009), for example, states that an individual's choices can be influenced by subtle changes in how alternatives are presented. The theory has been used to better understand how to foster sustainable cities (Radchenko, 2023) and encourage sustainable choices in the workplace (De Paolis *et al.*, 2025). Conversely, self-determination theory (Deci and Ryan, 1985) posits that an individual's motivation to engage in a behaviour is strongest when the psychological needs for autonomy, competence and relatedness are satisfied. This theory has been applied in various tourism-related contexts (Dodds *et al.*, 2022; Patwary, 2024) and to help understand sustainable behaviours in general (Wang *et al.*, 2021; Saini *et al.*, 2025). The diffusion of innovation theory, which explains how new ideas, technologies or behaviours spread within a social system over time, has been used to understand the adoption of sustainable transportation (Ahn and Park, 2022; Bokolo, 2023).

Frameworks such as the capability-opportunity-motivation-behaviour model (Michie *et al.*, 2011) and the motivation-opportunity-ability (MOA) framework (Rothschild, 1999) have been applied to the sustainable behaviour context less frequently (Davis *et al.*, 2015), despite offering potentially valuable insights into what determines individuals' sustainable behaviours,

such as zero-waste behaviours. The capability-opportunity-motivation-behaviour model posits that a behaviour results from an individual's capability, opportunity, and motivation, and that interventions to promote behaviours should be centred around the weakest of these elements. This model has been successfully applied to sustainable behaviours (Mezzacapo *et al.*, 2025; Chad, 2023). Similarly, the MOA framework states that a behaviour will occur if an individual has the motivation, opportunity and ability to do so. This framework has been used to help understand various sustainable behaviours such as green energy consumption (Charters *et al.*, 2023), food waste behaviours (Shan *et al.*, 2024), precycling behaviours (Lundberg *et al.*, 2024) and sustainable product purchasing (Yener *et al.*, 2023; Baek and Lee, 2025). Given that zero-waste behaviours include using sustainable energy sources, reducing food waste, recycling and using sustainable products (Johnson, 2013), the MOA framework is an appropriate framework to study zero-waste behaviours.

The MOA framework

The MOA framework was originally introduced by MacInnis and Jaworski (1989) in the context of advertising and later adapted to social issue behaviours (Rothschild, 1999). According to the MOA framework, for socially desirable behaviours such as zero-waste behaviours to take place, individuals need the necessary motivation, opportunity, and the ability or skills.

Motivation refers to an individual's internal drive to act and is often based on an individual's self-interest (Parkinson *et al.*, 2016). An individual will, for example, not engage in zero-waste behaviours if it does not benefit them in some way, such as financial savings or convenience. Opportunities refer to the external circumstances that enable or impede partaking in a behaviour (May and Previte, 2016). The absence of recycling facilities, for example, will prevent individuals from acting on their motivation and knowledge related to recycling. Ability refers to the skills or resources an individual needs to perform a behaviour (Rothschild, 1999). For example, individuals need to know how to separate their recycling, which products are reusable, and where to find their nearest stockists of sustainable products. According to Rothschild (1999), all three of these elements must be present for a behaviour to occur. If one or more elements are lacking, education, marketing or legal enforcement may be able to encourage that behaviour. A visual representation of this study's design is shown in Figure 1.

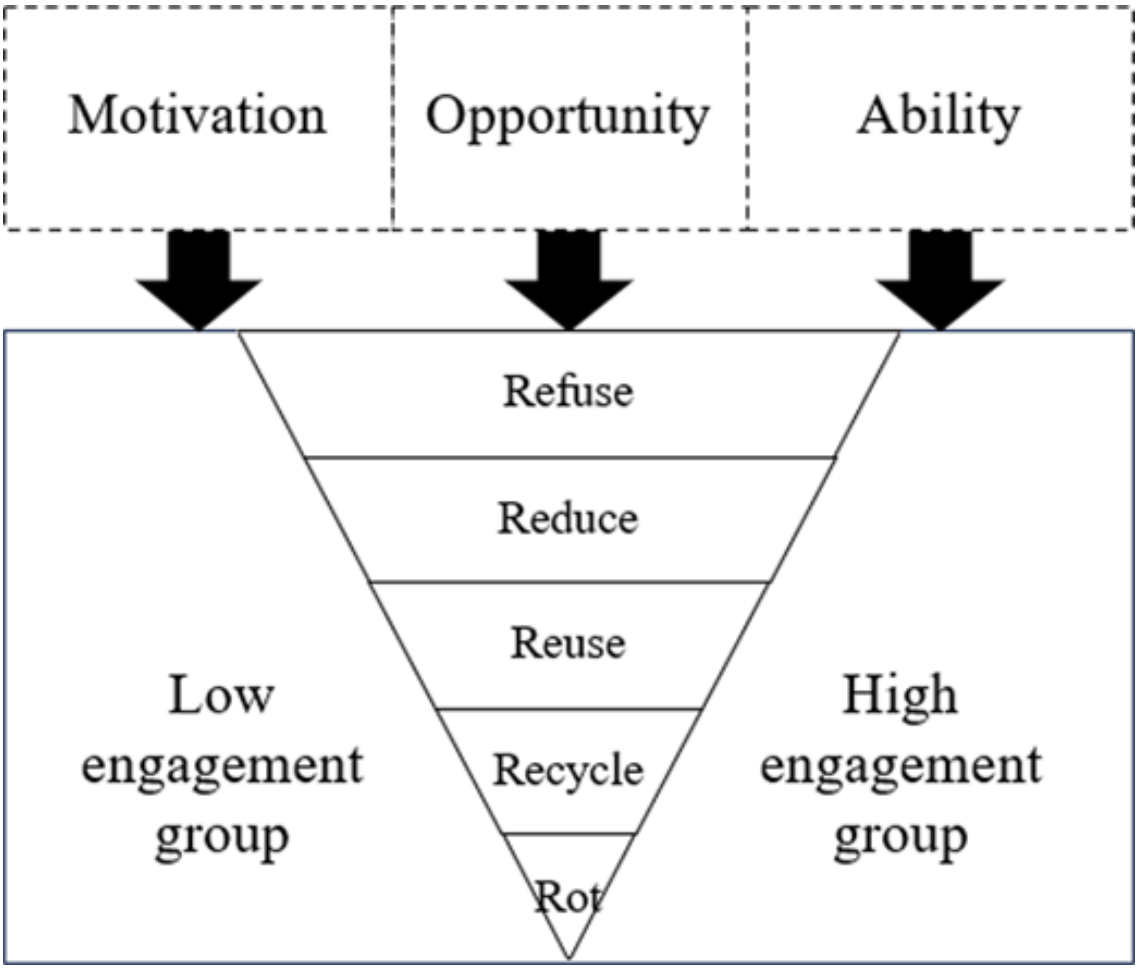

Figure 1. Research design

Source: Authors' own work

Methodology

A survey design was used to gather data, and discriminant analysis was conducted to predict group membership based on respondents' overall frequency of zero-waste behaviour. Discriminant analysis has the benefit of distinguishing between consumers by examining the combined effects of multiple predictors (Tabachnick and Fidell, 2019), capturing the complexity of all the zero-waste engagements in the 5R framework. The approach also allows for socio-demographic profiling of the groups (Tabachnick and Fidell, 2019).

Sample, measurement and data collection

The target population for this study consisted of South African adults. This study used a non-probability convenience sampling method, recruiting respondents from social media platforms based on their accessibility and willingness to participate. This sampling method is commonly used in research where timely access to participants is required and where random sampling is

not feasible (Etikan *et al.*, 2015). The ethics committee of the academic institution granted ethical clearance for the study (protocol number EMS086/22). A link to the pre-tested, self-administered questionnaire was created on the Qualtrics platform and made available on social media platforms such as Facebook, LinkedIn, Instagram and WhatsApp, resulting in 486 usable responses.

The sample consisted of a majority of females (66%), and most respondents were aged from 18 to 34 years (64.4%). A total of 38.1% were in the low to very low-income bracket, 25.1% were in the low emerging middle class, 22.2% in the emerging middle class and 14.7% in the middle class and higher. A third of the respondents had completed secondary schooling, and 60.5% had a tertiary qualification.

The measurement instrument (Appendix Table A1) included 30 questions (independent variables) adapted from Johnson (2013) representing the five components (5Rs) of zero-waste behaviour, namely, refuse (four items), reduce (nine items), reuse (nine items), recycle (four items) and rot (four items). For the dependent variable, respondents were given a description of zero-waste behaviours and asked how often they engaged in them. All items were measured on a five-point Likert-type scale ranging from "never" (1) to "always" (5). The questionnaire also included socio-demographic questions such as gender, age, education and income.

Results

Discriminant analysis

A stepwise discriminant analysis considered 30 contributing zero-waste activities to establish the relationship between these activities with respect to their relative importance and the frequency of overall zero-waste behaviour. The procedure was applied to determine the value of the variables for classification and predictive purposes, as well as the discriminating value of each of the 30 zero-waste activities.

First, two mutually exclusive groups were created for the frequency of zero-waste behaviour. Group 1 denoted consumers who indicated their zero-waste behaviour as never (1), rarely (2) or sometimes (3) on the Likert-type item, representing the low frequency of zero-waste behaviour group. Group 2 comprised consumers who indicated that they often (4) or always (5) participate in zero-waste behaviour, representing the high frequency of zero-waste behaviour group.

Next, the effectiveness of the discriminant function was assessed using eigenvalues and the canonical correlation (Tabachnick and Fidell, 2019), using SPSS version 29. The eigenvalue essentially reflects how strongly the 30 zero-waste activities separate the groups. The eigenvalue associated with the discriminant function was 0.306, and while this value is modest, it indicates that the function carries meaningful discriminatory power. The canonical correlation of 0.484 explained approximately 23% of the variance in group membership. Even though the variance only accounted for some of the explanatory power, the significant Wilks' Lambda result confirmed that the function differentiated the groups at a statistically meaningful level (Hair *et al.*, 2019; Tabachnick and Fidell, 2019).

Third, the significance of the discriminant function was assessed. The test of the null hypothesis is based on an F transformation of Wilks' lambda, which identifies a statistically significant discriminant function at the 0.000 level. The Wilks' lambda associated with the discriminant

function was 0.766, $\chi^2(5) = 128.62$ and $p < 0.001$, indicating that the predictors reliably distinguish between the two groups at a significance level exceeding 0.05 (p-value < 0.001).

Table 1. Stepwise discriminant structure coefficients

Zero-waste engagement behaviour	Wilks' Lambda	F	df1	df2	p-value	Structure coefficient (r)
I buy smart (e.g. items that are reusable, refillable, rechargeable, versatile, durable, etc.)	0.880	66.21	1	484	<0.001	0.668
I separate my recycling into different containers	0.822	52.42	2	483	<0.001	0.666
I use reusable products as opposed to disposable ones (e.g. reusable coffee cups, bottles, straws, cloth shopping bags, etc.)	0.796	41.16	3	482	<0.001	0.644
I repurpose items (e.g. reuse single-sided printed papers, use worn-out towels as cleaning rags, etc.)	0.778	34.25	4	481	<0.001	0.612
I avoid using paper unnecessarily	0.766	29.40	5	480	<0.001	0.562

Source(s): Authors' own work

Fourth, it was determined which of the 30 zero-waste activities significantly differentiated between the two groups. Of the 30 activities, 5 met the significance criteria for inclusion and retention in the stepwise discriminant-function analysis (F-to-enter > 3.84 and $p < 0.05$). These activities are outlined in Table 1 and show that the zero-waste activities relate to three of the 5R elements, namely, recycling, reducing and reusing. None of the activities relating to refuse and rot behaviours met the criteria for inclusion in the discriminant function. The findings indicate that buying items that are reusable, refillable, rechargeable, versatile and/or durable (0.668) are the most powerful discriminator among the five activities under consideration. An inspection of the mean discriminant scores (centroids) for each group reveals acceptable discrimination, as the mean values vary considerably between negative (−0.504) and positive (0.605) scores for Groups 1 and 2, respectively. Thus, lower discriminant scores were associated with a low frequency of zero-waste behaviour (Group 1) and higher scores with a high frequency of zero-waste behaviour (Group 2).

Fifth, the percentage share of cases that would be classified correctly, based on the discrimination functions, was assessed. As shown in Table 2, consumers who reported higher zero-waste behaviours were classified with better accuracy (76.9%) than those who reported lower zero-waste behaviours (69.4%).

Table 2. Classification matrix for two-group prediction for zero-waste behaviours

Actual group	Low zero-waste behaviour predicted group (%)	High zero-waste behaviour predicted group (%)
Group 1: Low zero-waste behaviour	69.4	30.6
Group 2: High zero-waste behaviour	23.1	76.9
Percentage of original grouped cases that were correctly classified	72.8%	

Source(s): Authors' own work

Finally, to give confidence, it was determined whether the classification accuracy achieved by the discriminant analysis was greater than that obtained by chance (about 25% greater) (Huberty and Olejnik, 2006). Calculations were then made to determine whether the model in Table 2 had satisfactory predictive power. To evaluate the validity of the framework, the proportional-chance criterion was calculated. The criterion took a value of 50.4% $[(265 / 486)^2 + (221 / 486)^2]$, while 72.8% of the cases were correctly classified with this function. This meant that the overall classification accuracy was higher than the proportional-chance criterion value (72.8% > 50.4%). The chance criterion was then used to evaluate whether the present function achieved a 25% margin. The percentage of cases correctly classified in the present model was higher than the chance criterion [72.8% < 63% (50.4 × 1.25)], indicating that the results are practically meaningful.

Table 3. Basic and socio-economic demographics for the two-group prediction for zero-waste behaviours

Basic and socio-economic demographics	% in low zero-waste behaviour predicted group	% in high zero-waste behaviour predicted group
Age		
18–24 years	26.8	17.9
25–34 years	42.6	41.8
35–44 years	18.7	18.3
45+ years	11.9	21.9
Gender		
Male	35.0	31.9
Female	65.0	68.1
Income in South African rand (R)		
R0–R2,000	19.6	15.1
R2,001–R9,000	16.6	24.7
R9,001–R20,000	22.6	27.5
R20,001–R41,000	23.4	21.1
R41,001–R83,000	11.5	7.6
R83,001–R157,000	3.0	2.8
More than R157,000	3.4	1.2
Education		
Secondary school completed or less	35.9	38.6
Tertiary qualification completed	64.1	61.4

Source(s): Authors' own work

Zero-waste group profiles

To address the third research objective, the low and high zero-waste behaviour groups were profiled in relation to their gender, age, education and income. The cross-tabulations for the basic and socio-economic demographics are presented in Table 3.

From Table 3, it can be seen that the gender split between the low versus high zero-waste engagement groups closely followed the overall sample distribution. When considering the gender distribution in the respective gender groups, the results showed slightly more males in the low zero-waste behaviour group (50.9% versus 47.4%) and slightly more females in the high zero-waste behaviour group (52.6% versus 49.1%). Proportionally more females engage in zero-waste activities than males, but the difference is not statistically significant, as shown by the chi-square test for independence (with Yates continuity correction): χ^2 (1, n = 482) = 0.416, p = 0.519 and phi = 0.03. This suggests that gender is not a predictor of zero-waste engagement.

Next, the sample was divided into four age groups: 18–24 years (22.2%); 25–34 years (42.2%); 35–44 years (18.5%); and 45 years and above (17.1%). Table 3 shows that those aged 25–34 years were the most represented group in both the low and high zero-waste behaviour groups. The chi-square test for independence showed a significant association between age and zero-waste engagement: χ^2 (3, n = 486) = 11.43 and p = 0.01. The Cramer's V value of 0.15 indicated a small effect (Cohen's, 1988), suggesting that there is little practical association between age and zero-waste behaviour. Nevertheless, the presence of a significant directional trend, as indicated by the linear-by-linear association test (standardised statistic = 3.138 and p = 0.002), suggested that zero-waste engagement behaviour is not random but changes progressively across age groups.

From an educational level perspective, 62.7% of the sample had completed tertiary schooling, while 37.3% had completed high school or less, showing that the sample was skewed toward a more educated population (Table 3). Among those with tertiary qualifications, 48.6% were in the low-engagement group, while 51.4% were in the high-engagement group, indicating a prevalence in both groups. The chi-square difference test (with Yates continuity correction) showed no statistically significant relationship between educational level and zero-waste behaviour: χ^2 (1, n = 469) = 0.268, p = 0.605 and phi = −0.02.

Finally, of the seven income groups in the overall sample, the largest segments were those ranging from R9,001 to R20,000 (25.1%) and from R20,001 to R40,000 (22.2%); this meant that most of the participants belonged to middle-income groups. The middle-income individuals seemed to be the most engaged, but this applied to both the low and high zero-waste behaviour groups. Table 3 shows that the high zero-waste engagement group's income, expressed in South African Rand (R), had a slightly higher representation at income levels ranging from R^2,001 to R40,000. The chi-square test for independence indicated no significant association between income and the zero-waste groups: χ^2 (6, n = 486) = 11.28, p = 0.08 and Cramer's V = 0.15. This suggests that zero-waste behaviour is not influenced by financial status.

Discussion and implications

This study aimed to identify which zero-waste activities determined respondents' overall engagement in zero-waste behaviours according to the 5R framework and to identify the

relative importance of each zero-waste activity. For this purpose, a discriminant analysis was conducted to divide the study's sample into two distinct groups: those who exhibited a low frequency of zero-waste behaviour and those who exhibited a high frequency of zero-waste behaviour. Thereafter, the respective zero-waste behaviour groups were profiled according to basic and socio-economic demographic characteristics. While the findings provide useful insights, they should not be generalised beyond the sampled South African consumers because of the absence of representative data for this population.

The results revealed that two components of the 5R framework, namely, *refuse* and *rot*, had the lowest adoption within the sample and were, thus, not identified as classifiers of zero-waste behaviour. This is in line with previous studies that reported that not all attitudes toward zero-waste behaviours (such as refuse and rot) translate into actual behaviour (Kunszabó *et al.*, 2022; Peyer *et al.*, 2017). This suggests that significant efforts are needed to shift cultural norms regarding certain zero-waste activities, such as refusing items such as shopping bags, gift bags, printed materials or promotional items. Also, knowledge on composting kitchen and garden waste or strategies on how to establish compost infrastructure could help to encourage rot behaviours.

The findings indicated that three components in the 5R framework are classifiers of zero-waste behaviour, namely, *reduce*, *reuse* and *recycle*, which align with a study by Săplăcan and Márton (2019). Based on the zero-waste activities representing these components, there were significant differences between the groups in five of these them. Specifically, those individuals who engaged in a high frequency of zero-waste behaviours were significantly more likely to avoid using paper unnecessarily (reduce), separate recycling into different containers (recycle), use reusable products as opposed to disposable ones (reuse), repurpose items for alternative uses (reuse) and buy smart such as reusable, refillable and rechargeable products (reuse). These results imply that the five activities that were most important should be included in marketing communication strategies to encourage consumers' participation in overall zero-waste behaviours. Several marketing opportunities arise when considering each zero-waste activity revealed by the research, and the implications thereof, as well as the application to the MOA framework, are discussed below.

Strategies to stimulate "reuse" behaviours

The most powerful zero-waste activity discriminator was individuals' purchase of smart (e.g. reusable, refillable and rechargeable) product alternatives, which could be classified as part of the *reuse* component in the 5R framework. The remaining two *reuse* zero-waste activities that distinguished those with low versus high frequency of zero-waste behaviours were individuals' use of reusable as opposed to disposable products and their repurposing of items.

From the perspective of the MOA framework, reusable products offer long-term financial and environmental benefits (Rizan and Bhutta, 2022) and have become increasingly available (Kunamaneni *et al.*, 2019), giving consumers the *motivation* and *opportunity* to purchase such products. Finding three of the five discriminating activities in this study in the *reuse* category is, thus, not surprising. To further strengthen these *reuse* behaviours, marketers should provide further *motivation*, *opportunity* and *ability* for consumers.

For high zero-waste engagers, marketers could *motivate* zero-waste engagement by offering incentives such as lifetime guarantees for smart (i.e., reusable and refillable) products. Social media campaigns can showcase stories of consumers who have reduced waste through smart

product alternatives and repurposing, showing consumers they have the *ability* to do the same. Consumers can be give*n opportunities* when businesses and brands offer reusable and refillable alternatives in stores or via online platforms and through education on these alternatives.

For low-engagement consumers, marketers could improve individuals' *motivation* and *ability* to engage in zero-waste behaviours via educational campaigns that highlight the financial benefits of transitioning to zero waste. These campaigns could use data visualisation to demonstrate the concrete steps needed to, for example, reduce food waste (Abos *et al.*, 2024). Consumers can be give*n opportunities* to reuse, such as stocking reusable and refillable product alternatives, offering refill stations in stores or incentivising the purchase of refill packs via discounts or loyalty programmes. Some examples include Stanley, which offers durable flasks and reusable travel mugs; The Body Shop, which offers haircare and handwash refill services; and Food Lover's Market, which offers a spice bar where customers can refill their spices and herbs. Conventional product brands that may not offer reusable, refillable or even recyclable product alternatives could emphasise that their packaging or containers can be repurposed, *motivating* consumers to switch to these alternatives. For example, brands such as KOO and All Gold often package their products in glass jars, which could be repurposed as storage containers or flower pots.

All three *reuse*-discriminating behaviours offer significant financial benefits to consumers (Rizan and Bhutta, 2022; Johnson, 2013). Therefore, from the perspective of the MOA framework, financial *motivation* may be the primary driver, while a lack of *opportunities* to purchase reusable products and the *inability* to use them may be the primary barriers. Of the above-mentioned strategies, marketers should primarily focus on making smart, reusable products more widely available and educating consumers about their usefulness and ease of use.

Strategies to stimulate "recycle" behaviours

The second most influential zero-waste activity that distinguished consumers with low versus high frequency of zero-waste behaviour was separating recycling into different containers. Studies have shown that recycling into different containers is a familiar, economical and easy zero-waste activity (Izagirre-Olaizola *et al.*, 2015; Oke *et al.*, 2021; Wang *et al.*, 2023), which illustrates that consumers have *motivation* and *opportunity* to engage in recycling activities. From an MOA framework perspective, marketers should, thus, primarily focus on consumers' knowledge of recycling and separating recyclable materials to improve their *ability* to participate in recycling.

From the perspective of the MOA framework, high-engagement consumers' *ability* to participate in recycling could be improved by educating them on advanced waste recycling practices, such as converting organic waste into compost for gardening (Fisher, 2023). These high-engagement consumers may also be an ideal audience for eco-conscious brands. For example, offering clothing products made from recycled materials *motivates* consumers to make eco-friendly choices and gives them the *opportunity* to engage in zero-waste behaviour.

For low-engagement consumers, the focus should be on educating them on the importance and ease of sorting waste. Providing clear recycling instructions on product labels or products with easily separable materials (e.g., detachable plastic and paper components) offers consumers the *ability* to sort their waste. Consumers can be *motivated* to purchase recyclable products by offering recycling separation bins at a discount when bought with the organisation's recyclable

product (s). Offering take-back schemes that recycles products into the same material stream can give consumers the *opportunity* to recycle. Some examples include South African Breweries, which have launched campaigns to encourage consumers to return their empty bottles (The South African Breweries, 2023), Wasteplan which gives customers rebates on collected waste (Wasteplan, 2025), Levi's that places recycling boxes at certain outlets (Levi Strauss and Co, 2024) and Apple's device trade-in service (Apple Inc, 2025). Educating consumers on the difference between at-home and out-of-home recycling is key, and a multi-layered communication strategy that uses social media posts, video clips, testimonials and educational information, such as a waste-sorting game, may be effective in promoting recycling behaviours (Temmerman and Veeckman, 2024).

Strategies to stimulate "reduce" behaviours

The avoidance of unnecessary paper use is also a differentiator between low- and high-engagement groups, aligning with the findings from a study by Sopha (2013). This study found that individuals who are in the habit of reducing paper consumption continue to do so, but those who feel obliged to reduce paper consumption do not necessarily do so. This may well be the situation with the high- and low-engagement groups in this study, signalling the need for educational campaigns that increase awareness of paper use. From the perspective of the MOA framework, marketers should primarily provide *motivation* for consumers to participate in these *reduce* behaviours, as technological advancements such as document creation, signing, sharing and storage (Xiong, 2021) have already provided consumers with the necessary *opportunity* and *ability* in the form of digital document generation, signing and storage capabilities.

For consumers in the high-engagement group, marketers could develop and position products or services as contributing to paper conservation (e.g. reusable napkins), which would resonate with these consumers, *motivate* them to use less paper and simultaneously provide them with the *opportunity* to do so. Marketers could offer businesses and consumers paperless solutions that eliminate the need for printed documents, giving them the *ability* to go paperless. (Adobe, 2025) , for example, offers consumers the "fill and sign" functionality, allowing them to complete and sign forms digitally and eliminating the need to print contracts and agreements.

For consumers in the low-engagement group, campaigns could initiate small changes as the first step toward a zero-waste lifestyle, such as emailing cashier receipts rather than printing them or *motivating* consumers to access the digital menu in restaurants, giving them the *opportunity* and *ability* to use less paper. Some examples include brick-and-mortar South African retailers that offer customers digital receipts and account statements via email or SMS (Business Insider South Africa, 2020), and fast-food outlets that offer digital menu boards, reducing the printing of paper menus (Sherbina, 2025). Based on a study by Ong *et al.* (2023), positive reinforcement and regular reminders via social media postings may also be effective in supporting the reduction of paper waste. As paperless transactions and communication are enabled, consumers should become accustomed to paperless interactions with businesses, encouraging similar behavioural changes in other parts of their lives.

Age-appropriate segmentation strategies

The findings indicated that most socio-demographic factors were ineffective in promoting zero-waste behaviours, suggesting that marketing strategies should rather focus on behavioural drivers. Though the impact of gender was not significant in this study, the fact that more

females than males engage in zero-waste activities is in line with a study by Badowska and Delińska (2019). Similarly, no significant association was found with income, but the descriptives showed that middle-income consumers were more engaged, which somewhat aligns with the study by Kronthal-Sacco and Whelan (2019), who reported that middle to higher household incomes were more likely to buy sustainability-marketed products. Education levels did not play a role in zero-waste behaviours in this study, which is in contrast with the reports of Coskun (2022), which indicated that education level is an important factor in influencing waste management behaviour.

The findings indicated that age affected zero-waste engagement, presenting opportunities to develop age-appropriate marketing strategies. Specifically, the youngest group (18–24 years) exhibited lower zero-waste engagement. Given the youth's affinity for digital platforms and the need to educate young consumers about environmental sustainability (Moshood *et al.*, 2023), social media campaigns that educate the youth on zero-waste activities are appropriate. Marketers can, for example, use age-appropriate influencers to showcase how they practice zero-waste behaviours daily, showing viewers their ow*n ability* to do so and *motivating* them by way of peer influence. These influencers can further offer viewers the *opportunity* to participate by including links to online zero-waste stores, for example.

The findings of this study also highlight the need for zero-waste education among the youth. Project-based learning could be one way to activate zero-waste knowledge in teaching contexts (Mahsun *et al.*, 2024). Such projects can give students the opportunity to identify zero-waste solutions, such as conducting lifecycle analyses of products, redesigning packaging for low waste or designing service models that encourage reuse. As young people are very active on digital platforms, media literacy education can help them analyse marketing claims to distinguish between authentic versus superficial sustainable practices and to discuss trade-offs between convenience and sustainability (Habito *et al.*, 2018). It may also be worthwhile for educators to align zero-waste practices with values such as social belonging, as these are identity markers for young people. Ideally, interventions should lead to habit formation by embedding zero-waste activities in everyday contexts, such as university cafeterias or campus events, through visible waste-sorting systems or reusable container discounts. Youth-focused campaigns could centre around aspirational values, using influencers or peer models for messaging. Content could include memes, short videos, reward systems or zero-waste challenges. The 45+ age group was slightly more engaged in high zero-waste behaviour, signalling that marketers could promote high-quality sustainable products and tap into longevity messaging focused on environmental well-being.

Implications for policymakers

Policymakers could also draw from the MOA framework to promote zero-waste behaviours. First, by appealing to consumers' financial self-interest, they can be *motivated* to engage in *reuse* behaviours by taxing single-use products and making reusable, refillable and rechargeable products tax-deductible. For example, reusable coffee cups are widely available, yet most consumers still opt for disposable ones. By taxing disposable coffee cups, consumers would be encouraged to bring their own reusable cups, saving money, helping businesses cut costs, generating government income and benefiting the environment. Governmental agencies could also consider reusing e-waste. Remanufacturing used electronic products, such as laptops, could help create community spaces where they can be used or shared (Belbağ and Belbağ, 2025).

To improve recycling, policymakers could offer tax-deductible or subsidised recycling separation containers. The financial incentive and access to recycling containers will offer both *motivation* and *opportunity* for consumers to recycle. Furthermore, consumers could be given the *ability* to recycle by educating them about how to separate their recycling, and the financial and environmental benefits this behaviour would bring. Implementing recycling separation initiatives at public institutions, such as universities and schools, could also help to make the separation of recyclable materials the norm, improve consumers' recycling skills and, thus, *ability*, leading to increased recycling separation at home. Policymakers could also encourage the recycling of e-waste, such as mobile phones or laptops, by offering discounts on (for example) public transport (Belbağ and Belbağ, 2025), another *motivational* strategy.

The reduced paper usage implies that more consumers could be encouraged to engage in overall zero-waste behaviours by (for example) incentivising consumers to go paperless. This might be achieved by taxing paper products (e.g., copy paper) and businesses that use excessive amounts of paper in their operations (e.g., hospitals and banks). These monetary penalties and incentives would discourage the purchase of paper products and encourage institutions to implement innovative technological solutions to avoid unnecessary paper use, *motivating* consumers to reduce paper use by appealing to their financial self-interest. Furthermore, policymakers could launch educational awareness campaigns that showed consumers how to avoid paper use in their everyday lives. Influential South Africans could be approached to promote a "Go Paperless" campaign and to demonstrate practical ways consumers can limit their paper use and how it would benefit them. This would make going paperless relatable and showcase how easy and beneficial it would be, fostering a sense of *ability* among consumers. Governments could also incorporate going paperless into school syllabi, encouraging such behaviours from a young age and setting the habit of avoiding paper use early on.

Considering the diverse incomes of South Africans, collective systems initiatives may be needed to make zero-waste engagement more accessible to low-income groups. In rural or underfunded urban areas, solutions could be shared composting hubs, public water refill stations or mobile collection services for e-waste or compostables. Another initiative may be subsidised pricing for reusable goods. Providing the necessary infrastructure could give consumers the *opportunity* to partake in zero-waste initiatives. Social marketing, together with education, could be a way to influence behavioural change in communities (Parajuly *et al.*, 2020). In this regard, public campaigns could focus on community-driven solutions over individual consumer efforts.

Ultimately, zero-waste engagement, such as refusing disposables and repairing and reusing products, leads to improved quality of life as it reduces clutter and saves money (Everitt *et al.*, 2023) and leads to a cleaner environment because of less processed packaging, fewer toxins from plastics and less litter (Bagui and Arellano, 2021). This, in turn, contributes to environmental justice by reducing plastic pollution in poor communities and lowering e-waste burdens through refuse and reduce behaviours (Mihai *et al.*, 2022). Thus, as zero-waste behaviours improve, they build legitimacy for structural shifts in production and waste systems as they reduce the demand for single-use plastics and support circular business models and green entrepreneurship (Agovino *et al.*, 2024). Furthermore, by combining *motivational* strategies, such as offering financial incentives or penalties, providing consumers with the *ability* to participate in zero-waste behaviours by providing the necessary infrastructure and by educating consumers on how to participate in zero-waste behaviours, giving them the skills and *abilities* to do so, zero-waste behaviours can be successfully encouraged in accordance with the MOA framework.

Theoretical and sustainable contributions

First, theoretically, this study contributes to the understanding of zero-waste behaviours among consumers, specifically from the perspective of Johnson's (2013) 5R framework. Second, the concept of zero waste has mostly been discussed in relation to manufacturing and waste management by municipalities (Săplăcan and Márton, 2019), whereas this study contributes to zero-waste behaviours of consumers. Third, amidst the conflicting opinions on how many components zero-waste consists of (Sang *et al.*, 2022; Abumalloh *et al.*, 2024; Meshram, 2024), this study provides support for Johnson's (2013) 5R framework, even though there may be a lower adoption of the refuse and rot dimensions in the South African context. Fourth, this study's findings contribute practically to the SDGs, particularly to SDG 12 (Responsible production and consumption). The findings revealed which zero-waste activities have been readily adopted, providing direction for promotional campaigns on the areas to focus on for wider adoption or to make inroads into those activities with low adoption rates. Finally, the findings guide policymakers and businesses on effective consumer education for waste reduction and on aligning product design with consumer zero-waste expectations.

Limitations and suggestions for future research

Some of this study's limitations are worth noting, as they offer researchers avenues for future research. First, the findings cannot be generalised to the broader population, as non-probability convenience sampling was used. Second, this study investigated only a limited number of zero-waste activities. In behavioural research, multiple factors often underlie consumer actions, and although the discriminatory power in this study was adequate, we acknowledge that additional unmeasured factors likely contribute to group differences. Future studies could, therefore, expand their investigations to include a broader range of zero-waste activities, such as the recycling activities investigated by Nguyen (2023) and the reuse activities investigated by Bigliardi *et al.* (2022). Third, this study was conducted in South Africa, a country that lags in adopting sustainability practices (Hoosain *et al.*, 2023). South African consumers' engagement in zero-waste activities may thus not be as advanced as that of more sustainably developed countries such as many European Union member states, Japan, and South Korea (Hoosain *et al.*, 2023). A cross-country comparison of consumers' engagement in zero-waste activities could shed light on how South Africa could encourage zero-waste behaviours more effectively.

Considering this study's limitations, future research could incorporate qualitative methods, such as interviews or ethnographic studies, to enhance the depth and contextual relevance of the findings and offer insight into the motivations, barriers and cultural norms influencing individuals' zero-waste behaviours. This would be particularly beneficial for developing targeted, culturally sensitive social marketing strategies, especially in heterogeneous contexts like South Africa. Integrating qualitative inquiry in future research would complement the current findings with a more nuanced understanding and help to make zero-waste efforts more effective. Finally, this study used the MOA framework as a lens through which to interpret its findings and make actionable recommendations. To further improve the framework's explanatory power, future studies could empirically measure various motivations (e.g. perceived usefulness and trust), opportunities (e.g. perceived price and perceived barriers) and abilities (e.g. attitude and subjective norms) of respondents (Nguyen and Vo, 2023; Guenzi and Nijssen, 2020) and determine how, and to what degree, each of these relates to the five components of zero-waste behaviours.

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Appendix

Table A1. All the 5R scale items were adapted from Johnson (2013) and were measured on a five-point Likert-type scale ranging from “never” (1) to “always” (5)

(1) Refuse: It refers to saying “no thank you” to environmentally damaging items such as disposable plastic bags, plastic bottles, disposable cups and lids, straws, hotel freebies and printed receipts at shops.

- I avoid disposable plastic items (e.g. plastic carrier bags, bottles, straws, etc.).
- I avoid taking freebies from establishments (e.g. complimentary toiletries, party favours, food samples, etc.).
- I avoid taking gift bags from events (e.g. conferences, awards, festivals, etc.).
- I avoid accepting printed documents (e.g. printed receipts, invoices, flyers and business cards).

(2) *Reduce*: It refers to minimising your consumption where possible. This includes letting go of unnecessary items, reducing the packaging you consume, minimising your car usage, reducing your personal belongings and printing less.

- I try to consume less in general.
- I let go of unnecessary items (e.g. donate, sell items second-hand).
- I try to reduce the product packaging I consume (e.g. by buying in bulk, buying package-free, buying loose vegetables, etc.).
- I try to minimise using my car (e.g. by biking, using public transport, carpooling, etc.).
- I try to minimise my use of technology (e.g. electricity, electrical appliances, electronic devices, etc.)
- I avoid using paper unnecessarily.
- I avoid printing unnecessarily.
- I try to reduce my amount of personal belongings.
- I try to stay away from activities that lead to consumption (e.g. watching TV, reading magazines, leisure or "window" shopping, etc.)

(3) *Reuse*: It refers to using products multiple times to maximise their use and lifespan. It includes using reusable and refillable items, sharing with others, purchasing second-hand goods and buying products that are rechargeable, versatile and durable.

- I reuse items as many times as possible.
- I use reusable products as opposed to disposable ones (e.g. reusable coffee cups, bottles, straws, cloth shopping bags, etc.).
- I use refillable products as opposed to disposable ones. (e.g. refillable water bottles, soap, pens, printer ink, etc.).
- I share items with others to consume less (e.g. borrowing, loaning, trading, renting, etc.).
- I buy second-hand items (e.g. from thrift stores, garage sales, antique markets, on Facebook Marketplace, etc.).
- I buy smart (e.g. items that are reusable, refillable, rechargeable, versatile, durable, etc.).
- I repair products instead of replacing them.
- I repurpose items (e.g. reuse single-side printed papers, use worn out towels as cleaning rags, etc.).
- I use rechargeable batteries as opposed to disposable ones.

(4) *Recycle*: It refers to knowing what is recyclable, having knowledge on the recyclability of different materials, having a designated recycling location in your home and sorting recyclables into separate containers.

- I know what materials are recyclable.
- I have knowledge on the recyclability of different materials.
- I recycle my waste (e.g. plastic, paper, metal, glass, etc.).
- I separate my recycling in different containers.
- I have a designated recycling location in my home.

(5) *Rot*: It refers to composing your organic waste such as fruit and vegetable peels and garden waste.

- I have knowledge on what materials can be composted.
- I compost organic kitchen waste.
- I compost organic garden waste.
- I maintain my own compost heap at home.