



Modelling zero waste behavioural intent: The moderating role of perceived behavioural control and Socio-Demographic factors

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ABSTRACT

The global culture of consumerism is fuelling the climate crisis. An increase in household consumption and the waste it creates holds many negative implications for consumers, businesses, brands, and governments alike. Thus a shift towards zero waste (ZW) behaviours among consumers is essential. To address a lack of understanding of ZW behaviours among individuals, this study investigated the intention to engage in these behaviours through the lens of the original theory of planned behaviour (TPB), with perceived behavioural control (PBC) as moderator. A survey of 486 South Africans validated the original TPB's ability to successfully model ZW behavioural intent, and confirmed the role of perceived behavioural control as moderator as opposed to its popularly accepted role as predictor. Various socio-demographic variables also played a significant moderating role in the model. This study also contributes to seven of the 2030 sustainable development goals (SDGs) of the United Nations (UN), and adds to the emerging stream of transformative consumer research (TCR). Several practical strategies are also offered to assist marketing practitioners and governments in increasing ZW behaviours to create a better environmental, economic, and societal future.

1. Introduction

The world is facing a climate crisis (NASA, 2021; United States Environmental Protection Agency, 2021) that is being fuelled by a global culture of consumerism (Bothun, 2018). More than half of the world's greenhouse gas (GHG) emissions, the main contributor to climate change, is as a direct result of household consumption (Ivanova et al., 2016), and managing the waste that stems from this consumption causes further GHG emissions (Vergara & Tchobanoglous, 2012).

Besides the obvious environmental consequences, these issues also have societal and economic implications. Climate change has prompted more and more consumers to adopt sustainable behaviours (i.e. 'green' or environmentally friendly) (Peattie, 2010; Deloitte, 2021) such as the use of sustainable products (International Trade Centre and European Commission, 2019), especially in developing countries such as South Africa (Nielsen, 2015). Ignoring this growing call for sustainability (Deloitte, 2020) puts businesses and brands at risk in respect of their reputation, financial performance, regulatory compliance, and consumers switching to more sustainable competitors (Wilbury Stratton, 2012), among other things. These businesses and brands also miss out on the potential opportunities offered by sustainability, such as gaining a

competitive advantage (Wilbury Stratton, 2012) and increasing sales (Kronthal-Sacco & Whelan, 2019). The increase in household consumption and waste creation also impacts governments, as it requires the costly establishment of landfills (Statistics South Africa, 2018), which contribute significantly to CH₄ emissions and the climate crisis, and thus threaten the agriculture, forestry, and tourism industries of these governments. This is especially detrimental to developing countries such as South Africa that are economically dependent on these industries (Schroders, 2016).

Businesses, brands, and governments miss out on the economic benefits embedded in plastic waste, much of which is currently being sent to landfill (European Commission, 2012; Godfrey & Oelofse, 2017). While South Africa has a well-established recycling industry, and one of the best performing recycling rates globally (Plastics SA, 2020; Greencape, 2020), only 34.5% of the country's general waste was recycled in 2017 (DEA, 2018). This leaves ample room for improvement in the recycling sector, improvement which could help alleviate some of the many socio-economic challenges facing South Africa, such as a high unemployment rate, crime, and poverty (Sadan & De Kock, 2020). The country's informal recycling sector created approximately 60,000 job opportunities in 2019 (Plastics SA, 2020) and may create even more

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employment opportunities if a culture of recycling is fostered amongst South Africans.

To address environmental, social, and economic-related issues, such as those mentioned above, the United Nations (UN) proposed the 2030 Agenda for Sustainable Development, which set 17 sustainable development goals (SDGs) for UN partner countries to work towards (United Nations, 2023).

The SDGs drive the view that promoting economic growth should go hand in hand with fighting climate change (United Nations, 2023; Jones et al., 2018). Fighting climate change, tackling the increase in consumption-induced household waste, and addressing the above-mentioned and other environmental, societal, and economic threats and opportunities presented by these issues requires a major shift from the current 'take-make-waste' linear economic model to a regenerative circular economy (Ellen MacArthur Foundation, 2019; Mission Zero Academy, 2023). Making the abstract concept of a circular economy a reality requires, among other things, actual changes to the world's consumption practices (Kangas et al., 2019), and addressing the consumption behaviours of individuals and households is particularly important, as this accounts for more than half of the world's GHG emissions (Ivanova et al., 2016).

Consumers have the power to mitigate global warming by making better consumption decisions (Dubois et al., 2019); but how can consumers be motivated to make better consumption decisions and reduce their household waste? The answer to society's waste problems, and one that holds many benefits for the environment, economy, and society alike (Tangri et al., 2022; Zaman, 2022), and that contributes to the SDGs (United Nations, 2023), is zero waste (ZW) (Zaman, 2015).

While ZW is a concept that can be widely applied, whether in entire cities, businesses, communities, or households (Zaman, 2022), this study focuses on ZW practices of individual consumers that have been largely neglected by researchers (Săplăcan & Márton, 2019).

Consumers who adopt ZW behaviours try to lessen their impact on the environment (Pedersen, 2017) by engaging in reduce, reuse, recycle, and composting behaviours and, in so doing, sending less waste to landfill (SF Environment, 2020). This principle of ZW can be applied to any part of the consumption of products and services (from shopping to consumption and disposal), and provides consumers with concrete actions they can take to curb their consumption and household waste creation (Săplăcan & Márton, 2019).

To be able to encourage ZW behaviours among consumers, and especially in developing countries such as South Africa, one must first understand what drives these behaviours (Steg et al., 2016). Thus, as a starting point, the purpose of this study is to determine whether ZW behavioural intent can be modelled using the theory of planned behaviour (TPB), a model that has shown great success in modelling similar pro-environmental behaviours (Li et al., 2020; T'ing et al., 2020; Raghu & Rodrigues, 2022; De Leeuw, Valois, Ajzen & Schmidt, 2015; Rastegari Kopaei, Nooripoor, Karami, Petrescu-Mag & Petrescu, 2021; Taylor & Todd, 1995).

Besides this main research question, this study seeks to address various other gaps in the literature, the first of which is the general lack of green consumer-behaviour-related research in developing countries (ShabbirHusain, 2020) such as South Africa. Second, while green consumer behaviours have been extensively studied using the well-known 3R (reduce, reuse, recycle) framework (Aguilar-Salinas et al., 2017; Attiq et al., 2021; Khan, Ahmed & Najmi, 2019; T'ing et al., 2020), the 5R ZW hierarchy proposed by Bea Johnson (2013) may better encapsulate individuals and their households' waste minimisation efforts. This study addresses this issue by using the 5R ZW hierarchy to investigate ZW behavioural intent among consumers. Third, this study contributes to the lack of research on ZW behaviours at household (Săplăcan & Márton, 2019; Zaman, 2015) and individual level (Spiteri, 2021). Fourth, while the TPB has been extensively used to model the adoption of the five individual dimensions of ZW behaviours (Li et al., 2020; T'ing et al., 2020; Raghu & Rodrigues, 2022; De Leeuw et al., 2015; Rastegari

Kopaei et al., 2021; Taylor & Todd, 1995), this study is one of the first to study these dimensions holistically as ZW behaviours, and to investigate the TPB's ability to model ZW behavioural intent at an individual level. Fifth, by investigating consumers' ZW behavioural intent, this study contributes to seven of the UNs (2023) SDGs and addresses the lack of business-related research on these SDGs (Bolton, 2022). Finally, by addressing sustainability issues, this study also contributes to the emerging stream of TCR research (Bolton, 2022).

The article is structured as follows: a review of the relevant literature and a formulation of appropriate hypotheses are followed by an outline of the study's methodology, a presentation of its results, and a discussion of the findings, managerial implications, theoretical contributions, limitations, and avenues for future research.

2. Literature review

2.1. Zero waste

The term 'zero waste' (ZW) was first used by Paul Palmer in 1973 (Palmer, 2004 in Zaman, 2015) to describe the process of recovering resources from chemicals. More recently ZW has been 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, 2018a). This definition implies that the concept of ZW aims to minimise waste at the level of resource extraction, production and consumption (Zaman, 2022). From a consumption perspective specifically, ZW means to be a careful consumer (Kim-Marriott, 2021) that changes their lifestyle to be more sustainable, reduces their production of waste and CO₂ emissions, and in so doing lowering their impact on the environment (Pedersen, 2017). Such ZW behaviours commonly include consuming and shopping less, avoiding the purchase of single-use products (e.g., bottled water, disposable plastic bags) and goods with unnecessary packaging, reusing products as many times as possible, and recycling and composting household waste.

Bea Johnson, the "fairy godmother of the modern ZW movement" (Matters, 2018), documented her family's journey to a ZW lifestyle in her book *Zero waste home* (2013). Johnson (2013) presented a 5R approach towards living a ZW lifestyle and minimising household waste creation, according to which consumers should "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".

Researchers have adopted multiple definitions for Johnson's (2013) 5Rs (i.e. 'refuse', 'reduce', 'reuse', 'recycle', and 'rot') (Raghu & Rodrigues, 2022; Mills, 2012; T'ing et al., 2020; Susanto et al., 2019). The first of the 5Rs ('refuse') has been defined as avoiding the accumulation of items (Raghu & Rodrigues, 2022) and not purchasing unnecessary items (Bogusz et al., 2021). Johnson (2013) defines 'refuse' as minimising indirect consumption by saying 'no thank you' to items such as disposable plastic bags, by refusing freebies, and by refusing printed receipts at shops and business cards you are not going to use.

'Reduce', the second 'R', has been defined as avoiding use (T'ing et al., 2020), using less (Mills, 2012; Ali & Yusof, 2018), and minimising waste (Raghu & Rodrigues, 2022). Johnson (2013) refers to 'reduce' as minimising consumption where possible by, for example, donating or selling items, buying bulk and carpooling.

The third 'R' ('reuse') has been defined as using items for as long as they are useable (Raghu & Rodrigues, 2022) and using items again rather than disposing of them (Ali & Yusof, 2018), including the use of reusable, refillable and rechargeable items (Johnson, 2013).

Researchers have defined the fourth 'R' ('recycle') as the conversion of waste into a useable form (Raghu & Rodrigues, 2022), turning old items into new ones (Ali & Yusof, 2018), being knowledgeable about recyclability of materials Johnson, (2013) and collecting, separating and processing recyclable waste (T'ing et al., 2020).

Some researchers consider the last 'R' ('rot') to form part of 'reduce' (Mills, 2012) or 'recycle' (Tonglet et al., 2004). This study adopts Johnson's (2013) view that composting should be a separate 'R', and that it refers to composting, or recycling, one's organic waste.

'Refuse' and 'reduce' address the creation of waste before consumption takes place, 'reuse' addresses thoughtful consumption, and 'recycle' and 'rot' address how to handle what is discarded post-consumption; and together these five behaviours or Rs constitute ZW behaviours (Johnson, 2013).

Throughout the study the terms *refuse*, *reduce*, *reuse*, *recycle*, and *rot* will be given in italics when referring to these terms as defined above.

2.2. Theory of planned behaviour

Ajzen's (1985) theory of planned behaviour (TPB) proposes that an individual's attitude to performing a behaviour, and the subjective norms related to the behaviour, determine the individual's intention to perform that behaviour. The more positive the individual feels about a behaviour (i.e. their attitude) (Ajzen & Madden, 1986) and the greater the perceived social pressure to perform the behaviour (i.e. subjective norms) (Ajzen, 1991), the more likely the individual is to perform the behaviour (i.e. intention) (Fishbein & Ajzen, 1975 in Davis, 1986). The theory further posits that the effect of attitude and subjective norms on intentions depends on the perceived behavioural control (PBC) the individual has over performing the behaviour (Ajzen, 2020). The easier an individual believes the behaviour will be to perform (Ajzen, 1991), the stronger will be the effect of their attitudes and subjective norms on the amount of effort they're willing to exert to perform the behaviour (Abraham & Sheeran, 2003). In turn, their behavioural intention determines whether they perform the actual behaviour (Ajzen, 1991).

After research had established PBC to have mostly main effects in the model, Ajzen (1991) reformulated the TPB with PBC as a predictor of intention rather than as a moderator. It is this reformulated model that has been popularly applied by researchers to model a wide range of behaviours (Ajzen, 2020). However, recent studies have indicated that PBC's role in the TPB is indeed that of a moderator (Earle et al., 2020; Hukkelberg et al., 2014; Yzer & van den Putte, 2014). These studies also successfully employed the TPB by investigating the effect of attitude and subjective norms on behavioural intent, without measuring actual behaviour and the relation between intention and behaviour. Given that research on ZW behaviours amongst consumers is in its infancy (Sáplácan & Márton, 2019), and literature suggests that several factors could influence ZW behavioural intention (Ali & Yusof, 2018; La Barbera & Ajzen, 2020, 2021; Rastegari Kopaei et al., 2021), this study investigates ZW behavioural intent through the lens of the original TPB (Ajzen, 1985).

This study's adoption of the original TPB (Ajzen, 1985), and investigation of PBC as a moderator of the attitude-intention and subjective norm-intention relationships, is deemed suitable for theoretical and practical reasons, similar to the approach of Liu et al. (2021). First, while interest in the moderating role of PBC within the TPB has been increasing in recent years, little empirical evidence exists to support this version of the TPB (La Barbera & Ajzen, 2021). It may, however, be theoretically meaningful to better understand PBC as a moderator in the TPB, as this could aid researchers in understanding what psychological processes help shape behaviour (Liu et al., 2021). Second, studies that have adopted this version of the TPB have focused mostly on PBC as a moderator of the intention-behaviour relationship, neglecting the moderating effect of PBC on the attitude-intention and subjective norm-intention relationships (La Barbera & Ajzen, 2021). Third, given recent success of using the TPB with PBC as moderator in research on *recycle* (Liu et al., 2021) and *reduce* (La Barbera & Ajzen, 2021) behaviours, PBC is expected to act as a moderator within the similar context of ZW behaviours as well. Like *recycle* and *reduce* behaviours, ZW behaviours comprise of a multitude of simple actions (e.g., saying no thank you to consumption opportunities, avoiding consumption, using

reusable and refillable product alternatives, sorting and recycling waste and composting) that do not require high levels of PBC. According to the TPB, consumers are more likely report intentions aligned with their attitudes and subjective norm, when their PBC is high (Hagger et al., 2022). Consumers generally hold positive attitudes towards sustainability issues such as recycling and often perceive it as a socially commendable. Nonetheless, their intent and behaviour to recycle is often dependent on their perceived capability of engaging in these practices (Rosenthal, 2018).

Because of a lack of research that has used the originally formulated TPB (Ajzen, 1985), this study turned to studies using the reformulated TPB to help to develop some of its hypotheses. The reformulated TPB has been extensively used to model the adoption of a variety of green behaviours (Al Mamun et al., 2018; Chan, 2001; Nameghi & Shadi, 2013), including the five dimensions (5Rs) of ZW behaviours: *refuse* (Raghu & Rodrigues, 2022), *reduce*, *reuse*, *recycle* (De Leeuw et al., 2015; T'ing et al., 2020; Ali & Yusof, 2018; Susanto et al., 2019), and *rot* (Rastegari Kopaei et al., 2021; Rahman et al., 2022; Graham-Rowe et al., 2015).

Some of these studies found only attitude to predict intentions to *reduce*, *reuse*, and *recycle* (Ali & Yusof, 2018; Susanto et al., 2019); others found both attitude and subjective norms to predict intentions to *reduce* (La Barbera & Ajzen, 2021), *reuse* (Nguyen et al., 2017), *recycle* (Strydom, 2018) and *rot* (Graham-Rowe et al., 2015); while some found subjective norms to be the only significant predictor of *reduce* and *recycle* intentions (Khan et al., 2019; La Barbera & Ajzen, 2020). Despite these divergent results, the original TPB is still viewed as a valuable lens through which to study ZW behaviours, since the majority of reviewed studies, even though they used the reformulated TPB, found both attitude and subjective norms to have a significant effect on the intention to engage in *refuse*, *reduce*, *reuse*, *recycle*, and *rot* behaviours (Li et al., 2020; T'ing et al., 2020; Raghu & Rodrigues, 2022; De Leeuw et al., 2015; Rastegari Kopaei et al., 2021; Taylor & Todd, 1995), the five dimensions that collectively make up ZW behaviours (Johnson, 2013). We thus hypothesise the following:

H1. There is a positive relationship between attitude and ZW intentions.

H2. There is a positive relationship between subjective norms and ZW intentions.

As postulated in the original TPB (Ajzen, 1985), and as mentioned previously, the effect of attitude and subjective norms on intentions depends, or is moderated by, the perceived control an individual has over performing the behaviour (PBC) (Ajzen, 2020). Research has confirmed PBC's moderating effect (Castanier Deroche & Woodman, 2013; Earle et al., 2020; Hukkelberg et al., 2014; Yzer & van den Putte, 2014), albeit seldom in a green behaviour-related context. However, since the original TPB postulates that PBC moderates the relationship between intentions and its predictors; and, since this moderating effect has been established in the context of *reduce* behaviours (La Barbera & Ajzen, 2021), a dimension of ZW behaviours (Johnson, 2013), we hypothesise the following:

H3. PBC has a moderating effect on the relationship between attitude and ZW intentions.

H4. PBC has a moderating effect on the relationship between subjective norms and ZW intentions.

Background factors such as demographic characteristics are also assumed to have an indirect influence on intentions, and can provide researchers with valuable information that is not provided by the theory itself (Ajzen, 2020). Socio-demographic elements have an important effect on environmentally friendly behaviours (ShabbirHusain, 2020); but these effects seem to be inconsistent across studies and to depend on which green behaviour is in question (Zhang & Dong, 2020). For example, one study on *reuse* behaviours found gender to moderate both the attitude-intention and subjective norm-intention relationships in

the TPB (Sun & Wang, 2020), while another found only the attitude–intention relationship to be moderated (Nguyen et al., 2017). The ZW movement is being led by women (Clark, 2016); so, despite these inconclusive findings, this study hypothesises the following:

H5. Gender moderates the relationship between attitude and ZW intentions.

H6. Gender moderates the relationship between subjective norms and ZW intentions.

As in the case of gender, the previous findings related to age’s moderating role were not cohesive. Age moderated the attitude–intention relationship with regard to *reuse* behaviours in one study (Sun & Wang, 2020); but both the attitude–intention and subjective norm–intention relationships in another (Moon, 2020). Regardless of these conflicting findings, the age of an individual, and specifically the generation to which they belong, is believed to play a role in ZW behaviour adoption: Generation Z (individuals born between 1997 and 2013) (Beresford Research, 2021) have been found to adopt sustainable behaviours more than other generational groups (Deloitte, 2021), while a significant number of Generation Y (Millennials – that is, individuals born between 1981 and 1996) (Beresford Research, 2021) indicate that they are actively choosing sustainable products or that they buy from sustainable brands (PWC, 2021). This, and the fact that the ZW movement is being led by young millennials (Clark, 2016), leads us to hypothesise the following:

H7. Generation moderates the relationship between attitude and ZW intentions.

H8. Generation moderates the relationship between subjective norms and ZW intentions.

With regard to income, a study on *reuse* behaviour found the attitude–intention relationship to be moderated (Sun & Wang, 2020), while a study on waste minimisation behaviours found neither relationship in the TPB to be moderated (Ertz et al., 2021). Despite these findings, it is known that income affects the likelihood of purchasing sustainable products (Kronthal-Sacco & Whelan, 2019) and that following a ZW lifestyle is costly (Kim-Marriott, 2021). We thus hypothesise the following:

H9. Income moderates the relationship between attitude and ZW intentions.

H10. Income moderates the relationship between subjective norms and ZW intentions.

Findings related to the moderating effect of education have also been inconsistent: a study related to *reduce*, *reuse*, and *recycle* behaviour found no moderating effects in the TPB (Attiq et al., 2021), while studies of

sustainable purchase decisions established education as a moderator of the attitude–intention relationship (Delistavrou, 2022; Chekima et al., 2016). As these findings are inconclusive, this study seeks to establish whether education acts as a moderator in the context of ZW behavioural intent:

H11. Education moderates the relationship between attitude and ZW intentions.

H12. Education moderates the relationship between subjective norms and ZW intentions.

Fig. 1 below shows the study’s conceptual framework and stated hypotheses.

3. Methodology

3.1. Sample and data collection

The study’s data was collected using a self-administered, web-based questionnaire created using Qualtrics, an online survey platform. After obtaining ethical clearance (EMS086/22), a pre-test was conducted among research professionals from a convenience sample of the study’s population, and minor adjustments were made to the questionnaire based on the feedback received. A link to the final questionnaire was distributed (posted, shared, or ‘boosted’ via a paid advertisement) on some of South Africa’s most used social media platforms (Kemp, 2022) namely Facebook, Instagram, LinkedIn, and WhatsApp, constituting non-probability convenience sampling. Gathering data from a non-probability convenience sample using social media was deemed appropriate as social media are a key driver of the ZW movement (Sáplăcan & Márton, 2019) and several studies investigating similar constructs within the context of environmentally friendly behaviours were successful in their use of this sampling technique (Botetzagias et al., 2015; Pandey et al., 2023; Ybyraimova, 2023).

A total of 517 responses were collected, and after cleaning and coding the data, inspecting it for out-of-range values, and removing 31 responses that contained missing values, a final sample size of 486 was realised. This is well within the acceptable range, based on the sample sizes of previous studies investigating similar constructs (Ham et al., 2015; Emekci, 2019; Al Mamun et al., 2018; Watson & Smith, 2020).

The demographic profile of the respondents indicates that about two-thirds of them were female (66%) and only one-third were male (33,1%). Most of the respondents were aged 25–34 years (42,2%), followed by those aged 18 to 24 (22,2%), 35 to 44 (18,5%), and 45 to 54 (12,8%). Almost half of this study’s respondents could be categorised as belonging to Generation Y (Millennials – that is, born between 1981 and 1996) (49,8%), followed by Generation Z (those born between 1997 and 2012) (28,4%), and Generation X (those born between 1965 and 1980)

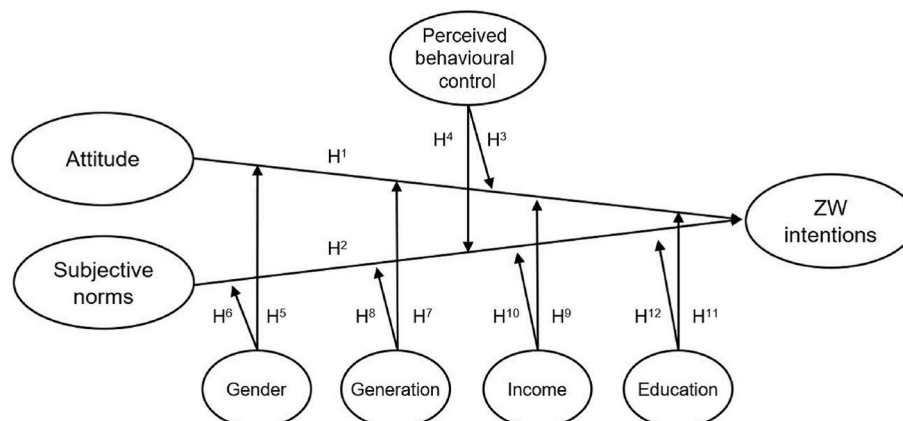


Fig. 1. The study’s conceptual framework.

(18,9%) (Beresford Research, 2021).

The income categories used in this study were defined according to the guidelines suggested by the Bureau of Market Research (BMR) (Momentum, 2021). Based on these income categories, most of this study's respondents could be categorised as the low emerging middle class (25,1%), followed by the emerging middle class (22,2%), those with low income (20,8%) or very low income (17,3%), while only 14,7% of the respondents formed part of the realised middle class, emerging affluent, and affluent and wealthy categories.

Most of the respondents had obtained a tertiary qualification (60,5%), followed by those who had completed their secondary schooling (33,5%). To be able to conduct further statistical analyses, the income and education variables had to be regrouped into three (low, low to middle, and middle to high) and two (secondary schooling or lower, and tertiary qualification) categories respectively.

3.2. Questionnaire and measures

Screening questions were used to confirm that the respondents were adult South Africans. Then, to ensure compatibility between the behaviour of interest and the study's constructs, an explicit definition of ZW behaviours was provided to respondents. The definition provided was as follows:

Zero waste behaviours refer to behaviours that try to minimise the amount of waste you as a consumer create and dispose of. These behaviours include, amongst others, avoiding or saying 'no thank you' to products you do not need (refuse), reducing your consumption in general, reusing products, recycling and composting (rot).

The main constructs of the survey instrument were constructed using items from existing scales adapted to the context of this study. The scales measuring attitude (five items), subjective norm (three items), PBC (three items) and intentions (three items) were adapted from Taylor and Todd (1995) and Madden et al. (1992), using the suggestions of Ajzen (1991) as a guideline. Attitude was measured on a semantic differential scale, while subjective norms, PBC, and intentions were all measured on a five-point Likert scale ranging from strongly disagree (1) to strongly agree (5). The questionnaire concluded with questions about respondents' demographic information such as gender, age, income, and education.

3.3. Data analysis

The Statistical Package for Social Sciences (SPSS) version 28 was used to test the model using two-step covariance-based structural equation modelling (CB-SEM).

First the measurement model was run, after which its reliability and validity were assessed. In accordance with the recommendations made by Kline (2023), model fit was evaluated by assessing several approximate fit indexes: the Steiger-Lind root mean square error of approximation (RMSEA), with its 90% confidence interval ($\leq 0,08$) (Malhotra, 2020); the Bentler comparative fit index (CFI) ($\geq 0,90$) (Malhotra, 2020); the incremental fit index (IFI) ($\geq 0,90$) (Hair et al., 2014); and the standardised root mean square residual (SRMR) ($\leq 0,08$) (Hu & Bentler, 1999). Construct validity was assessed using composite reliability (CR) and Cronbach's alpha (CA) values, and convergent validity was tested using the average variance extracted (AVE) and the loadings of the individual items that form each construct.

Second, the structural model was run, and model fit was assessed in the same manner as described for the measurement model.

Finally, the study's hypotheses were tested. The statistical significance of the relationships among the study's constructs was estimated, and multigroup CFA analyses were conducted to test for moderation. To conduct the multigroup CFA analyses, the study's sample was grouped according to each of the moderating variables, and the chi-square values of the constrained models were compared with those of the

unconstrained models. In cases where the chi-square values showed a difference of more than 3,84 for a relationship path, moderation was present (Awang, 2014). Furthermore, to understand better the moderating effects in the model, several simple slope analyses were conducted using Hayes' (2012) PROCESS macro in SPSS.

4. Results

4.1. Measurement model, reliability, and validity

Before beginning the structural model testing, the fit of the measurement model and the reliability and validity of the constructs were assessed. Initial results revealed two indicator items with factor loadings of below 0,5 (ATT1 and ATT3, both related to the attitude construct); these items were thus excluded from further analysis (Hair et al., 2014). The CFA showed an acceptable model fit, as $X^2(p) = < 0,001$; $X^2/df = 2068$; RMSEA = 0,047; CFI = 0,975; IFI = 0,975; SRMR = 0,0383.

Following the assessment of the measurement's model's fit, reliability and validity were assessed (Table 1).

All CR and CA values were above 0,7 (Hair et al., 2014), indicating convergent validity. The AVE values for attitude, PBC, and intention were all above 0,5 (Malhotra, 2020), and, while the subjective norm construct's AVE value was above only 0,4, the construct's composite reliability score was higher than 0,6, indicating acceptable convergent validity (Malhotra & Dash, 2011; Malhotra, 2020). None of the factor loadings was above 0,9, indicating discriminant validity (Kline, 2023).

Table 1

Confirmatory factor analysis, means (reliability and validity assessment).

CONSTRUCTS & ITEMS	M	SD	FACTOR LOADING	CR	CA	AVE
Attitude: Engaging in ZWB in the near future will be ...				0,784	0,775	0,548
Pleasant – unpleasant	4,27	0,885	0,744			
Useless – useful	4,63	0,754	0,783			
Enjoyable – unenjoyable	4,07	1,027	0,691			
Subjective norms: The people who ...				0,732	0,707	0,485
... influence my decisions think that I should engage in ZWB.	3,40	0,987	0,757			
... are important to me think that I should engage in ZWB.	3,32	1,038	0,786			
... are important to me would approve of me engaging in ZWB.	3,90	0,903	0,513			
Perceived behavioural control				0,819	0,713	0,601
Whether or not I engage in ZWB is entirely up to me.	3,98	0,971	0,763			
I have complete control over the amount of ZWB I engage in.	3,85	1,033	0,770			
Whether or not I engage in ZWB effectively is completely within my control.	3,91	1,015	0,792			
Intentions				0,846	0,854	0,648
I intend to engage in ZWB in the near future.	4,13	0,773	0,753			
I will try to engage in ZWB in the near future.	3,13	0,781	0,849			
I will make an effort to engage in ZWB in the near future.	3,19	0,766	0,810			

All factor loadings were significant at the 0.05 level; SD = standard deviation; M = mean; CR = composite reliability; CA = Cronbach's alpha; AVE = average variance explained; ZWB = zero waste behaviours.

Furthermore, as can be seen from Table 2, each of these square roots (on the diagonal) was greater than the correlations among the constructs, indicating discriminant validity (Hair et al., 2014).

As the above results confirmed the reliability and validity of the study's measurement model, the structural model was run to test the hypotheses.

4.2. Structural model and hypotheses testing

The structural model showed an acceptable model fit, as $X^2(p) < 0,001$; $X^2/df = 2708$; RMSEA = 0,059; CFI = 0,975; IFI = 0,975; SRMR = 0,0383. The relational hypotheses were thus tested.

The statistical significance of the relationships among the study's constructs was estimated. Both paths in the model were statistically significant, and both H1 and H2 were supported, as attitudes ($B = 0,187$, $t\text{-value} = 4,431$, $p < 0,001$) had a weak positive relationship and subjective norms ($B = 0,530$, $t\text{-value} = 7,451$, $p < 0,001$) had a strong positive relationship with consumers' intentions to engage in ZW behaviours.

In addition to analysing the structural model's fit, a model comparison was performed to determine whether the original TPB is better able to model ZW behavioural intent than the reformulated TPB. The first model, in which PBC acted as a moderator of the attitude-intention and subjective norm-intention relationships, had lower information criterion values (AIC = 106,997; BIC = 194,908) than the second model, in which PBC acted as a predictor (AIC = 159,287; BIC = 284,873). This indicates that the original TPB, in which PBC acts as a moderator, is indeed better able to model the adoption of ZW behavioural intent.

4.3. Moderating effects

To examine the moderating effects of PBC, gender, generation, income, and education on the two relationship paths in the model, multigroup CFA analyses and simple slope analyses were conducted. The findings are summarised in Table 3 below.

With regards to PBC, respondents were grouped into two groups: low versus high PBC. Those individuals with scores of four or less on a five-point Likert scale were classified as having low PBC, while those with a score of more than four were classified as having high PBC. The results showed that PBC moderated both relationships in the model; and the simple slope analyses revealed both relationships to be stronger for individuals with high as opposed to low levels of PBC, supporting H3 and H4. The relationship between attitude and intention was much stronger for individuals with high PBC, while the relationship between subjective norms and intentions was only slightly stronger for individuals with high PBC.

Gender and education also moderated both relationships in the model, supporting H5, H6, H11, and H12. Simple slope analyses showed the impact of attitude on intentions to be strongest for females and individuals with a tertiary qualification, while the impact of subjective norms on intentions was strongest for males and individuals with a secondary or lower level of schooling.

Both generation and income only moderated the subjective norm-intention relationship, supporting H8 and H10. The simple slope analyses indicated that the impact of subjective norms on intentions was

Table 2
Correlation and square root of AVE's matrix.

	ATT	SN	PBC	INT
ATT	0,740			
SN	0,409	0,696		
PBC	0,274	0,442	0,775	
INT	0,457	0,632	0,491	0,805

ATT = attitude; SN = subjective norms; PBC = perceived behavioural control; INT = ZW intention.

strongest for Generation X and those in the low to middle income category. H7 and H9 were not supported, as the attitude-intention relationship was not moderated in the case of Generation Z and the low income groups.

5. Discussion and managerial implications

The global culture of consumerism (Bothun, 2018), the household consumption of products and services, and the management of the waste it creates, are responsible for large amounts of GHG emissions and contribute significantly to climate change (Ivanova et al., 2016; Vergara & Tchobanoglous, 2012). While the UNs SDGs addresses such climate change and sustainable consumption-related issues in order to ensure a sustainable future for all (Jones et al., 2018), TCR is needed to provide governments, businesses, and consumers with practical research findings that enable them to actually address these societal issues (Ozanne et al., 2011; Ozanne Mick & Pechmann, 2015).

Research on sustainable consumption practices such as ZW behaviours contributes to the emerging stream of TCR and to addressing the SDGs (Ozanne et al., 2015). ZW provides consumers with concrete actions they can take to curb their consumption and waste creation (Săplăcan & Márton, 2019). ZW thus represents a solution to society's waste problems (Zaman, 2015), and holds many benefits for environment, economy, and society alike (Tangri et al., 2022).

However, to encourage ZW behaviours among consumers, it is important first to understand what drives such behaviours (Steg et al., 2016). To this end, the purpose of this study was to determine whether the ZW behavioural intent of South Africans could be modelled using the theory of planned behaviour (TPB) and to explore the moderating role of PBC. The role of several socio-demographic variables in ZW adoption were also investigated, as such elements have been proven to affect environmentally friendly behaviours (ShabbirHusain, 2020).

The study's results revealed that the TPB, with PBC as a moderator, can indeed successfully model ZW behavioural intent. In line with previous studies related to *refuse, reduce, reuse, recycle*, and *rot* behaviours (Li et al., 2020; Ting et al., 2020; Raghu & Rodrigues, 2022; De Leeuw et al., 2015; Rastegari Kopaei et al., 2021; Taylor & Todd, 1995), the five dimensions that collectively constitute ZW behaviours (Johnson, 2013), this study found attitude and subjective norms to have significantly positive effects on ZW intentions. Establishing that these significant positive effects hold true for ZW behaviours collectively (as opposed to its five individual dimensions) is important, as the concept of ZW is a holistic approach to addressing the world's waste problems (Zaman, 2015).

In line with previous studies investigating some of the individual dimensions of ZW behaviours (Săplăcan & Márton, 2019; De Leeuw et al., 2015; Khan et al., 2019), this study's findings showed that attitude had a significant positive effect on ZW intentions (H1). Consumers who are more positive towards ZW behaviours are more likely to engage in these behaviours (Ajzen & Madden, 1986). Positive attitudes to ZW behaviours could be cultivated by creating an awareness of ZW behaviours via marketing communications (Anvar & Venter, 2014). These communications should be factual and explained well (Nameghi & Shadi, 2013), and could leverage the positive effect of social influence on attitudes by, for example, targeting individuals' friends and family (Anvar & Venter, 2014). Furthermore, careful attention should be paid to the information provided by the labels on ZW products (Ceri et al., 2018) and the affordability of engaging in ZW behaviours (Anvar & Venter, 2014), as these factors also affect consumers' attitudes. Businesses, brands, and governments could, for example, use their websites and publications (blogs, magazine and newspaper articles etc.) to disseminate the facts about the benefits of ZW behaviours for consumers and the environment alike. These communications should also frame the attributes of ZW products and behaviours as gains rather than losses (Dolgoplova et al., 2021). For example, marketing campaigns could use memorable slogans such as "Less trash, more cash" or "Be an

Table 3
Variable grouping, chi-square differences, and slope analyses results.

Variable	Grouping	Path									
				Attitude-Intention				Subjective norms-Intention			
		Group	N	%	Con	Uncon	Diff.	Slope	Con	Uncon	Diff.
PBC	Low	306	62.96	62.502	46.935	18.567	0,3231	150.679	46.935	103.744	0,3658
	High	180	37.04	71.541	50.534	21.007	0,6343	112.188	50.534	61.654	0,3660
Gender	Males	161	33.4	43.999	39.632	4.367	0,4465	88.894	39.632	49.262	0,4449
	Females	321	66.6	90.741	64.260	26.481	0,4991	189.846	64.260	125.586	0,4129
Gen	GenX	92	19.5	45.977	40.791	5.186	0,6292	74.820	40.791	34.029	0,5166
	Gen Y	242	51.3	68.857	52.273	16.584	0,4946	133.221	52.273	80.948	0,3779
	GenZ	138	29.2	33.00	31.837	1.163	0,4339	72.666	31.837	40.829	0,4943
Income	Low	185	38.1	41.9	39.492	2.408	0,4061	106.301	39.492	66.809	0,3844
	Low to middle	230	47.3	70.834	46.070	24.764	0,5497	122.439	46.070	76.369	0,4310
	Middle to high	71	14.6	47.251	37.996	9.255	0,4477	65.118	37.996	27.192	0,3669
Edu	Secondary	175	37.1	51.191	38.528	15.663	0,4984	93.371	38.528	54.843	0,3620
	Tertiary	294	62.7	70.631	55.631	15	0,4777	157.504	55.631	101.873	0,4870

PBC = perceived behavioural control; Gen = Generation; Edu = education; Con = Constrained; Uncon = unconstrained; Low PBC

environmental hero, go zero” to create an awareness of ZW behaviours and to communicate the gains or benefits of engaging in them. Consumers should also be incentivised to publish online reviews of ZW products and -services they’ve used, as this can lead to a more positive impression and sales of ZW products and services (Ma et al., 2022).

The study’s results further showed subjective norms to have a strong positive effect on ZW intentions (H2) – stronger than in previous studies investigating individual dimensions of ZW behaviours (Rastegari Kopaei et al., 2021; Raghu & Rodrigues, 2022). This is also in contrast to a previous study on ZW principles that established a negative association between these constructs (Săplăcan & Márton, 2019). The strong effect of subjective norms on ZW intentions may be because many South Africans already implement ZW practices in their daily lives (Watson & Smith, 2020), such as refusing single-use plastic bags at grocery stores, donating items they no longer need, buying in bulk, recycling, and composting their household’s waste (Johnson, 2013). Behaviours such as these may thus be the norm, and South Africans may experience perceived social pressure to perform them (Ajzen & Madden, 1986). Social media marketing is an ideal tool to leverage this strong positive impact of subjective norms on ZW intentions; and communicating the benefits of engaging in ZW behaviours via social media and using appropriate social media influencers could improve the public’s attitudes to ZW behaviours and the related subjective norms, thus making it more likely that individuals would engage in ZW behaviours. Businesses and governments could, for example, publish and promote their ZW awareness campaigns on social media platforms, and even approach South African public figures such as sports stars, artists and musicians, or other prominent individuals to help to disseminate the benefits of ZW. These prominent figures would also act as social influencers, helping to make ZW behaviours the new societal norm, and in so doing pressure consumers to behave in a similar manner. The impact of social influence could be further leveraged by highlighting the growing trend that is ZW lifestyle adoption to South African consumers (Sajid, Zakkariya & Ertz, 2023), or by launching competitions that challenge friends and families to adopt ZW behaviours in order to produce as little household waste as possible over a certain period of time in order to win a ‘ZW starter kit’ containing ZW products. Leveraging consumers’ relationships with family and friends (interpersonal relationship), as well as their relationships with public figures like influencers, businesses and governments (public relationships) are both effective strategies to promote *reduce* behaviours (Li et al., 2023).

PBCs role as a moderator of the attitude – intention relationship (H3) is in line with previous studies on *reduce* behaviours (La Barbera & Ajzen, 2020; Li et al., 2020), while PBCs moderation of the subjective norm–intention relationship (H4) contrasts with these same studies, which found a negative (La Barbera & Ajzen, 2020) or no significant moderating effect (Li et al., 2020). These contrasting findings regarding

the subjective norms–intention relationship may be because the previous studies only investigated the *reduce* dimension of ZW behaviours (La Barbera & Ajzen, 2020; Li et al., 2020). For both the attitude–intention and subjective norm–intention relationships, the moderating effect was stronger for individuals with high as opposed to low PBC. This means that the easier an individual feels it would be to perform ZW behaviours, the stronger would be the effect of their attitude and subjective norms on their intentions to engage in these behaviours, and the more likely they would be to engage in these behaviours. As individuals’ PBC is based, among other things, on the difficulties they think they would face when engaging in the behaviour in question (Ajzen & Madden, 1986), such as an increase in price or the effort, skills, or knowledge required to engage in ZW behaviours (Testa et al., 2021), doing so should be made affordable and easy, and awareness should be created of the convenience and practicality of engaging in such behaviours. Businesses, brands, and governments should emphasise how easy and financially beneficial it is to engage in ZW behaviours, and in so doing remove the barrier of ‘difficulty’ these individuals perceive. Phrases such as “Zero trash, more cash” or “Five simple steps to wasting less” could be used in social media campaigns to emphasise the financial benefits and simplicity of ZW behaviours.

The results revealed gender (H5, H6) to moderate both relationships in the model. In line with a study conducted on *refuse* behaviours (Gulid & Yansomboon, 2022), attitude had a stronger impact on intentions among females than among males. Subjective norms’ effect on intentions, on the other hand, was found to be stronger among males – a finding that contrasts with those of multiple green behaviour-related studies that found gender to have no effect on this relationship (Sun & Wang, 2020; Nguyen et al., 2017). These contrasting findings may be because these previous studies investigated only the *reuse* dimension of ZW behaviours.

Previous studies on *reuse* behaviours found age to moderate only the attitude–intention relationship (Sun & Wang, 2020) or neither relationship in the TPB (Cao, 2023). This study, on the other hand, found generation to moderate only the subjective norm–intention relationship (H9) and not the attitude–intention relationship (H8). The fact that these previous studies investigated only the *reuse* dimension of ZW behaviours may explain the contrasting findings. In line with a study on *reuse* behaviours that found subjective norms’ impact on intentions to be stronger for older age groups (Moon, 2020), this study found the subjective norms–intention relationship to be strongest among Generation X. This supports the idea that different generations rely on the opinion of their peers to different extents during green decision making (Wang, 2017). Generation did not moderate the attitude–intention relationship, as moderation was present only for Generation X and Generation Y, not for Generation Z. While this finding is in line with one study on *reuse* behaviours (Sun & Wang, 2020), it contrasts with another (Moon, 2020)

in which not only did Generation Z moderate the relationship in question, but the moderating effect was strongest among younger age groups. The lack of moderation by Generation Z in this study may be explained by Generation Z's lack of environmental concern (Pop et al., 2020); and the contrast with the findings of the previous studies mentioned above may be because they investigated only the *reuse* dimension of ZW behaviours.

Like generation, income moderated only one of the relationships in the TPB. In contrast to the findings of a study on *reuse* behaviours (Sun & Wang, 2020), which found income to moderate only the attitude–intention relationship, this study found the opposite: that income moderated only the subjective norm–intention relationship. With regard to the attitude–intention relationship, this study found that moderation was present only for the low-to middle- and middle-to high-income groups, not the low-income group. This may be explained by the fact that living a ZW lifestyle is costly (Kim-Marriott, 2021); attitudes' effect on ZW intentions may thus be strengthened only in the cases of individuals who have the financial means to act on their positive attitudes. The subjective norm–intention relationship, on the other hand, was moderated in the case of all three income groups, with the strongest effect present in the low-to middle-income group and the weakest in the middle-to high-income group. Thus, even though there may be less of a financial barrier to adopt ZW behaviours, more affluent individuals are less likely to engage in ZW behaviours because of social pressure than other income groups.

Like gender, education moderated both relationships in the model. In contrast to a study on *reuse* behaviours by Chekima et al. (2016), which found attitude to have a stronger impact on intentions for individuals with tertiary qualifications, this study found the opposite: that attitude had a greater impact on intentions for individuals with a secondary or lower level of schooling. With regard to the subjective norms–intention relationship, the findings showed that this relationship was much stronger for those with a tertiary qualification, which is in contrast to a study on *recycle* behaviours (Issock et al., 2020) that found education to have no moderating effect. Once again, these contrasting findings may be because Chekima et al. (2016) and Issock et al. (2020) investigated only single dimensions (*reuse* and *recycle*) of ZW behaviours. This study's sample also contained a disproportionate number of individuals with a tertiary qualification, which may have affected these findings.

The findings related to the moderating role of the above socio-demographic variables suggest that the effect of individuals' attitudes to ZW behaviours on the likelihood that they would engage in these behaviours is strengthened in the case of females and individuals with a secondary or lower level of schooling. The effect of subjective norms related to ZW behaviours on the likelihood of these behaviours being performed is strengthened in the case of males, those who belong to Generation X, those who earn a low to middle income, and those who have a tertiary qualification. The marketing campaigns suggested above that would be aimed at improving individuals' attitudes to engaging in ZW behaviours should thus be primarily focused on females and individuals with a secondary or lower level of schooling, while the use of social media marketing to influence subjective norms related to ZW behaviours should be targeted first at men, individuals who belong to Generation X, those in the low to middle income category, and individuals who hold a tertiary qualification.

5.1. Theoretical contributions

In addition to the study's main research findings and its managerial implications, this study makes several theoretical contributions.

First, by investigating consumers' ZW behavioural intent, this study directly contributes to seven of the UNs (2023) SDGs. The aim of engaging in ZW behaviours is to reduce household waste, a practice that prevents water pollution (SDG 6), the pollution of marine life (SDG 14), and waste's generally negative impact on the environment (SDG 11). ZW behaviours also encompass using resources more efficiently (SDG 8) and

reducing one's impact on the environment and its natural resources (SDG 15) by adopting more sustainable consumption patterns such as reducing, reusing, and recycling (SDG 12). By reducing the production and disposal of waste, ZW behaviours ultimately also contribute to fighting climate change (SDG 13). Some researchers argue that all marketing research should address the SDGs; yet very few business-related studies have done so (Bolton, 2022).

Second, by addressing sustainability issues this study also contributes to the emerging stream of transformative consumer research (TCR), academic research that investigates consumption-related issues to create a better world for both consumers and the environment (Ozanne et al., 2015). There is a need for useful and credible research by marketers to address the complex changes driven by environmental and economic changes (Bolton, 2022) and TCR seeks to provide such practical research findings that governments, businesses, and consumers could use to drive societal change (Ozanne et al., 2011). A sustainable future requires governments, businesses, and society to change their mind-sets and behaviours (Jones et al., 2018); and understanding ZW behavioural intent among South African consumers is a step towards changing consumer behaviour for the better.

Third, by conducting a South Africa-based study, this study addresses the general lack of green consumer behaviour-related research in developing countries (ShabbirHusain, 2020).

Fourth, the TPB has been able to successfully model the adoption of *refuse*, *reduce*, *reuse*, *recycle*, and *rot* behaviours (Li et al., 2020; Ting et al., 2020; Raghu & Rodrigues, 2022; De Leeuw et al., 2015; Rastegari Kopaei et al., 2021; Taylor & Todd, 1995) – behaviours that collectively make up ZW behaviours (Johnson, 2013) – but this study is one of the first to use the TPB to study these five dimensions holistically as ZW behaviours. Furthermore, the above-mentioned studies employed the popularly accepted TPB rather than Ajzen's (1985) original formulation of the TPB. Recent studies, however, have proven the original TPBs success in modelling behaviour (Castanier et al., 2013; Earle et al., 2020; Hukkelberg et al., 2014; Yzer & van den Putte, 2014), and this study confirmed this in the context of ZW behaviours.

Fifth, the above-mentioned studies employed the popularly accepted reformulated TPB (Ajzen, 1991) as opposed to the original formulation of the TPB (Ajzen, 1985). By adopting Ajzen's (1985) original formulation of the TPB, in which PBC plays a moderating as opposed to a predictive role, this study addresses the stark lack of green behaviour-related research using Ajzen's (1985) original theory.

Sixth, ZW has been widely investigated in the production and waste management context, but research at household (Săplăcan & Márton, 2019; Zaman, 2015) and individual level (Spiteri, 2021) has been neglected. Studies have investigated ZW from a production and supply perspective, but have largely neglected studying the waste problem from the demand side or from the consumer perspective (Săplăcan & Márton, 2019).

Finally, green consumer behaviours have been extensively studied using the well-known 3R (reduce, reuse, recycle) framework (Aguilar-Salinas et al., 2017; Attiq et al., 2021; Khan et al., 2019; Ting et al., 2020). However, this framework was derived from the waste management hierarchy (Brennan et al., 2014), a tool developed with legislation and policy development in mind (Price & Joseph, 2000), and the 3Rs may thus not be the most suitable framework to study households' and individual consumers' ZW behaviours.

While the 3Rs fail to encapsulate the full extent of ZW waste reduction efforts (Zero Waste International Alliance, 2018b), the 5Rs proposed by Bea Johnson (2013) was conceptualised specifically with individual's and households' waste minimisation efforts in mind. However, this is one of the first studies to use this 5R approach to investigate ZW behaviours among consumers.

6. Limitations and recommendations for future research

While this study makes several valuable contributions, it is worth

noting its limitations, the first of which is the limited generalisability of the findings owing to the use of a non-probability sampling.

Second, although it is evident that the TPB is an applicable theoretical lens to investigate ZW intentions and behaviours, other theories could also shed light on ZW behaviours, given that research on the antecedents of ZW behaviour is in its infancy. Popular theories through which to study green behaviours include social identity theory or norm activation theory (ShabbirHusain, 2020). In addition, the model was limited to the antecedents specified in the TPB; so future studies could also explore proven antecedents of green behaviours such as environmental concern, social issues, green product attributes, social values, and various emotions (Joshi & Rahman, 2015) to see whether these constructs also drive ZW intentions and ultimately behaviour, which was excluded from this study. Future research could also investigate the possibility of a ZW intention-behaviour gap as explored by Zhang, Lai, Wang and Wang's (2019) in a waste-sorting context.

Last, social media platforms are important tools to help ZW principles to go mainstream (Săplăcan & Márton, 2019) and these platforms could be used to educate consumers about ZW, and in so doing foster a more positive attitude to these behaviours among consumers and embed the idea of ZW in South African society and its subjective norms, and so promote the adoption of these behaviours. Future research should thus explore the role of social media in South Africans' ZW intentions and behaviours, especially since social media are a key driver of the ZW movement (Săplăcan & Márton, 2019).

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CRedit authorship contribution statement

Euodia Isabella Botha: Conceptualization, Data curation, Formal analysis, Methodology, Validation, Writing – original draft, Writing – review & editing. **Melanie Wiese:** Supervision, Writing – review & editing.

Declaration of competing interest

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Data availability

Data will be made available on request.

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