

Article

South African Township Consumers' Recycling Engagement and Their Actual Recycling Behavior

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Abstract: Given that there is a huge gap between environmental concerns, recycling awareness, and township consumers' actual recycling behavior, it is important to determine their actual recycling behavior in order to develop sustainable recycling campaigns in townships. Studies have pointed out the significance of consumer, that is, user engagement in driving actual recycling behavior as part of addressing the negative effects of environmental challenges linked to not recycling on climate change. Studies on recycling behavior in South African townships are limited. The collection of waste in South African townships is less effective than in urban areas. This has resulted in consumers disposing of their waste informally in the spaces between their houses and shacks. An online survey was conducted among 411 township consumers in South Africa, which showed that a positive attitude towards recycling and perceived behavioral control positively and significantly affect consumers' intention to engage in recycling, whereas subjective norms had no effect. Recycling attitude, personal norms, subjective norms, facilitating conditions, and environmental concerns were found to influence consumers' actual recycling behavior. Furthermore, users' intention to engage in recycling was found to mediate the relationship between recycling attitude, perceived behavioral control, facilitating conditions, personal norms, and actual recycling behavior. This paper contributes to the literature on recycling behavior and is useful for municipalities, policy makers, organizations, governments, and other relevant stakeholders on the drivers of actual recycling behavior among township consumers.



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Keywords: recycling engagement; actual recycling behavior; extended theory of planned behavior

1. Introduction

All over the world the rapidly growing population has increased the consumption of packaged goods, resulting in increased general waste. This is true of South Africa as well. Household waste generation in South Africa is at its highest level ever, which is of great concern [1–3]. Globally, waste is expected to reach 3.40 billion tons by 2050 [1]. In South Africa, endless efforts have been put in place to encourage sustainable behavior, but to little effect. The recycling habits of consumers have simply not kept up with the huge generation of waste [4]. In 2015, waste accounted for 13% of municipal solid waste globally [5]. In South Africa, 55 million tons of waste were produced in 2018, with only 11% of this being diverted into landfill sites [6]. If not addressed, the increasing waste generation could cause more harm not only to the economy but also to the health and living conditions of the people of the country. Recycling supports environmental protection by reducing carbon emissions [7]; however, South Africa recorded 10% of waste recycling in 2018 [8].

Recycling is a strategy used for the reduction of the negative effects of waste on the environment [9]. The high rate of waste requires that consumers' attitudes be determined to

understand how they can be engaged with recycling with the intention of influencing their actual recycling behavior. The recycling behavior of consumers in South Africa has steadily decreased, with fewer and fewer consumers in townships being involved in recycling. Strydom [8] proved that, in South Africa, urban consumers are more involved in recycling behavior, while those in townships are less involved due to limitations in the provision of refuse and sanitation services [10–12]; for example, studies state bluntly that township consumers generally do not have access to refuse and sanitation services. Municipal services in South African townships are often inconvenient, inaccessible, and costly [12,13], and Smith [14] cites the lack of access to facilities needed for recycling purposes as an inhibiting factor for township consumers' involvement in recycling.

Recycling involves the conversion of waste into reusable materials, which are then brought back into industrial processes [15]. Recycling is a useful and sustainable production method that can be used to reduce pollution, thereby effectively addressing environmental concerns [16]. Discarded waste that is not recycled can cause significant environmental problems [17]. A more effective way of reducing household waste is required which might involve the recycling of packaging in daily life [18].

Given the huge gap between township consumers', hereafter referred to as users, environmental concerns, recycling awareness, and actual recycling behavior, it is important that they are engaged with recycling and develop actual recycling behavior to create sustainable recycling campaigns in townships. Studies have pointed to the significance of consumer engagement in driving recycling behavior as part of addressing climate change [19–22]. However, very few studies have investigated recycling user engagement in South Africa, and none of these studies have investigated township consumer recycling engagement behavior, instead focusing on urban areas [5,23,24]. Studies on recycling behavior mainly determine the factors influencing recycling behavior [8,25,26]. To achieve the main aim of this study, which is to investigate the effect of user recycling engagement on actual recycling, the study adopted the extended theory of planned behavior. The collection of waste in South African townships is less effective and inefficient [27] compared to traditionally white suburbs, which receive better services [8,28]. Consumers residing in South African township areas generally dispose of their waste informally in the streets or between their houses and shacks due to the lack of refuse and sanitation services [10,11,29]. Two of the biggest townships in South Africa, Soweto and Alexandra, fall within the parameter of the City of Johannesburg. The City of Johannesburg generates more than 1.5 million tons of general waste annually, with the average lifespan of general waste being 10 years in landfill sites [30]. User engagement with household waste recycling refers to how affectionately, cognately and behaviorally present consumers as users are, as well as how dedicated they are to the recycling of household items [31].

Although there are ample studies on consumer engagement, there are only a few empirical studies on engagement from a recycling perspective. Yet, it is crucial for individual households to feel engaged for the recycling process to work [32]. Municipalities in SA are failing to work closely with the communities as a result of low awareness of recycling as a waste management strategy [33]. Current studies have indicated a lack of awareness and interest in recycling, especially in townships [34], which is why this study determined the drivers of recycling engagement and actual recycling behavior. The study also responded to a call by [35] for research on what determines household waste and disposal. The study further responds to calls for recycling behavior studies applying the TPM model in different research settings and contexts [25], as well as to country-specific research [36].

SA is reportedly 30 years behind many developed and developing nations in offering effective waste management systems [37]. Although legislation exists that can be used to enforce recycling in the country, the country still faces low recycling rates, possibly

due to the inability to enforce these regulations [38]. In some townships, consumers walk long distances to the nearest waste container, which may contribute to low recycling rates [39] and the practice of dumping garbage on the streets [12]. While some promotional activities have been launched in SA in the past decades to encourage recycling activities, these initiatives seem to have been fruitless due to the absence of recycling infrastructure, ineffective regulation enforcement, mismanagement of municipal waste, and insufficient education on waste disposal [37].

A study by [38] reported a high level of dissatisfaction among residents due to inadequate collection of recyclable waste. Respondents were also found to have a low level of knowledge about recycling of waste, with limited recycling initiatives taking place within their communities. Kubanza [39] proposed a public awareness campaign as a mechanism to create recycling awareness and encourage effective waste sorting systems in townships, which would require the involvement of all stakeholders, both private and public, in the recycling process. The situation in SA is like that of other developing countries, where between 50 and 80% of municipal waste generated ends up in landfills [40]. In some developing countries, inadequate infrastructure and limited funding are significant barriers to effective waste management service delivery [41–43]. The differences in socio-economic and political situation across developing countries have also contributed to the mismanagement of waste [41]. The poor management of waste systems in SA is like that of other developing countries such as Nigeria, Rwanda, and Pakistan [42–45].

Developing countries fail to implement efficient and effective waste management processes [46]. This leads to the mismanagement of waste that they generate [47]. For example, in Nigeria, recycling of waste such as plastic is largely ignored, with cities generating of the majority of the waste [48]. The ineffectiveness of recycling policies in Nigeria has resulted in the country losing opportunities to recycle 32 million tons of solid waste that are generated yearly in the country [49]. Other countries, such as Ghana, Kenya, Rwanda, and Sudan, face similar challenges, including increased waste generation, insufficient waste disposal sites, and a high level of dependency on landfill instead of recycling [41,50]. A study in Kenya identified socio-economic factors, recycling infrastructure, cultural factors, as well as negative public attitude as barriers to recycling in the country. The study further indicated that social norms and active involvement of communities in recycling, through sharing of information and providing recycling support services, could lead to actual recycling behavior [51–54].

A study by Wardrop, Dzodzomenyo, Aryeetey, Hill, Bain., & Wright [40] found that Nigeria generates a higher rate of plastic waste compared to other nations, such as Ghana and Liberia. A study in Uganda revealed the availability of facilities such as physical space for segregation containers, functional social networks in the communities, financial rewards, and awareness of the benefits of recycling benefits, together with community support, could drive actual recycling behavior [55].

2. Literature Review

Sekhampu [56] define townships as an underdeveloped areas that include racially segregated metropolitan areas earmarked for non-whites including Africans, Indian and all people of color during the partied system. Townships constitute over a quarter of SA population due to growing urbanization from rural areas to cities and consist of 76 large townships [57]. This has led to overcrowding in townships resulting in increased waste and pollution which has affected service delivery due to limited and aging infrastructure [57].

Townships were established during the apartheid era when people were segregated according to the color of their skin. Black people were not allowed to live in the cities and urban areas but could only live in townships. Township areas were far from cities

and residents were required to travel quite a distance to the closest shopping area. The residents in the townships did not have the opportunities and advantages associated with life in cities, since they were excluded due to their geographical location and were as well as, materially and psychologically [58]. Townships dwellers were and are still excluded from quality service delivery, with poor waste management service delivery [59] resulting in many residents living in unhealthy and even life-threatening conditions. Providing such services could involve them into recycling which could minimize the unhealthy conditions by diverting packages from landfill [60].

South Africans still face inequalities and unevenness in waste management delivery services due to geographic and demographic characteristics such as geographical location and socio-economic characteristics, respectively [60]. These disparities are linked to the apartheid era laws that excluded non-whites such as Africans, Indians and other people of color from receiving services offered to whites in the country resulting in people from, low-income areas such as the township are receiving poor municipalities that those in high income areas [61].

Municipalities in SA have made major strides in service delivery. However, townships still face inequality of service delivery including the waste management services even after 30 years of democracy [62]. Municipalities in the country have failed to address the service delivery gap between urban and townships areas with the latter still not access reliable and sustainable waste management services [63]. This applies to township areas that predominantly host Africans who are historically marginalized [63,64]. This is also linked to the inability of some township consumers to pay rates and taxes while some have no title to their land [65].

2.1. The Extended Theory of Planned Behavior (TPB)

The theory of planned behavior (TPB) is used to explain why individual consumers engage in specific targeted behavior [66]. The theory was developed by [67] in 1991 as an extension of the theory of reasoned action (TRA). TPB is widely regarded as one of the most popular and validated social-cognitive models of human behavior [67]. According to the TPB theory, behavior is guided by the intention of an individual intention to perform a certain act and is a function of three main factors: attitude toward the behavior, subjective norms (SN), and perceived behavioral control (PBC) [68]. The theory is considered one of the most influential in explaining people's behavior [69] and has been applied in many studies and different contexts producing differing findings [70–73] and has thus been validated as a relevant model for studying recycling behavior. As appears in Table 1 below, the findings show the application of the TPB model differ for different developing and developed economies as well as for different contexts. Current studies recommend extending the TPB model for increased predictive power [74]. Therefore, this study has included factors such as facilitating conditions, personal norms and environmental concern since these have been considered to be a major barrier for recycling in low-income areas [3,8,74].

Table 1. TPB application.

Model Applied and Source	Country	Context	Findings
TPB [8]	SA	Urban consumers recycling behavior	All three TPM constructs influence recycling intention
TPB [75]	SA	Urban middle income consumers-recyclers and non-recyclers	Attitude and social norms influenced both recyclers and no-recyclers while perceived behavioral control did not have a significant effect on non-recyclers

Table 1. Cont.

Model Applied and Source	Country	Context	Findings
TPB model and Schwartz's Value Theory (1992) [76]	Mexico	e-waste recycling	All three TPM constructs influence recycling intention. Social norms reduce the overall predictive power of the model.
Extended TPB [77]	United Arab Emirates (UAE)	e-waste recycling intention/young consumers	Subjective norms and behavioral control do not influence e-waste recycling
TPB [78]	USA	Public Service Announcement (PSA) video on recycling engagement	All three TPM constructs influence recycling intention
Extended TPB [79]	Ghana	Acceptability and use of waste bin	Attitude and subjective norms influence Acceptability and use of waste bin. Perceived behavioral control did not have such influence
TPB [80]	Ghana	Households' source separation intention	Attitude and subjective norms influence households' source separation intention. Perceived behavioral control did not have such influence
TPB [81]	Nigeria	Urban consumers, Lagos	Attitude and effect on recycling intention while social norms did not have such an effect. Perceived behavioral control influenced purchase behavior
TPB [82]	India	e-waste recycling	All three TPB constructs influence recycling intention
TPB [83]	Bangladesh	Recycling behavior	Attitude and Perceived Behavioral Control insignificant at 95% confidence level while social norm is completely insignificant
TPB [26]	Lithuania	Textile waste recycling	All three TPB constructs influence recycling intention
TPB [35]	Algeria	Green Start-Ups for Collection of Unwanted Drugs	All three TPB constructs influence recycling intention

TPB is preferred in most studies due to its flexibility in incorporating other factors determining behavior [84,85]. However, TPB also has its limitations, and therefore studies have extended the TPB model and demonstrated its ability to predict consumer behavior [69] to enhance its ability to predict consumer behavior [86]. This study has adopted the extended TPB to explain the influence of recycling user engagement on actual recycling behavior.

Previous studies identified different factors explaining recycling behavior with no consensus among them [87]. This could be due to the different contexts of these investigations and the fact that recycling behavior is being studied across interdisciplinary research areas.

2.2. Recycling Engagement

The term “engagement” has been used to describe the nature of specific interactions and/or interactive experiences by individual consumers. In most studies consumer engagement denotes a tool that can be used to create, build and enhance consumer relationships [88]. Engagement is a multidimensional construct that is dynamic in nature and emerges at different levels of intensity over time [48]. Engagement has been applied in different contexts including brand communities' engagement [87,88], engagement in online communities [89,90], social and online communities [91–93], and advertising [94].

The literature review brought to light different contexts, subjects and conceptualization of the concept [95,96]. Engagement as a concept has been applied widely in different domains including psychology, political science, organizational behavior and sociology [97] as well as how people engage in specific behaviors [98]. This study applies engagement in a consumer behavior context, specifically recycling behavior.

The recycling process involves an individual collecting and processing of the materials for use in the production of new products instead of throwing them away [18]. Recycling behavior draws from considerable efforts by an individual through the sorting, preparing, and storing of the waste, which is some form of engagement, and is influenced by a series of factors [99].

Engaging users in specific activities over time leads to continued and committed behavior. Engaging users is associated with positive behaviors such as stronger consumer-brand relationships, increased satisfaction and loyalty, as well as increased purchasing [100]. Most research studies on user engagement focus on brand communities' engagement and social media engagement. The current study focuses on engaging consumers as users in recycling and how this can influence actual recycling behavior. Engaging consumers in recycling can lead to increased recycling activities. Ref. [101], like [102], noted the importance of actively engaging users in recycling as an effective waste management strategy. This would require the identification and classification of waste into various categories such as compost, glass, paper, metal, and plastic. Engaging users into recycling by developing waste sorting engagement is an enabler for sustaining the recovery of resources, reduction in landfill space, as well as for increasing the rates of recycling [103]. It should be noted that high intention to recycle might not lead to actual recycling [104]. Ref. [85] opined that the buying behavior patterns of users influence how they engage with recycling implying the differences in consumer recycling behavior. However, it proved that there was a link between user engagement and recycling behavior [103]. Refs. [105,106] also agree that user engagement significantly influences the level of recycling in communities and encourages specific behavior change.

2.2.1. Recycling Attitude (RA) and Actual Recycling Behavior (AB)

Ajzen [67] defines attitude as relating to human behavior in which an individual is either favorable or unfavorable towards a specific action. It is important to study attitude since it has an influential role in decision making [67], and when people are favorable towards a particular action, it leads to positive consequences [107]. In the context of recycling, attitude refers to a favorable disposition or emotion toward recycling. Attitude was proven to be a key component in driving environmental behavior positively and to have a positive relationship with recycling intention [108,109]. Attitude was also found to moderately influence the relationship between personal norms and recycling behavior [109]. Razali, Daud, Weng-Wai, & Jiram [110] found little that attitude has towards waste separation behavior while other studies found attitude to significantly influence recycling behavior [111–114].

H1a: *Recycling attitude (RA) positively and significantly influences user intention to engage in recycling.*

H1b: *Recycling attitude (RA) positively and significantly influences actual recycling behavior (AB).*

2.2.2. Perceived Behavioral Control [PBC] and Actual Recycling Behavior (AB)

Ajzen [67] defines perceived behavioral control (PBC) as referring to user's perception about how easy or difficult it is to perform a specific action. Perceived behavioral control differs among individual consumers depending on how they perceive their ability

or inability to perform a specific action [18]. It reflects consumers past experiences and the associated obstacles with performing an action [111]. Existing studies have presented conflicting findings on the effect of perceived behavioral control on individual consumers' intention to engage in recycling with some demonstrating the effect that perceived behavioral control has on recycling engagement intentions [66,109,111,115,116] while others show an insignificant impact [116,117] demonstrating the need for further investigations of these relationships in different contexts. Kumar [116] reported a stronger effect that perceived behavioral control has on user intention to engage in recycling while [66] reported that individual consumers with strong perceived behavioral control exhibit a strong intention to engage in recycling. Perceived behavioral control was reported to positively and significantly influence actual recycling behavior (AB) via user intention to engage in recycling [111].

H2a: *Perceived behavioral control (PBC) positively and significantly influences user intention to engage in recycling (UE).*

H2b: *Recycling attitude (RA) positively and significantly affects the perceived behavioral control (PBC).*

2.2.3. Subjective Norms [SN] and Actual Recycling Behavior (AB)

As defined by ref. [67], subjective norms refer to the social pressures individual consumers perceive pushing them to act or not to act in a particular way. It captures the feelings that an individual has from social pressures about a given behavior which includes restrictions from family, friends, the law and regulations [18]. The presence of subjective norms in consumer behavior signifies the importance of significant others in influencing individual consumers to perform a certain action. Subjective norms have more influence towards actual recycling behavior when it is positive than when it is negative [118,119]. The influence of subjective norms on behavioral intentions has been confirmed in existing studies [111,115]. Ref. [120] as well as [121] confirmed that subjective norms have an influence on pro-environmental behavior, and thus recycling behavior. Refs. [117,122] highlighted the significant impact that subjective norms have on recycling intention. However, ref. [37] study failed to confirm that the relationship between subjective norms and recycling intention is significant and positive. The mediation effect of subjective norms (SN) on actual recycling behavior (AB) via user intention to engage in recycling (UE) was supported by refs. [111,123].

H3a: *Subjective norms (SN) positively and significantly determine the user's intention to engage in recycling (UE).*

H3b: *Subjective norms (SN) positively and significantly have a relationship with actual recycling behavior (AB).*

2.2.4. Personal Norms (PN) and Actual Recycling Behavior (AB)

Personal norms refer to a situation when users feel they have a moral obligation to perform or refrain from performing in a specific manner [124], an element considered the most influential determinant of norm-oriented behavior [120]. Strong personal norms increase the likelihood of environmentally friendly behavior [125]. Ref. [121] reported that personal norms were highly associated with the intention to recycle. Ref. [126] found that people with a sense of moral obligation regarding the environment were more likely to engage in reduction behaviors. In this study, personal norms are defined as a sense users perceive of the moral obligation they have towards recycling. Acting personal norms makes people feel that there is a moral obligation to use recyclable product packages. Ref. [127]

confirmed the effect of personal moral norms on recycling intention. Ref. [128] found that personal norms strongly influence consumers' behavioral intention. Refs. [129,130] indicated the mediation role of personal norms in the adoption of electric vehicles and pro-environmental behavior.

H4a: *Personal norms (PN) positively and significantly influence user intention to engage in recycling (UE).*

H4b: *Personal norms (PN) have a positive and significant relationship with recycling attitude (RA).*

H4c: *Personal norms (PN) positively and significantly influence actual recycling behavior (AB).*

2.2.5. Facilitating Conditions (FC) and Actual Recycling Behavior (AB)

The importance of facilitating conditions (FC) was proposed by [131] who argued that such conditions were necessary for a particular behavior to be exhibited and to determine if such would occur or not [132]. This included the necessary resources needed to facilitate a certain favorable behavior [133]. Facilitating conditions consist of factors such as time, cost, and the necessary bins and sorting facilities that are needed for recycling purposes [134,135]. The presence and absence of these conditions greatly influence consumer behavior towards recycling [136]. Ref. [137] argued for the need to determine the explanatory potential of recycling facilities on consumers' recycling behavior. Ref. [138] found an insignificant effect of facilitating conditions on behavioral intention. Studies have supported the mediating effects of facilitating conditions on intention with [139] stating that absence of facilitating conditions moderated the relationship intention and actual behavior while others reported no such effect [140].

H5a: *Facilitating conditions (FC) positively and significantly influences user intention to engage in recycling (UE).*

H5b: *Facilitating conditions (FC) positively and significantly influences actual recycling behavior (AB).*

H5c: *Facilitating conditions (FC) positively and significantly influences perceived behavioral control (PBC).*

2.2.6. Environmental Concerns (EC) and Actual Recycling Behavior (AB)

Environmental concern (EC) refers to the attitude an individual consumer has regarding the environment and their concerns about its degradation [141]. It measures the level of awareness of environmental problems and the efforts needed to address these challenges [142]. Ref. [18] highlighted the importance of investigating the relationship between environmental concerns and recycling behavior stating that the higher the public concerns about the environment, the more environmentally conscious people become. Ref. [143] supports that the more concerned the public is about the environment, the more they adopt a positive attitude towards environmental behavior. Ref. [144] also claims that the more environmentally concerned the public is the more positive is their attitude towards environmentally friendly behavior.

Testing the indirect effect of environmental concerns [145] proved a significant relationship with individual behavioral intentions. Ref. [146] found that personal norms mediate the effect of environmental concerns on behavioral intention. Ref. [128] reported the direct effect of environmental concerns on consumers' behavioral intention and that the personal norms mediate this relationship. Ref. [146] supported [147], citing that those environmental

concerns have a high predictive power towards behavioral intention. The influence of environmental concerns (EC) on subjective norms (SN) was confirmed by [148].

H6a: *Environmental concerns (EC) positively and significantly influence recycling attitude (RA).*

H6b: *Environmental concerns (EC) positively and significantly influence personal norms (PN).*

H6c: *Environmental concerns (EC) positively and significantly influence subjective norms (SN).*

H6d: *Environmental concerns (EC) positively and significantly influence user intention to engage in recycling (UE).*

H6e: *Environmental concerns (EC) positively and significantly influence actual recycling behavior (AB).*

2.2.7. Recycling User Engagement and Actual Recycling Behavior (AB)

Ref. [67] defined a consumer's behavioral intention as the level at which they are willing to try harder and the extent of the effort exerted in performing a certain action. The individual consumer's behavioral intention can predict their specific behavior, which is also influenced by individual attitude, perceived behavioral control, and personal norms [66]. Ref. [4] as well as [116] concluded that consumers' recycling intention positively and significantly influences actual recycling behavior. Ref. [4] further found that a consumer's intention to do recycling had a mediate the effect of recycling attitude, subjective norms, perceived behavioral control and actual recycling behavior. As indicated by ref. [66], when consumers are highly motivated to recycle, they will be more likely to engage in actual recycling behavior.

H7: *Consumers' intention to engage in recycling positively and significantly influences actual recycling behavior (AB).*

Against the above background, the following additional hypotheses were formulated

H8: *Consumers' intention to engage in recycling mediates the effect of recycling attitude on actual recycling behavior (AB).*

H9: *Consumers' intention to engage in recycling mediates the effect of perceived behavioral control on actual recycling behavior (AB).*

H10: *Consumers' intention to engage in recycling mediates the effect of subjective norms (SN) on actual recycling behavior (AB).*

H11: *Consumers' intention to engage in recycling mediates the influence of personal norms on actual recycling behavior (AB).*

H12: *Consumers' intention to engage in recycling mediate the effect of facilitating conditions (FC) on actual recycling behavior (AB).*

H13: *Consumers' intention to engage in recycling mediates the effect environmental concerns (EC) on actual recycling behavior (AB).*

The hypotheses above appear in the conceptual model in Figure 1 below:

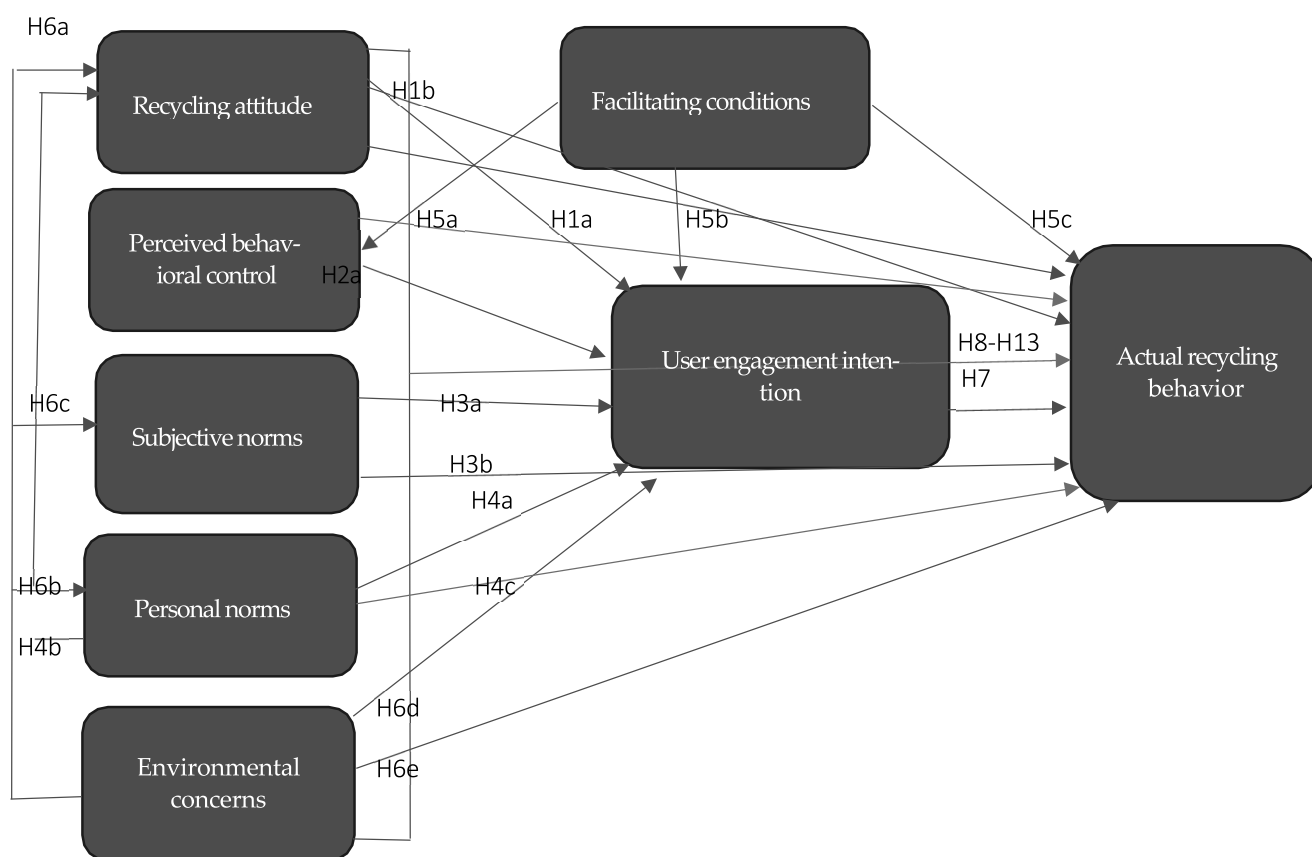


Figure 1. Conceptual model.

3. Materials and Methods

3.1. Target Population

The sample ideal for this study was South African township dwellers. Townships in South Africa are home to a diverse population consisting of people from different races, ethnic groups and age groups [3,149]. Townships in South Africa have been largely ignored by municipalities and receive minimal service delivery [12,60]. Although recycling occurs in townships, the large amount of general waste lying on township streets and vacant areas calls for action to increase recycling behavior by individual consumers living in these townships [55,149]. Figure 2 below shows the general waste in townships.



Figure 2. Recycling in townships Source: [Own].

The participants for this study consisted of males and females between the ages of 18 and 65. The study had eight constructs consisting of 3 items for recycling attitude, 7 items for perceived behavioral control, 4 items for subjective norms, 3 items for user engagement intention, 4 items for actual recycling behavior, 3 items for environmental concerns, 5 items for personal norms and 4 items for facilitating conditions. All together there were 33 items. The respondents totaled 411 and were considered sufficient as recommended by ref. [150]. A random sampling method from a national consumer panel of 40,000 was used. Random numbers were assigned to each participant and the first 1000 members were selected and invited to participate in the study. Only the participants who met the criteria for the study, e.g., township consumers were selected. Table 2 below shows the demographics of the respondents.

Table 2. Demographics data.

Criterion	Val	<i>n</i>	%
Gender	Male	275	66.9%
	Female	136	33.1%
	Total	411	100.0%
Age	18–24 years	116	28.2%
	25–29 years	111	27.0%
	30–40 years	145	35.3%
	41–50 years	28	6.8%
	51–59	7	1.7%
	60+	4	1.0%
	Total	411	100.0%
Marital status	Married	96	23.4%
	Unmarried	315	76.6%
	Total	411	100.0%
Level of education	Did not complete high school	11	2.7%
	Completed Grade 12/matric	154	37.5%
	Completed short courses	25	6.1%
	Post-school qualification—diploma or certificate	119	29.0%
	Post-school qualification—degree	102	24.8%
	Total	411	100.0%
Income	R0–R2500 [\$132]	103	25.1%
	R2501 [\$132]–R5000 [\$264]	69	16.8%
	R5001 [\$264]–R7500 [\$397]	68	16.5%
	R7501 [\$397]–R12,500 [\$661]	64	15.6%
	R12,501 [\$661]–R20,000 [\$1058]	65	15.8%
	More than R20,000 [\$1058]	42	10.2%
	Total	411	100.0%

From Table 2 above, one can see that most respondents were male, between 18 and 29 years old, unmarried, with a post-school qualification and earning an income of up to \$264.

3.2. Measures

The measurement scales for this study were sourced from validated studies. The scales were measured using a 7-point Likert scale which was operationalized to measure the recycling behavior of township consumers.

The measurement items had 7 items for perceived behavioral control [151], 3 items for attitude [152], 4 items for subjective norms [153] 3 items for environmental concerns [151], 5 items for personal norms [154], 4 items for facilitating conditions [155], 3 items for recycling engagement intention [156], and 4 items for actual recycling behavior [157]. All the questionnaire items were measured using a 7-point Likert scale.

3.3. Data Analysis

The data analysis carried out to test the conceptual model for the study was achieved through the use of SPSS Amos 27 software. The analysis included confirmatory factor analysis (CFA) and was performed to assess the quality and accuracy of the measuring model and to test validity and reliability. Further analysis included structural equation modeling (SEM) which was needed to determine if the proposed research model could be used to explain actual recycling behavior. SEM is considered useful when testing complex relationships since it runs the multiple regression equations simultaneously and accounts for the measurement error in the model [158]. SEM tests the causality of relationships between variables and determines the contribution of each towards the overall performance. It combines factor analysis and multiple regression analysis and allows for the analysis of relationships among multiple variables [159].

4. Results

Using SEM, the conceptual model was tested. The results of the analysis are presented in Tables 3–7 and Figure 2 below and included the model fit indices, validity, reliability, and path estimates.

Table 3. Model fit indices.

Indices	CMIN	df	CMIN/df	GFI	NFI	TLI	CFI	RMSEA	SRMR
Values	509.49	247	2.063	0.91	0.93	0.95	0.96	0.051	0.046

4.1. Validity and Reliability

The reliability of the scale was computed through Cronbach's α using IBM SPSS 28. The Cronbach's α for each item ranged from 0.819 to 0.902, which is supported in current studies [155]. The Cronbach's α for recycling attitude was 0.847; for perceived behavioral control = 0.835; subjective norms = 0.883; user engagement intention = 0.902; actual recycling behavior = 0.819; environmental concerns = 0.890; personal norms = 0.825; and facilitating conditions = 0.821.

The model conceptualized for this study was assessed for fitness. This was achieved before the testing of hypotheses. The confirmatory factor analysis (CFA) was used to determine the measurement model and multiple fit criteria using the model fit indices. The indices produced satisfactory values of $\chi^2 = 509.49$; $df = 247$, $\chi^2/df = 2.06$; CFI = 0.96; TLI = 0.95; RMSEA = 0.051 as supported by [160] who state that the goodness-of-fit index (GFI), CFI, TLI, IFI, relative fit index (RFI) and NFI, must be greater than or equal to 0.9 to show a good model fit and that any value greater than 0.8 can marginally be accepted. The model fit indices appear in Table 2.

Iriyadi., & Puspitasari [161] suggested that the factor loading, construct reliability and average variance extracted (AVE) must have a threshold of 0.70, 0.70 and 0.50, respectively,

to assess the constructs' validity and the reliability of the measurement model. The construct validity was achieved through convergent and discriminant validity, as supported by Hair, Anderson, Tatham., & Black [162]. Two approaches were used to achieve this. The factor loadings were all above 0.5, the average variance extracted was also above 0.5 and the composite reliabilities were also above 0.7, thus indicating that the measurement model has sufficient convergent validity [163]. Table 3 below shows the reliability and validity values.

To measure the discriminate validity, the heterotrait–monotrait (HTMT) ratio was used, which showed that all the ratios were lower than the acceptable values of 0.85 [158].

The common method bias was tested through the Harman single-factor model. The model showed poor model fit–fit ($\chi^2/df = 8\,000$; CFI = 0.59; TLI = 0.57; RMSEA = 0.131; SRMR = 0.101). These values of the indices demonstrated that the common method bias was not significant and did not threaten any validity.

Table 4. Internal and external validity testing.

Construct	Item	Factor Loadings	Cronbach's Alpha	Composite Reliability	Average Variance Extracted
RA	RA 1	0.863	0.847	0.859	0.671
	RA 1	0.701			
	RA 1	0.788			
PBC	PBC 1	0.782	0.835	0.842	0.576
	PBC 2	0.760			
	PBC 3	0.776			
	PBC 4	0.844			
SN	SN 1	0.845	0.833	0.877	0.725
	SN 2	0.777			
	SN 3	0.873			
PN	PN 1	0.797	0.825	0.829	0.619
	PN 2	0.695			
	PN 3	0.779			
EC	EC 1	0.867	0.890	0.894	0.738
	EC 2	0.807			
	EC 3	0.856			
FC	FC 1	0.810	0.876	0.835	0.630
	FC 2	0.657			
	FC 3	0.792			
I	I 1	0.864	0.902	0.906	0.763
	I 2	0.827			
	I 3	0.885			
ARB	ARB 1	0.600	0.758	0.770	0.532
	ARB 2	0.781			
	ARB 3	0.635			

Table 5. HTMT Analysis.

	PN	AB	EC	FC	PBC	RA	SN	UE
PN								
AB	0.590							
EC	0.543	0.343						
FC	0.511	0.645	0.400					
PBC	0.613	0.507	0.615	0.558				
RA	0.260	0.304	0.459	0.222	0.483			
SN	0.657	0.490	0.418	0.419	0.537	0.172		
UE	0.477	0.567	0.453	0.459	0.614	0.613	0.396	

4.2. Hypothesis Testing: Direct Relationships

The results of the conceptual model testing are presented below in Tables 5 and 6.

The hypothesis H1a, that recycling attitude (RA) positively and significantly influences user intention to engage in recycling (UE). This hypothesis is supported ($t = 6.836$, $p < 0.001$). The standardized beta coefficient (0.499) indicates that recycling attitude explains about 50% of the variation in user intention to engage in recycling which implies that by changing user attitude, the user intention to engage in recycling will increase by 50%.

H1b which states that recycling attitude (RA) positively and significantly influences actual recycling behavior. This hypothesis is also supported with a p -value of 0.007 and a standardized beta coefficient of 0.177 ($t = 2.565$). The effect of recycling attitude on actual recycling behavior (AB) is about 17%, by changing user attitude, the actual recycling behavior will increase by 17%.

H2a: Perceived behavioral control (PBC) positively and significantly influences user intention to engage in recycling (UE). This hypothesis is also supported with a p -value of 0.001 and a standardized beta coefficient of 0.253 ($t = 3.163$). The effect of perceived behavioral control on user intention to engage in recycling is about 25%, which implies that by changing perceived behavioral control, the user intention to engage in recycling will increase by 25%.

H2b: Perceived behavioral control (PBC) positively and significantly influences user intention to engage in recycling (UE). This hypothesis is also rejected with a p -values of 0.986 and a standardized beta coefficient of 0.004 ($t = 0.044$).

H3a: Subjective norms (SN) positively and significantly influence user intention to engage in recycling (UE). This null hypothesis is rejected (Std $\beta = 0.076$, $t = 1.462$, $p = 0.143$). This implies that subjective norms do not significantly explain the user's intention to engage in recycling.

H3b: Subjective norms (SN) positively and significantly influence actual recycling behavior (AB). This hypothesis is supported ($t = 2.491$, $p = 0.013$). The standardized beta (0.142) shows that subjective norms explain about 14% of actual recycling behavior, which implies that by changing subjective norms actual recycling behavior will increase by 14%.

H4a: Personal norms (PN) positively and significantly influence user intention to engage in recycling (UE). This hypothesis is supported ($t = 3.017$, $p = 0.001$). The standardized beta of 0.181 shows an 18% contribution towards explaining user intention.

H4b: Personal norms (PN) positively and significantly influence actual recycling behavior (AB). This hypothesis is supported ($t = 12.180$, $p < 0.001$). The standardized beta of 0.609 shows a contribution of 61% towards subjective norms.

H4c: Personal norms (PN) positively and significantly influence actual recycling behavior (AB). This hypothesis is supported ($t = 6.379, p < 0.000$). The standardized beta of 0.421 shows a contribution of 42% towards subjective norms.

H5a: Facilitating conditions (FC) positively and significantly influences user intention to engage in recycling (UE). This hypothesis is supported ($t = 4.818, p < 0.001$). The standardized beta (0.318) indicates that facilitation conditions explain about 32% of user intention. This implies that increasing facilitating conditions could lead to 32% increase on use intention to engage in recycling.

H5b: Facilitating conditions (FC) positively and significantly influences actual recycling behavior (AB). This hypothesis is supported ($t = 7.515, p = 0.001$). The standardized beta (0.496) indicates that facilitating conditions have an effect of 50% towards explaining actual recycling behavior.

H5c: Facilitating conditions (FC) positively and significantly influences perceived behavioral control (PBC). This hypothesis is supported ($t = 12.378, p < 0.001$). The standardized beta (0.557) indicates that facilitating conditions have an effect of 56% towards explaining perceived behavioral control.

H6a: Environmental concerns (EC) positively and significantly influence recycling attitude (RA). This hypothesis is supported ($t = 6.896, p = 0.001$). The standardized beta (0.462) shows a 46% contribution of environmental concerns towards explaining the variation in recycling attitude.

H6b: Environmental concerns (EC) positively and significantly influence personal norms (PN). This hypothesis is supported ($t = 10.840, p = 0.001$). The standardized beta of 0.542 shows that the effect of environmental concerns on explaining personal norms is stronger than the effect of EC on UE (54%).

H6c: Environmental concerns (EC) positively and significantly influence subjective norms (SN). This hypothesis is supported ($t = 7.207, p < 0.001$). The standardized beta of 0.418 shows a medium effect that environmental concerns have towards subjective norms.

H6d: The hypothesis that environmental concerns (EC) positively and significantly influence user intention to engage in recycling (UE) was accepted (Std $\beta = 0.278, t = 3.159, p = 0.001$).

H6e: The hypothesis that environmental concerns (EC) positively and significantly influence actual recycling behavior (AB) was accepted (Std $\beta = 0.115, t = 3.159, p = 0.001$).

H7: Consumer intention to engage in recycling (UE) positively and significantly influences actual recycling behavior (AB). This hypothesis is supported ($t = 4.029, p < 0.001$). The beta coefficient of 0.274 implies that user intention explains about 27% towards actual recycling behavior.

Table 6. Direct relationships.

Hypotheses	Standard Beta Coefficient	S.E.	t-Values	p-Values	Decision
H1a	0.499	0.073	6.836	0.001	Supported
H1b	0.177	0.073	2.565	0.001	Supported
H2a	0.253	0.080	3.163	0.001	Supported
H2b	0.004	0.080	0.044	0.986	Rejected
H3a	0.076	0.052	1.462	0.143	Rejected
H3b	0.142	0.057	2.491	0.013	Supported
H4a	0.181	0.060	3.017	0.001	Supported
H4b	0.609	0.050	12.180	0.001	Supported
H4c	0.421	0.060	6.379	0.000	Supported

Table 6. *Cont.*

Hypotheses	Standard Beta Coefficient	S.E.	t-Values	p-Values	Decision
H5a	0.318	0.066	4.818	0.001	Supported
H5b	0.496	0.066	7.515	0.001	Supported
H5c	0.557	0.045	12.378	0.001	Supported
H6a	0.462	0.067	6.896	0.001	Supported
H6b	0.542	0.050	10.840	0.001	Supported
H6c	0.418	0.058	7.207	0.001	Supported
H6d	0.278	0.088	3.159	0.001	Supported
H6e	0.115	0.063	1.825	0.056	Supported
H7	0.274	0.068	4.029	0.001	Supported

Table 7. Indirect relationships.

Path	Total Effect	Direct Effect	Indirect Effect	S.E.	t-Val	p-Val	Decision
H8: RA → UE → AB	0.203	0.047	0.156	0.049	3.184	0.001	Supported
H9: PBC → UE → AB	0.005	−0.073	0.078	0.030	2.600	0.001	Supported
H10: SN → UE → AB	0.119	0.102	0.018	0.013	1.385	0.104	Rejected
H11: PN → UE → AB	0.382	0.270	0.033	0.017	1.941	0.007	Supported
H12: FC → UE → AB	0.434	0.390	0.042	0.018	2.333	0.001	Supported
H13: EC → UE → AB	0.185	−0.133	−0.016	0.022	−0.727	0.364	Rejected

4.3. Hypotheses Testing: Indirect Relationships

H8: The effect of recycling attitude (RA) on actual recycling behavior (AB) is mediated by user intention to engage in recycling (UE). The hypothesis is supported (indirect effect = 0.156, $t = 3.184$, $p < 0.001$).

H9: The influence of perceived behavioral control (PBC) on actual recycling behavior (AB) is mediated by user intention to engage in recycling (UE). The hypothesis is supported (indirect effect = 0.078, $t = 2.600$, $p < 0.001$).

H10: The effect of subjective norms (SN) on actual recycling behavior (AB) is mediated by user intention to engage in recycling (UE). The hypothesis is not supported (indirect effect = 0.0018, $t = 1.385$, $p = 0.104$).

H11: The effect of personal norms (PN) on actual recycling behavior (AB) is mediated by user intention to engage in recycling (UE). The hypothesis is supported (indirect effect = 0.033, $t = 1.941$, $p = 0.007$).

H12: The influence of facilitating conditions (FC) on actual recycling behavior (AB) is mediated by user intention to engage in recycling (UE). The hypothesis is supported (indirect effect = 0.042, $t = 2.333$, $p = 0.001$).

H13: The influence of environmental concerns (EC) on actual recycling behavior (AB) is mediated by user intention to engage in recycling (UE). The hypothesis is not supported (indirect effect = −0.016, $t = −0.727$, $p = 0.364$).

Figure 3 below shows the results of the hypotheses presented above:

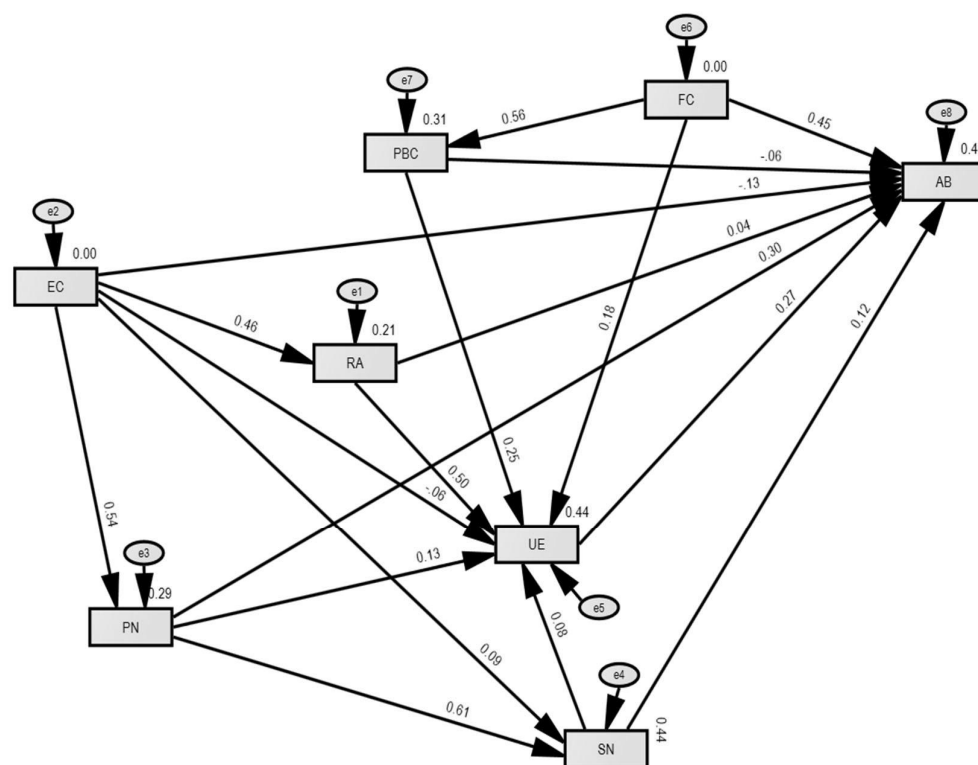


Figure 3. Path model.

5. Discussions and Implications

This study used the extended theory of planned behavior to investigate the recycling engagement intention and actual recycling behavior of township consumers in South Africa. The study proposed 15 direct hypotheses, and 6 indirect hypotheses. The results of hypotheses H1a and H1b testing confirmed the association between recycling attitude and actual recycling behavior. Compared to other variables in the TPB model, the association showed a stronger effect, with predictive power of 50%, validating that changing individual consumer attitude can influence someone's intention to engage in recycling and actual recycling behavior. The effect towards user intention to engage in recycling is stronger than for actual recycling behavior. The results are supported by [108,111]. Cho [66] as well as Tiew, Basri, Deng, Watanabe., & Zain [164] found that attitude significantly influence the intention to adopt recycling behavior. Contradicting studies, however, found that recycling attitude has little influence while others reported that it did not even have an association with user intention to engage in recycling [110]. The differences in these findings could be linked to the fact that they targeted a different population. For example, Cho [66] targeted university students while [108] targeted the urban community with curbside recycling program. Of the variables with a direct relationship with user intention to engage in recycling, recycling attitude explains 50% of user intention to engage in recycling while perceived behavioral control, personal norms, facilitating conditions and environmental concerns explain 25%, 18% and 32% and 28%, respectively.

H2a shows a positive association between perceived behavioral control (PBC) and user intention to engage in recycling which supports hypothesis H2a. The effect that PBC has on the user's intention to engage in recycling is much lower than the effect that recycling attitude (RA) has on the user's intention to engage in recycling. Individual consumers are influenced by their ability to have control over their recycling behavior. The effect of PBC on user intention to engage in recycling is widely supported in existing studies [66,111,115].

The significant effect on the relationship between subjective norms (SN) and actual recycling behavior (H3c) demonstrates that the subjective norms of individual consumers

should be used to influence them to engage in actual recycling. These results support the findings in existing studies [120,121]. For example, [66] found SN to be the most influential determinant of AB. The influence of SN on AB is supported by de Leeuw, Valois, Ajzen., & Schmidt [165].

A positive association is also shown between personal norms (PN) and actual recycling behavior (H4c) which implies that PN do influence consumers to engage in actual recycling. This demonstrates that consumers feel obligated to engage in recycling. This study however found that PN has a very strong association of 60% with subjective norms (SN), more than it has with actual recycling behavior (42%). The results are in line with the findings of Gholamrezai et al., and Shi et al., [121,126].

H5b a positive association between (FC) and AB. This validates the notion that consumers' actual recycling behavior depends on available facilities. FC has the strongest predictive power of 50% towards actual recycling behavior. The association between FC and UE is weaker compared to the association between FC and AB demonstrating that the more available the facilities need for recycling purposes, the more likely consumers can recycle [136,137].

A positive relationship between EC and AB (H6e) was found, but lower than that of EC and RA (H6a), as indicated by 46% predictive power of EC regarding RA. EC predict UE with a predicting power of 0.278, more than with AB with a predicting power of 0.115. Another strong and positive relationship was found between EC and PN, which showed that EC has a 54% predictive power regarding PN. It appears that consumers who are concerned about the environment feel obligated to recycle, implying that increasing environmental awareness and knowledge about the environment is likely to increase consumers' intention to engage in recycling. This assertion is supported in existing studies by [18,128]. EC was found to have an insignificant effect on subjective norms (SN) (H6c), a finding also supported by Song et al., [128].

UE shows an association with (AB), supporting H7. This validates existing reports that intention as a relationship with behavior as proven in existing studies [4,37].

Regarding the mediation effect of EU on the relationship between RA, PN, FC and EC with AB, RA has a stronger effect (0.156).

The hypotheses testing the mediation of user intention to engage in recycling with recycling attitude (RA) (H8), perceived behavioral control (PBC) (H9), personal norms (PN) (H11) and facilitating conditions (FC) (H12), were all accepted except for H10 and H13. These results signify the importance of engaging consumers in recycling since it leads to actual recycling behavior. The results further indicate that recycling engagement is an added value to the relationship and leads to increased predictive power of facilitating conditions, and personal norms on actual recycling behavior. User engagement in recycling influence the relationship between perceived behavioral control and actual behavior while it reduces the predictive power of attitude on actual recycling behavior. These findings are in line with the findings of [4] as well as [166,167]. The insignificant mediation effect of UE on the relationship between SN and AB was by Taufiq & Vaithianathan [168] and differs from [4,111,169].

6. Conclusions

6.1. Theoretical Recommendations

This study proposes theoretical contributions to enhance insights into recycling behavior, especially within the context of South African townships. The study adopted the extended theory of planned behavior (ETPB) to investigate township consumers' actual recycling behavior. By applying the ETPB model, the study validated its applicability in explaining the recycling behavior of township consumers.

This study found that recycling attitude, subjective norms, personal norms, facilitating conditions and environmental concerns positively and significantly influence actual recycling behavior, whereas perceived behavioral control was found to have had no such effect. Existing studies did not apply these concepts to the recycling behavior of township dwellers, and this study therefore fills a gap in this regard. This study confirms that by enhancing facilitating conditions, changing personal norms, and improving the recycling attitude of township consumers, their actual recycling behavior could be increased. The study also adds to current knowledge since it could not confirm the effect of perceived behavioral control of consumers' intention to engage in recycling—something which was found in existing studies [127]. The unique contribution of this study lies in the finding that social norms can predict actual recycling behavior and not user intention to engage in recycling. This could be because social pressure from the community and other stakeholders motivates users to recycle, which demonstrates the importance of engaging the community in creating recycling awareness and improving recycling in various locations. The study further makes unique contributions by finding that perceived behavioral control did not have a significant influence on actual recycling behavior. This could be due to township customers believing that they do not have any influence over the services and facilities provided by municipalities, especially since some of them belong to lower-middle, working-class, and low-income groups.

This demonstrates that extending the theory of planned behavior could help explain consumer intention to engage in recycling. Of the constructs that were tested to determine the factors driving township consumers to engage in actual recycling, facilitating conditions, personal norms, and recycling attitude had the highest predictive power of 50%, 42%, and 18%, respectively. This is supported by current studies that produced similar findings [113] but also differ from others than produced higher predictive power. Cho [66] states that the various strengths of the theory of planned behavior differ in different contexts. This study contributes to the validation that other factors, such as personal norms, facilitating conditions, and environmental concerns, also influence township consumers' actual recycling behavior. The study also demonstrates that adding these factors to the TPB model could enhance actual recycling behavior. This is true for facilitating conditions which have been identified as one of the major barriers to recycling in developing countries.

This study also demonstrates that the non-TPB constructs, such as personal norms and facilitating conditions, also mediate the relationship between user engagement intention to recycle and actual recycling behavior, as does perceived behavioral control and recycling attitude. This implies the need to also consider additional factors in determining township consumers' recycling behavior.

6.2. Practical Recommendations

This study has practical implications for policy makers, government, municipalities, and concerned organizations. The study has confirmed the effect of recycling attitude, subjective norms, personal norms, facilitating conditions, and environmental concerns on consumers' actual recycling behavior. Therefore, policy makers and municipalities should invest efforts in changing township consumers' attitude towards recycling, enhancing facilitating services as well as taking cognizance of people's personal norms. This would require that they give more information and communicate more clearly about recycling and its impact on society, the environment, and climate change. This could be in the form of a promotional campaign that not only creates awareness of recycling and its impact on the environment but also links it to projects that involve and increase consumer participation in recycling projects. Recycling projects could be launched within the township communities, especially for unemployed residents with monetary rewards.

Township consumers generally feel obligated to engage in recycling. This implies that they have a strong sense of morality that will compel them to engage in recycling. Since personal norms are associated with the intention to engage in recycling, government and municipalities could ensure that they legislate the involvement of individual consumers in recycling. For example, it could be made law that anyone dumping waste in the streets, or any unlawful public space, will be prosecuted. Municipalities could also sponsor recycling projects taking place in the townships and publicize the activities to demonstrate their commitment to encouraging and supporting actual recycling behavior.

Since this study found that facilitating conditions influence consumer intention to engage in recycling and their actual recycling behavior, government and municipalities should consider making it a priority to provide facilitating resources needed for recycling purposes since this will motivate and encourage township consumers to recycle. This requires that facilities such as recycling bins, bags, and others be made available to each individual family in a township. Garbage collection services could be strengthened to include all communities. The distance that consumers travel to the nearest place for dumping could also be reduced to discourage those dumping waste on street level. Municipalities could ensure that the collection of recyclable items from allocated collection areas is made easily accessible [84]. Facilities and services that could ensure the separation of waste could be provided [68]. Municipalities could further determine how they can work collaboratively with household consumers in searching for solutions for the efficient and effective way of managing waste [67]. Incentives could also be considered in townships that encourage actual recycling behavior. Recycling initiatives involving communities could be established and the technical knowledge of recycling could be shared, e.g., how to separate waste at source and other methods of recycling [170,171].

Since the relationship between environmental concerns and actual recycling behavior was found to be significant, municipalities could continuously communicate the effect of recycling on the environment to ensure that township consumers stay aware of the negative effect of not getting engaged in recycling and for them to gain further knowledge on the importance of recycling. Communication efforts could also be directed towards encouraging people to become actively involved in recycling.

The study has confirmed that TPB constructs such as recycling attitude and perceived behavioral control mediate the relationship between user engagement intention and actual recycling behavior except for personal norms. The non-TPB construct, facilitating conditions, was also found to mediate the relationship between user engagement intention and actual recycling behavior. Municipalities, governments, and organizations involved in recycling could change consumer attitude and make available much-needed resources such as recycling bins, bags, and other necessary things to increase actual recycling behavior.

6.3. Limitation and Directions for Future Research

This study has several limitations. The first limitation relates to the participants of the study, namely township consumers in South Africa. Township consumers do not represent all consumers in South Africa, since it excludes consumers in rural, urban, and other locations. Future studies could investigate participants from different regions and possibly compare their recycling behavior to determine any differences among them.

The second limitation relates to the theoretical model that is explained by 44% of the variance of consumers' intention to engage in recycling as well as 47% of the variance of actual recycling behavior which means that there are other factors that could explain consumers' intention to engage in recycling and their actual recycling behavior. Future studies could identify additional factors that could influence consumers' recycling behavior.

The third limitation relates to the adoption of the extended theory of planned behavior to investigate the recycling behavior of township consumers. Future studies could also adopt other models to explore if they could be more effective in encouraging actual recycling behavior. Models such as the Swartz value model or the Triandi's of Interpersonal behavior and Norm Activation Model (NAM) could be explored since most studies have explored the TPB modes. Applying these models could help broaden the factors that could be used to drive recycling behavior.

The use of online data collection could also be a limitation since some respondents could rush the completion of the questionnaire to save on data usage. This could possibly cause bias. Since respondents were also reached using different online methods such as email, WhatsApp, and online surveys, this could also influence the quality of the responses. Future studies could combine different data collection methods, including face-to-face interviews and group discussions, to discuss deeper what could further influence township consumers to engage in recycling.

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