BASELINE OF HOUSEHOLD DOMESTIC WASTE RECYCLING BEHAVIOUR IN LARGE URBAN AREAS – SOUTH AFRICA 2010

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Executive Summary

This report presents the findings of a national research project undertaken in late 2010, before the requirements for source separation of recyclables under the National Environmental Management: Waste Act (NEM:WA) (RSA 2008) was implemented. Implementation of the NEM:WA requires changes in the management of waste, including municipal solid waste. Waste separation at household level needs to be implemented and the necessary municipal waste collection services put in place in support of this changed waste management practice.

The aim of the project was to establish a baseline of South African urban household's behaviour with respect to domestic waste recycling. It is envisaged that the findings of this baseline study, a first for the country, can *inform waste management decision-making* and *guide government and industry initiatives* towards implementation of the NEM:WA. It also provides a baseline against which to *monitor growth* in post-consumer recycling and changes in household behaviour. Understanding which variables have the greatest effect on recycling behaviour, can serve as an entry point to *inform communication strategies and information-based policy instruments* which would have an impact in positively changing household behaviour towards increased recycling.

At the time of the waste recycling survey (November 2010) by far the majority of South African households in large urban areas did not recycle (73.1%). Only a very small fraction of the urban households (3.3%) recycled most of their household waste on a fairly frequent basis. The study targeted a representative sample of 2004 households in 11 of the larger urban areas in South Africa. Thus, the figures for recycling behaviour can be extrapolated to the South African population in larger urban areas.

The Theory of Planned Behaviour (TPB) provides a framework for better understanding people's recycling behaviour, and the variables according to Ajzen (1991) that influence behaviour, namely, attitude, subjective norm (social pressure), perceived behavioural control, and intention to recycle.

The majority of respondents hold a negative attitude towards recycling. While the moral component of people's attitude towards recycling was more positive, the results suggest that the perceived inconvenience of recycling is the biggest contributor to the overall negative attitude towards recycling. The social pressure component of the TPB has the largest influence on intention to recycle. However, social pressure to recycle at households is minimal in South Africa. The recycling community (3.3% of the urban population) is too small a group to provide the necessary pressure, particularly in the absence of strong messages from government and industry. Perceived behavioural control is, according to the TPB, the main factor that influences recycling behaviour but, respondents feel that it is not within their control to recycle. However, it is encouraging that respondents are positive about their intention to recycle should they have kerbside collection for their recyclables. The further the distance of a household to a drop-off centre, the less likely it will be that a household will take recyclables to such a drop-off centre.

The TPB was found to explain 26.4% of the variation in recycling behaviour and 46.4% of the variation in intention to recycle for South African urban households. While comparable with international studies, the results confirm that there are other variables than those proposed in the TPB that play a role in recycling behaviour.

The situational factors at household level (space, time and untidiness) are significant reasons why people do not recycle, followed by lack of knowledge and inconvenient recycling facilities. Although the results suggest that recycling facilities exist, the convenience of these facilities is not satisfactory. Further investigation is needed to understand the perceived reasons for this inconvenience.

Based on the research findings, the least complicated separation and waste collection system to accommodate the collection of recyclables at kerbside has the greatest potential to be supported by South African urban households and thus to encourage recycling.

The study results should be interpreted within the general waste management context at the time of the study. Three-quarters of the respondents in large urban areas of South Africa indicated that they receive a kerbside waste collection service. This figure is higher than reported in the Census 2011 findings and highlights the importance of understanding the sub-populations within the South African waste sector. The satisfaction with the general waste collection service in relation to cost, as well as the willingness to pay for additional recycling services has an implication for the provision of a service for the collection of recyclables. The results suggest that households would not be willing to pay for an additional recycling service.

Government and industry need to send out a clear recycling message to all South Africans to compensate for the lack of social pressure that the majority of households in South Africa's large urban areas experience. This can be done through focussed recycling awareness creation communications; creating an enabling environment for South Africans to recycle; and setting a follow-worthy example. Given South Africa's diversity, the ideal enabling environment would not necessarily be the same in all areas. Government should partner with the private waste sector to run public participation processes to determine communities' recycling facilities of choice, to provide the recycling facilities of choice, to create the necessary awareness around the availability or schedules of such a recycling service, to provide the necessary knowledge about what is recyclable and how to recycle, and to provide regular feedback to continuously encourage people to recycle.

Given that not all urban areas are the same, more focussed regional or local recycling behaviour studies are now suggested. This will allow the waste sector to better understand which recycling schemes will and will not work for a community. The influence of situational household factors, as well as the other barriers to recycling, and the possible solutions to overcome these barriers, needs to be further investigated through qualitative research.

The study has provided a very good, and particularly useful, first national baseline of post-consumer recycling behaviour in large urban areas, which has been well received by the waste sector. Monitoring of household recycling behaviour against this baseline will be highly relevant to the implementation of waste legislation. In addition, opportunities for numerous further studies are recognised.

1 INTRODUCTION

This report presents the findings of a national research project undertaken in late 2010. The aim of the project was to establish a baseline of South African urban household's behaviour with respect to domestic waste recycling.

The report consists of four sections. The introduction, **Section 1**, provides the background and context within which the results as discussed in the remaining sections should be interpreted. The research method is briefly described in **Section 2**. The results are presented in **Section 3**, in four distinct sub-sections: the first dealing with level of satisfaction with waste management services; the second presents the results within the Theory of Planned Behaviour theoretical framework; the third presents the barriers to recycling at household level; and the fourth sub-section presents the results from three ancillary variables which potentially influence recycling behaviour, namely, awareness of recycling facilities, willingness to pay for recycling services, and knowledge that enables recycling. In **Section 4**, the authors draw some conclusions from the results and recommendations on the way forward.

1.1 Background to the study

Population growth, combined with increased consumption rates and a throw-away culture has resulted in increased waste generation. In many municipalities in South Africa waste is a low priority and waste management is not given the attention it needs, resulting in the failure of waste management services (RSA 2000; Nhamo *et al.* 2009). Many municipalities in developing countries do not have sufficient solid waste management systems (Bartone 2004, Abdrabo 2008, Imam et al. 2008, Parrot et al. 2009, Kgosiesele and Zhaohui 2010). The challenged waste management situation is thus not unique to South Africa.

Implementation of the National Environmental Management: Waste Act (NEM:WA) (RSA 2008), which came into effect on 1 July 2009, requires changes in the management of waste, including municipal solid waste. Waste separation at household level needs to be implemented and the necessary municipal waste collection services put in place in support of this changed waste management practice (NEM:WA Sections 7(2) *(a)*, 22(2) and 23(2), and Section 4.1 of the National Domestic Waste Collection Standards (RSA 2011)).

To date, waste recycling in South Africa focussed on pre-consumer recycling – the recovery of recyclable materials from pre-consumer commercial and industrial processes. In order to increase the national recycling figures, the national recycling initiative needs to be expanded to also include household recyclables (Oelofse and Strydom 2010).

Shifting the focus of the South African recycling sector to include post-consumer recycling requires dedicated household participation and, as such, drives the need to understand the change in recycling behaviour that is needed at household level, as well as in municipalities and in the recycling industry in South Africa.

1.2 Purpose of the study

This report discusses the findings from a survey conducted during November 2010 before the requirements for household recycling under NEM:WA were implemented. The purpose of the baseline study, a first for the country, was three-fold: firstly the study ascertained the status of recycling behaviour in South Africa at household level at a given point in time; secondly it captures people's perceptions of the barriers to recycling before the waste act was implemented; and thirdly, it provides guidance on which interventions at household level would be the most successful to encourage and maximise household recycling behaviour. The survey was conducted amongst 2004 residents in large urban areas in South Africa.

Focussed research provides insight into the attitudes and perceptions that drive waste management behaviour. Such insight provides a basis for effective evidence-based policy and management decisions. It is envisaged that the findings of this study can *inform waste management decision-making* and *guide government and industry initiatives* towards implementation of the NEM:WA. It also provides a baseline against which to *monitor growth* in post-consumer recycling and changes in household behaviour. Understanding which variables have the greatest effect on recycling behaviour, can serve as an entry point to *inform communication strategies and information-based policy instruments* which would have an impact in positively changing household behaviour towards increased recycling. For example, how can recycling scheme designs encourage household recycling? How should a recycling scheme be structured, how should it function and where should it be located? Related to communication strategies, what message should awareness programmes convey; what should the timing be; how often and in what form should communications be?

1.3   Waste recycling behaviour

The following section provides an overview of some of the literature which was reviewed and which informed this study.

1.3.1   The Theory of Planned Behaviour

The Theory of Planned Behaviour (TPB) is the most widely used theoretical framework to explore the relationships amongst variables that have an influence on behaviour (Nilsson and Küller 2000, Armitage and Conner 2001). According to this framework (Figure 1), behaviour is preceded by a person's intention to act a certain way (Fishbein and Ajzen 1975). Three factors (or constructs) determine a person's intention to perform a certain action: attitude towards the behaviour, social pressures (subjective norm), and perceived behavioural control (PBC) (Fishbein and Ajzen 1975, Ajzen and Madden 1986). Attitude is a personal factor which refers to a person's positive or negative evaluation of the behaviour and subjective norm is a social factor which refers to the perceived social pressure to comply with the specific behaviour. Both attitude and subjective norm are grounded in the belief systems of a person (Ajzen and Madden 1986). The third factor, PBC, is independent of subjective norm and attitude and is the degree to which a person believes they are capable and able to perform the specific behaviour. PBC exerts influence on both the intention to behave, as well as independently on the behaviour itself (Ajzen 1985).

Given the successful application of the TPB in other empirical studies (Francis *et al.* 2004, Tonglet *et al.* 2004, Barr 2007), the TPB is also used in this study to explain and help understand recycling behaviour in urban households in South Africa. Within the framework of the TPB, the sub-questions interrogated in this report are:

1. Which variables have the greater effect on urban household recycling behaviour?
2. Are the findings from the South African baseline study similar to the findings of international studies of domestic waste recycling behaviour to allow generalisation and thus co-learning across boundaries?
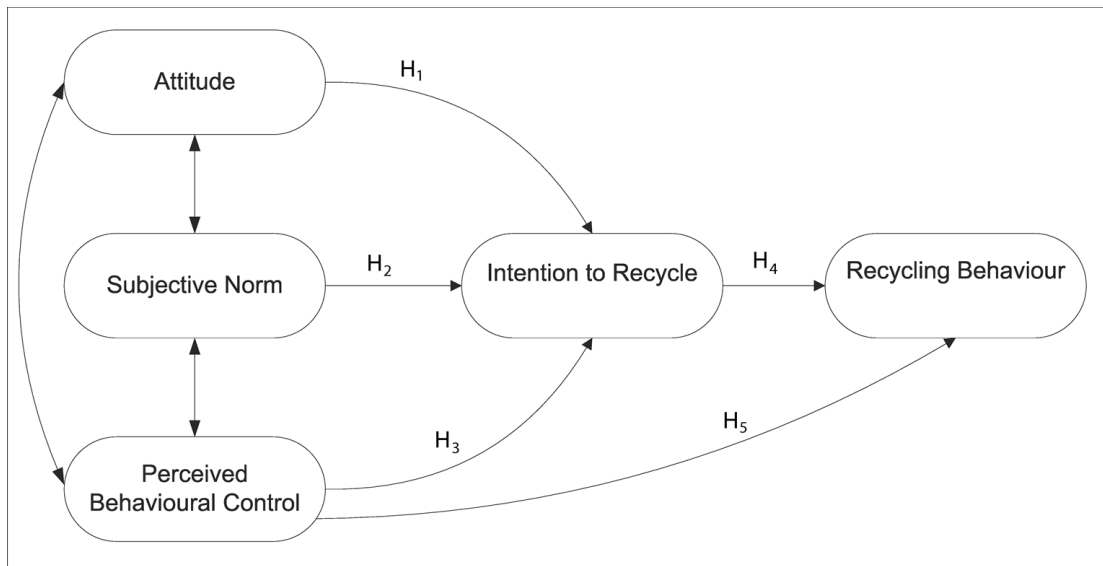
Figure 1. The Theory of Planned Behaviour as applied for recycling behaviour (after Ajzen and Madden, 1986)

To determine which variables have the greater effect on recycling behaviour, several hypotheses are formulated and shown in Figure 1. The hypotheses are:

H_1 A positive attitude has a positive effect on intention to recycle
H_2 Social pressures to recycle (the beliefs and the judgements) has a positive effect on the intention to recycle
H_3 The more a person perceives he/she has control over the act of recycling, the greater the intention to recycle
H_4 Intention to recycle has an effect on recycling behaviour
H_5 The more a person perceives he/she has control over the act of recycling, the more positive the recycling behaviour

1.3.2   Reasons for non-recycling

Barr (2007:468) emphasises that the intention to act does not necessarily result in the actual behaviour, and that "*recycling is governed chiefly by normative and convenience-based factors*". Barr (2007) concludes by recommending several situational and psychological variables which most probably have an effect on recycling behaviour. In a similar study on reasons why people do not recycle, McDonald and Oats (2003) allowed respondents to formulate their own perceived barriers to recycling. McDonald and Oats (2003) considered their qualitative approach complimentary to the many quantitative UK studies on barriers to recycling.

Several studies have been conducted during the past more than two decades in an attempt to identify the barriers to recycling on household level with the ultimate aim to increase recycling behaviour (Chung and Poon 1996, Seik 1997, Perrin and Barton 2001, McDonald and Oats 2003, Barr 2007, Timlet and Williams 2011). The sections below review the findings from these international studies which explored the reasons for non-recycling. The main barriers are grouped and discussed according to four categories, namely, *situational factors* at household level; *knowledge*; situational factors related to *recycling facilities*; and, *psychological factors*.

1.3.2.1 Situational factors at household level

Not having the time is reported as one of the main reasons why households do not recycle (MORI 2002, Robinson and Read 2005, Ojala 2008, Omran *et al.* 2009, Miafodzyeva 2010). Before the introduction of kerbside collection schemes in Bradford and Leeds in the UK, not having time was the most mentioned reason why surveyed households did not recycle (Perrin and Barton 2001). The time constraint is mainly due to the time it requires to take recyclables to drop-off sites (McDonald and Ball 1998, MORI 2002). Households consisting of retired people are typically those with more time on hand and showed higher recycling participation rates (Martin *et al.* 2006).

Several studies found insufficient space, both inside and outside homes, as a reason why households do not recycle (De Young 1990, MORI 2002). Storage space is one of the logistical issues that negatively influence recycling rates (Perrin and Barton 2001, MORI 2002, McDonald and Oates 2003, Martin *et al.* 2006, Ojala 2008). People living in flats in particular, compared to those living in loose-standing houses, might find it too crowded to separate and store recyclables (MORI 2002, Miafodzyeva 2010). A UK study suggests that recycling participation is higher in areas where there is space in gardens to store recycling bins and bags (Robinson and Read 2005).

The possibility of unpleasant odours is another reason why households do not want to recycle (Ojala 2008, Miafodzyeva 2010). The feeling of untidiness that is associated with keeping and storing of recyclables can also have a negative effect on recycling behaviour (MORI 2002).

1.3.2.2 Knowledge

Knowledge of recycling includes a number of issues, including an awareness of the locality of recycling facilities (Barr 2007, Vicente and Reis 2008), knowing how to recycle at home, and which materials are recyclable (De Young 1990, Vicente and Reis 2008). The value of knowledge about recycling to increase recycling rates is confirmed by several studies. Robinson and Read (2005) found that well targeted communications which increase awareness, such as door-to-door delivery of promotional material on recycling, can have a major impact on individuals' commitment to recycle. Perrin and Barton (2001) found that providing participants in a recycling scheme with regular feedback and recycling information increased the recovery of recyclables, e.g. the recovery of food cans increased when the "how to" message was communicated that the cans "don't have to be clean to be in the recycling scheme" (Perrin and Barton 2001:70). Regular feedback together with the visibility of a recycling bin also serves as a much needed reminder for people to put recyclables out (McDonald and Ball 1998, Perrin and Barton 2001).

1.3.2.3 Situational factors related to recycling facilities

Recycling behaviour is not only dependent on awareness of recycling facilities and knowing how to recycle; it is also dependent on perceptions of how convenient it is to recycle (Perrin and Barton 2001, Barr 2007). Several studies identified collection of recyclables at kerbside as a primary motivator to encourage households to recycle (McDonald and Ball 1998, MORI 2002, Barr 2007) and Chung and Poon (1996) found that binary sorting of waste was preferred to multi-sorting.

Access to good recycling facilities is essential to encourage recycling behaviour (Robinson and Read 2005, Barr 2007, Shaw and Maynard 2008). A reliable, convenient and easy to use recycling service will support maximum participation in such a recycling scheme (Martin et al. 2006). Higher participation levels are also reported with the provision of receptacles for recyclables (Robinson and Read 2005). Improving recycling schemes, the infrastructure and the operation thereof, to suit household preferences has greater potential to positively change householders' recycling behaviour than either incentives or penalties (Shaw and Maynard 2008). Timlett and Williams (2011) argue that a combination of infrastructure, service delivery and consumer behaviour determines efficient recycling.

According to Vicente and Reis (2008), the recycling of household waste is everybody's responsibility and this responsibility should be communicated. If there is someone in the household that constantly reminds everyone to recycle, it helps to foster recycling behaviour (MORI 2002). Tucker (2001) showed that recyclers have a stronger sense of responsibility – attitudes of "duty" – towards recycling than non-recyclers. However, both groups felt that recycling was a local authority responsibility (Tucker 2001). Although recycling facilities of which households approve have the greater potential to change recycling behaviour (Tucker 2001, Shaw and Maynard 2008), the type of recycling scheme that is provided does not influence people's inherent feeling of responsibility towards recycling (Tucker 2001). This contradiction – recyclers having a stronger sense of responsibility, approved facilities positively change recycling behaviour, and type of scheme does not influence feelings of responsibility – emphasises the complexity of understanding recycling behaviour, which is not an exact science.

Several studies showed that a disinterest to recycle is a barrier to recycling. More than 14% of the respondents in a study by Robinson and Read (2005) indicated disinterest in the recycling schemes that were available in the London borough in the UK, and 10% and 9% of the respondents in Glasgow and Falkirk, respectively (McDonald and Ball 1998). In a study in the northern part of Malaysia (Omran et al. 2009), 21% of the respondents showed a disinterest in recycling, the third highest reason given for non-recycling.

Some non-recyclers reported that it is not necessary to recycle, that it would not make a difference whether they recycle or not (McDonald and Ball 1998). Being assured that a household's contribution to recycling could make a difference in the bigger scheme of waste management would encourage recycling behaviour (Shaw 2005). It is unlikely that individuals who feel indifferent to recycling would recycle (Vicente and Reis 2008) and thus, the challenge is to replace indifference with concern (Vicente and Reis 2008).

2 RESEARCH METHOD

2.1 Research design

To measure current levels of waste recycling behaviour in South Africa; testing of the Theory of Planned Behaviour (Section 3.2); and identification of the main reasons for non-recycling (Section 3.3), a descriptive quantitative research approach was followed (Creswell 2003, Leedy and Ormrod 2005). A fixed-form survey with selection of options was used to gather data within a short period of time (Babbie and Mouton 2001). A structured questionnaire standardised the interview process by ensuring that the same questions were posed in the same way[1] (Kempton *et al.* 1996).

2.1.1 Sampling

This study targeted a representative sample of households in large urban areas in South Africa. A total of 2004 households in 11 of the larger urban areas were interviewed: 354 respondents from Cape Town; 330 from Johannesburg; 324 from Durban; 294 from East Rand; 228 from Pretoria; 150 from Port Elizabeth; 115 from Vaal; 66 from East London; 60 from Pietermaritzburg; 54 from Bloemfontein; and, 30 from Welkom. A representative sample of urban households was selected, because a household's income is not always related to area of residence. Rural areas were excluded from this study because the National Waste Management Strategy (DEA 2011) set targets for the initiation of separation at

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[1] Markinor rotated the starting point within subsections of the questionnaire (refer to Section 2.1.2 Data collection, for more information on the survey company).

source programmes by 2016 in large urban areas, and because of the uncertainty related to waste management services in many of these areas.

A random probability sampling method was followed and data points weighted to represent as near as possible the South African population in the large urban areas (Babbie and Mouton 2001). A Kish-grid was used to select individual respondents within a household (Kish 1949). The relatively large sample size (n=2004) reduced the effect of sampling errors (Babbie and Mouton 2001, Page and Meyer 2003, Brace 2004). The relatively small sample sizes per area do not allow for statistical analysis of the results per area. The demographic composition of the sample is shown in Table 1.

Table 1: Demographic composition of the sample group (n=2004).

Parameter	Sample distribution	
	n	%
Gender:		
Male	1002	50
Female	1002	50
Total	2004	100
Age (years):		
16-17	69	3.4
18-19	85	4.2
20-24	271	13.5
25-29	215	10.7
30-34	222	11.1
35-39	256	12.8
40-44	205	10.2
45-49	176	8.8
50-54	133	6.6
55-59	95	4.7
60-64	103	5.1
65+	173	8.6
Refused	1	0
Population:		
Black	1338	67
White	290	14
Coloured	255	13
Indian/Asian	121	6
Working status:		
Full-time	665	33.2
Part-time	233	11.6
Not working: housewife	126	6.3
Student	199	9.9
Retired	232	11.6
Unemployed: Looking for work	481	24.0
Not looking for work	68	3.4
Education (formal):		
No schooling	29	1.4
Some primary	113	5.6
Primary school	115	5.7
Some high school	725	36.2
Matric/Grade 12	678	33.8
Artisans certificate obtained	73	3.6
Technikon diploma/degree completed	148	7.4
University degree completed	87	4.3
Professional	15	0.7
Technical	15	0.7
Secretarial	2	0.1

Parameter	Sample distribution	
	n	%
Other	4	0.2
Type of dwelling:		
House/cluster house	1213	60.5
Flat	85	4.2
Matchbox/RDP	348	17.4
Hostel/compound/boarding house	16	0.8
Room in backyard	57	2.8
Shack	276	13.8
Other	9	0.5
Financial status (household income):		
None	46	2.3
R1-<R2k	321	16.0
R2k-<R5k	434	21.7
R5k-<R10k	285	14.2
R10k-<R20k	175	8.7
R20k+	148	7.4
Refused	564	28.1
Do not know	31	1.6
Number of people in house earning income:		
0	72	3.5
1	934	46.6
2	810	40.4
3	132	6.6
4	35	1.7
>4	9	0.5
Refused	13	0.7
Motor vehicle in household:		
Yes	833	41.6
No	1171	58.4
Telephone in house (land line):		
Yes	432	21.6
No	1572	78.4
Television set in household:		
Yes	1919	95.8
No	85	4.2
Radio set in household (in working order):		
1	1207	60.2
2	300	15.0
3	83	4.1
None	414	20.7
Internet access:		
At work	199	18.9
At home	230	4.9
Via cell phone	267	2.0
None	1486	74.2

For correlations between demographic variables and intention to recycle and recycling behaviour, refer to Annexure D.

2.1.2   Data collection

Data was collected for this research by Ipsos-Markinor (Pty) Ltd, a global market research organisation. The larger sample size that professional survey companies guarantee was the most cost effective way to obtain the data and a set of questions was included in the 2010 Markinor Omnibus survey. The

interviews were conducted face-to-face at respondent's homes. If a respondent refused to participate, he/she was substituted using the same procedure in another household. All ethical requirements were adhered to: each participant received and acknowledged receiving a briefing pamphlet that explained the purpose of the study; contact details were provided should further information have been required; anonymity of the respondents was guaranteed; and the identity of the individual respondents cannot be linked back to the data or to their area of residence. Participation was on a voluntary basis and participants did not receive any rewards or incentives for taking part in the survey.

2.1.3   Questionnaire

Data was collected by means of a questionnaire, which consisted of 3 main sections. Sections 1 and 2 consisted of a total of 50 waste and recycling behaviour related questions.

2.1.3.1   *Theory of Planned Behaviour*

The *first section* of the questionnaire made up the constructs or measurements of the Theory of Planned Behaviour, a theory widely used in understanding waste recycling behaviour (refer to Annexure A). The Theory of Planned Behaviour consist of a number of constructs which measure respondents' behaviour, intentions to behave, attitudes, subjective norms and perceived behavioural control. Data was collected for each of these constructs by means of a number of statements. The statements were anchored on either side with strongly agree/strongly disagree or, with two opposite statements, for example bad/good (refer to Annexure A).Where applicable, and similar to many other Theory of Planned Behaviour studies (Francis et al. 2004), 7-point Likert-type rating scales (Likert 1932) and 7-point semantic differential scales were used.

The sequence of questions can influence survey results (Brace 2004). Therefore, the behaviour questions preceded the attitude questions to avoid that the easier factual accounts of behaviour are aligned to match the aspirations acquired with answering the attitude and other questions (Brace 2004).

2.1.3.2   *Current waste management service and reasons for not recycling*

The *second section* of the questionnaire gathered data on respondents' perceptions of their current waste management service and explored the reasons why people do not recycle.

Information on the current collection service for general mixed household waste was collected to provide context for the respondents' perceptions and actions related to recycling. The intention was not to collect national waste collection service data and data on receptacles in use at a national level, but rather to determine a profile of the services which the respondents in this survey receive. The current domestic waste collection service for general mixed household waste, and how respondents experience this service, provides a framework within which householders' perceptions and expectations related to waste collection services are formed. In turn, these perceptions and expectations are conveyed to perceptions and expectations related to recycling services, which ultimately might lead to, or not lead to, recycling behaviour. Apart from discussing the domestic waste collection services for mixed waste which the respondents' received at the time of the survey, this section also show the respondents' level of satisfaction with these services. Information about respondents' experience of their current receptacles for general mixed household waste, could inform decisions about the types of receptacles to use for recycling. Understanding the expectations of communities related to recycling will help to inform the design for recycling schemes; recycling schemes that will be supported and used by the community members. Knowing whether communities would be willing to pay for recycling collection services would also inform decisions about recycling scheme designs.

Being the first study of this kind in South Africa and given the envisaged relatively large sample size of 2004 respondents, this study followed the example of Barr (2007) by providing in the final questionnaire ten possible pre-selected reasons for non-recycling to choose from. Respondents were requested to

select from this list of ten statements the three most important reasons why they think people do not recycle. The question was phrased in an impersonal manner to firstly prevent a desirability bias and to secondly provide respondents that recycle the opportunity to also convey their perceptions about why they think people do not recycle.

The reasons for non-recycling statements, with shortened phrases in brackets as further on referred to in the text, are:

Situational factors at household level
1. They do not have the time (*no time*)
2. They lack space to keep the recyclables (*no space*)
3. Keeping the materials until it is recycled is dirty and untidy (*dirty and untidy*)

Knowledge
4. They do not know what can and what cannot be recycled (*lack knowledge*)

Situational factors related to recycling facilities
5. Recycling facilities are inconvenient (*facilities inconvenient*)
6. Recycling services are poor or does not exist (*recycling services poor/lacking*)
7. They do not have a kerbside collection service for recyclables (*no kerbside collection*)

Psychological factors
8. They are not responsible for recycling in their households (*no responsibility*)
9. They cannot be bothered (*not bothered*)
10. They think it will not make a difference whether they recycle or not (*make no difference*)

2.1.3.3   Demographics

The *third section* of the questionnaire collected basic demographic data on the participants (Refer to Table 1).

2.1.4   Testing of the questionnaire

A draft questionnaire was compiled from a review of the international literature on similar studies. To identify gaps in this early draft of the questionnaire, a pre-study was conducted amongst a small selected group of recyclers and non-recyclers. Closed and open-ended questions were used to identify possible gaps between the international literature and the South African situation (Refer to Annexure B). Thereafter, the draft questionnaire was tested in a pilot study for ease of use and to sharpen the constructs. A small group of individuals (n=59) completed the pilot questionnaire on an anonymous basis. Each construct (measuring tool) was tested statistically for consistency and reliability. After completion of the pilot study the questionnaire was shortened to include those questions that would add the most value.

2.1.5   Latent variables[2]

A short summary of the items that make up each of the constructs of the TPB are provided below (refer to Annexure 1 for a detailed description of the items):

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[2] The reliability of a construct depends on the set of questions or statements. All questions or statements that make up a single construct should measure the same parameter, adding to measure the latent variable as accurately as possible. Leading questions could bias the outcome of a study and should be avoided. For example, if respondents were asked whether they recycle, as a single measurement of their recycling behaviour, the score for recycling behaviour would most probably be much higher than when a group of related probing questions were combined into a behaviour score.

- Recycling behaviour – 3 items: recycling frequency (7 options[3] ranging from never to always), recycling quantity (7 options ranging from nothing to everything for 5 streams of recyclables with space to specify additional recyclables[4]) and taking responsibility (4 options ranging from no one to I am and sometimes someone else is).
- Intention to recycle – 7 items, four testing the probability of recycling under various circumstances and three testing the probability of executing various recycling activities: sorting; putting out recyclables for collection; and, taking recyclables to collection points.
- Attitude towards recycling – 7 items starting with "For your household to recycle is..." anchored on either side with: undesirable/desirable; a waste of time/useful; bad/good; unimportant/ important; useless/useful; a hassle/easy; awakens negative/ positive emotions
- Subjective norm – 5 items: three items about the perceptions of others and two statements about motivation to comply: It is expected of you to recycle; Most of the people important to you want you to recycle; Your municipality thinks it is important for your household to recycle; Your household does not want to recycle/wants to recycle; For your household to recycle is difficult/easy
- Perceived behavioural control – 6 items: three items measure opportunity to recycle and three items ability to recycle: The opportunities for you to recycle are none/plenty; You know how to recycle false/true; To recycle is difficult/easy; There are recycling schemes in your area; The necessary resources and facilities are available that allow you to recycle; You are aware of recycling schemes in your area

2.2 Statistical method

2.2.1 Variables

The mean of the individual items that made up each construct was calculated to derive a score per respondent for each of the constructs. The MS Excel data analysis function was used for descriptive statistics (graphs, frequency tables, the mean scores, percentiles etc.), and for determining measures for variability and relationships between variables (correlation and regression analyses) which was undertaken by the CSIR.

2.2.2 Theory of Planned Behaviour

For data analyses the ordinary least-squares regression method, a mathematical procedure to identify the linear equation that best fits a set of ordered pairs, was used. The Theory of Planned Behaviour was tested by a structural equation model (SEM) fitted to the raw (unstandardised) latent variables[5] to predict recycling behaviour[6].

Each of the constructs was examined for reliability (similar results likely to be obtained with a retest) and unidimensionality (the items in a construct work together to measure one latent trait). The Guttman's lambda 6 (λ_6) (Guttman 1945), as well as the criticised (Sijtsma 2009), but still widely used Cronbach alpha (α) (Cronbach 1951) report reliability, and Revelle's beta (β) report internal consistency (Revelle 1979) (Refer to Annexure C).

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[3] Markinor requested an eighth don't know option which, although not read out, was indicated by 33 of the respondents.

[4] Respondents received the option to specify more types of materials that they recycle, but none of the respondents exercised this option.

[5] Using standardised latent variables would have changed the estimated regression path coefficients (β values), but not the goodness-of-fit statistics (R^2). Standardising the latent variables (LVs) imply that each LV is centred on its mean value and divided by its standard deviation, resulting in LVs with a mean zero and a standard deviation of 1.

[6] The analysis of the data was partly outsourced to Dr Mark Difford, Nelson Mandela Metropolitan University

2.2.3 Reasons for non-recycling

Using MS Excel the total number of times each reason for non-recycling was selected was calculated and expressed as a percentage of the total number of reasons selected.

2.2.4 Missing or inappropriate answers

A small number of respondents gave inappropriate answers in the first section of the questionnaire (scores of 0 or 8 which is equivalent to "not applicable" or "do not know" and do not form part of the 7-point scales). Thirty three respondents indicated that they do not know how often their households recycle. Of these, 29 respondents selected the nothing option in the statement that tested the quantity that households recycle and their "don't know" options was subsequently changed to "never". The remaining 4 respondents' "don't know" option for frequency of recycling was also scored to match their recycling quantity scores. The 33 respondents represent 1.65% of the total sample group. Given the large sample size, these adjustments should have no significant effect, even if the modified scores are incorrect by more than 2 units. The occurrence of inappropriate answers to other items was low and treated as missing. The statistical methods make provision for such instances by dropping those observations with missing values in the specific analyses affected by the missing information, and thus retaining information of non-missing values in other analyses. In the third section of the questionnaire refusal to answer demographic questions was more often which rendered the statistical analysis of such result inaccurate. For example, the financial status was refused by about 25% of the respondents and where applicable the living standards measurement (lsm) was used instead.

3 RESULTS

3.1 Waste management services

3.1.1 Domestic waste collection services for mixed general waste

Three-quarters of the respondents in large urban areas of South Africa (75.8%; 66.8% kerbside and 9.0% combination including kerbside) indicated that they receive a kerbside waste collection service for their general mixed household waste (Figure 2).

A small percentage of the respondents (7.6%) rely on communal waste services: communal and/or informal collections (5.2%); drop-off (1.4%); and, a combination of services (no kerbside) (1.0%). For 5.2% of respondents no waste service (kerbside or communal) is provided and 1.1% of respondents resort to on-site (own site) disposal. Surprisingly 10.3% of respondents do not know how their waste is collected.
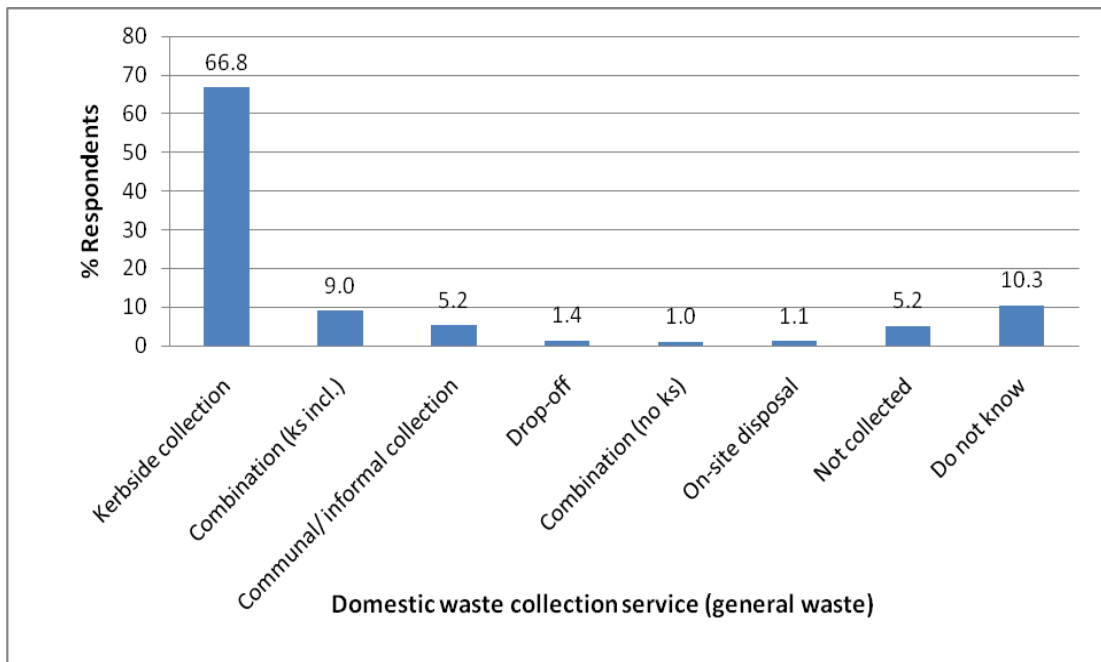
Figure 2. Mixed general household waste collection/disposal service as reported by the sample group of 2004 households in the large urban areas in South Africa.

Since the focus of this research was only on South Africa's large urban areas, it is to be expected that the majority of respondents (75.8%) would report on receiving a kerbside waste collection service by their local municipality (or designated municipal contractor). The figure is higher than the 63.6% of South Africans reported to receive a kerbside refuse removal service by their local authority/private company in the 2011 national census (StatsSA, 2011) (Table 2). This highlights the importance of understanding the sub-populations within the South African waste sector.

Table 2. Comparing the reported waste services of the baseline survey to the national census data

	Urban Baseline 2010	South Africa 2011 [(*)]
Removed by local authority/private company	75.80%	63.61%
Communal refuse dump	7.60%	1.88%
Own refuse dump	1.10%	28.21%
No rubbish disposal	5.20%	5.41%
Other	10.30%	0.89%

[(*)] StatsSA (2011). Census in Brief.

3.1.2   Service satisfaction

While 60.6% of the respondents indicated that they are satisfied with their current waste collection service (sum of blue bars 5-7, Figure 3), 25.1% are not satisfied (sum of blue bars 1-3). The remainder of the respondents (14.3%) indicated the neutral option of neither satisfied nor unsatisfied (bar 4). The percentage of respondents that are satisfied decreases from 60.6% to 36.7% when asked about their satisfaction considering what they now pay for waste collection services – the value for money (hatched bars, Figure 3). The average measure for satisfaction with the current waste collection service for mixed general household waste decreased from 4.75 to 3.74 when the value for money is considered (Table 3).
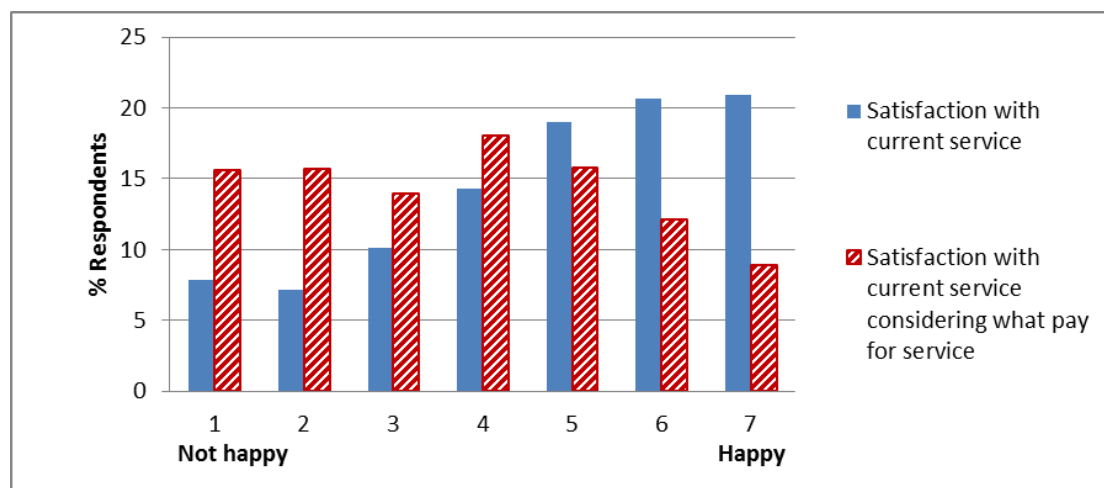
Figure 3.   Householder's satisfaction with current waste collection services for general mixed household waste.

Table 3:   Mean values comparing the satisfaction of respondents with their current waste collection services for mixed general household waste and their satisfaction with the service considering what they pay.

Parameter	$\bar{x}$	SD	n
Happy with current waste collection service for mixed general household waste	4.75	1.85	2004
Considering what pay, happy with current waste collection service	3.74	1.88	2004

3.1.3 Receptacles in use for mixed general domestic waste

The respondents reported a range of waste receptacles currently in use for their general household waste: wheelie bins (39.7% of the respondents), plastic bags (22.5%), bins (18.1%) and bin/bag combinations (10.9%) (Figure 4). The remaining 8.8% of the respondents supply their own receptacles, and is captured with the "none" segment in Figure 4. Of the households that supply their own receptacles, a third reported that they do not receive a general mixed waste collection service.
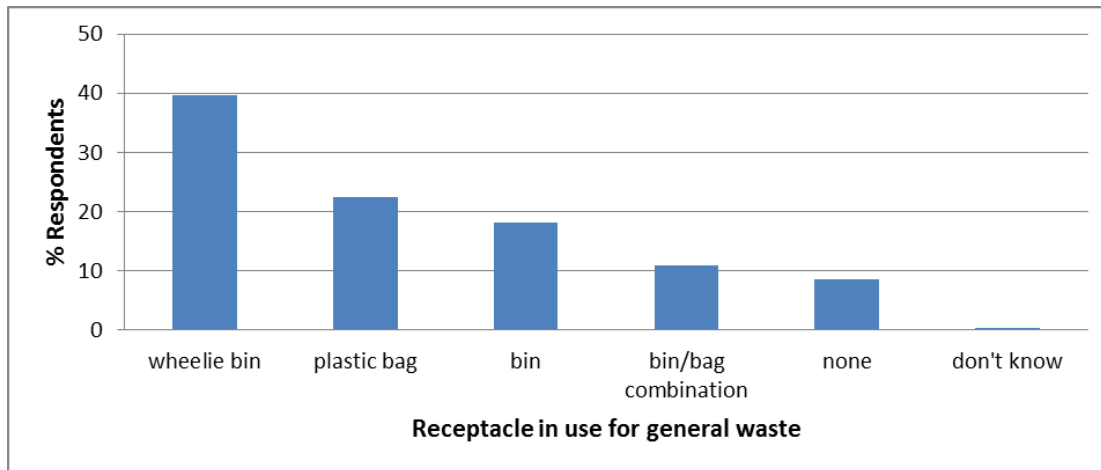
Figure 4. Receptacles in use for mixed general household waste as reported by the respondents (n=1997). Seven respondents (0.35%) chose the other or don't know option and due to being less that 1% when rounded is not included in the diagram.

3.1.4 Level of satisfaction with receptacle type

Excluding those respondents that supply their own receptacles, overall respondents are satisfied with their receptacles for mixed household waste – the mean satisfaction score ($\bar{x}$) is 4.92. Those respondents that do not receive a receptacle and have to supply their own are unsatisfied with their receptacles ($\bar{x}$=3.31).

The results indicate that respondents' level of satisfaction with their household waste receptacles is related to the type of receptacle in use. The level of satisfaction is measured with three items: receptacles are easy to use; receptacles are functional; and receptacles are comfortable. Using average scores as a measure, the respondents that are the most satisfied with their type of receptacle are those with wheelie bins, followed by bins, plastic bags, and bin/bag combinations (Table 4).

Table 4: Satisfaction with receptacle for mixed general household waste. The satisfaction score of each respondent is the mean of three items: functional, easy to use and comfortable.

Receptacle for mixed general household waste	$\bar{x}$	SD	n
Wheelie bins	5.40	1.37	795
Bins	4.68	1.46	363
Plastic bags	4.51	2.52	451
Bin/bag combinations	4.45	1.35	218
None – supply own	3.31	1.39	170

There is no significant difference in satisfaction with specific receptacles between urban informal and formal areas. Figure 5 shows the same data set with the level of satisfaction with receptacles for general mixed household waste on a 7-point scale, ranging from a low (1) to high level of satisfaction (7).
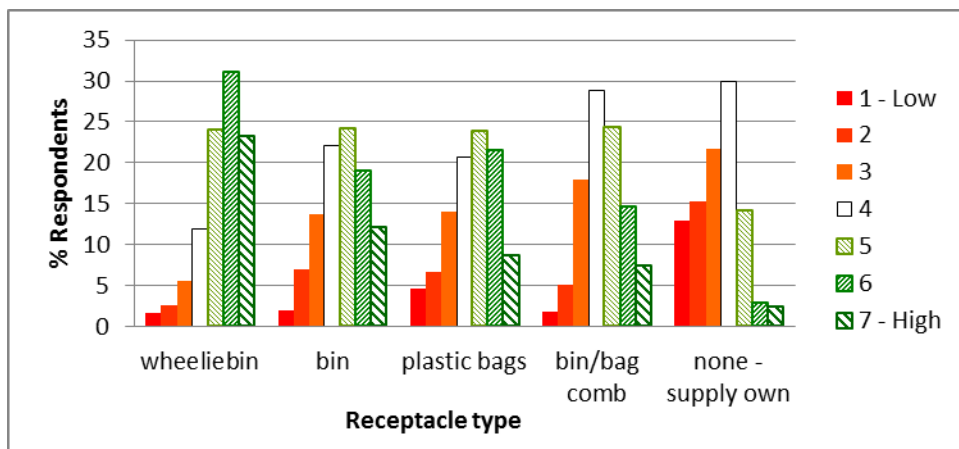
Figure 5. Level of satisfaction with receptacles. Satisfaction is measured with the sum of three items, which each measure the level of agree and disagreement with functionality, ease of use and comfort.

3.1.5 Receptacle size

The majority of respondents chose the neutral middle option (option 4) to indicate whether their receptacles are too small or too big (Figure 6). Where agreement with a receptacle being too small or too large is an expression of dissatisfaction, in this instance, the neutral option indicates satisfaction with the receptacle size (shown by the white bars in Figure 6). These results should be interpreted with caution, because family size is not taken into account.
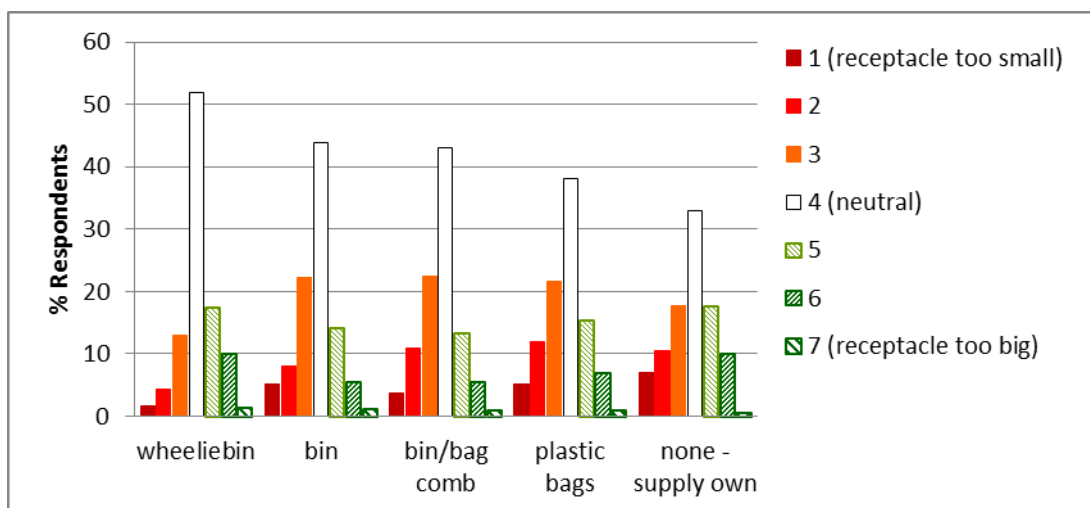
Figure 6. Perceptions about receptacle size, with shades of red indicating the percentage of respondents that agree that their receptacles are too small and hatched shades of green indicating agreement that receptacles are too big.

Fifty two percent (51.8%) of the respondents with wheelie bins chose the neutral option 4, and 28.9% selected an option on the 'too large' side of the 7-point scale (options 5-7). Of the 19.1% that selected an option on the 'too small' side of the 7-point scale (options 1-3), 13.1% choose the option 3 which is just off the neutral/satisfied option. With the mjority (80.7%) of respondents selecting an option 4 to 7,

it can be suggested that wheelie bins are the optimal size or slightly larger than what is needed at this given point in time.

The results for the bin, bin/bag combination and plastic bag receptacles suggest that these receptacles could be slightly on the small side. The majority of users of these three receptacle types are satisfied with their receptacle size (neutral/satisfied white bar): for the bin, bin/bag combination and plastic bag users 43.8%, 43.1% and 38.1%, respectively. More than 35% indicated that their receptacles are too small: for the bin, bin/bag combination and plastic bag users 35.5%, 37.2% and 38.8%, respectively. Less respondents indicated that their receptacles are too big: for the bin, bin/bag combination and plastic bag users 20.7%, 19.7% and 23.1%, respectively.

The data show no correlation between receptacles being either too big or too small and self-reported recycling behaviour (r=0.054) and could be because of the low percentage recyclers at the time of the survey.

3.2 The Theory of Planned Behaviour: A case study

This section presents the results of a case study of the application of the Theory of Planned Behaviour (TPB) to domestic waste recycling in large urban areas in South Africa. The Theory of Planned Behaviour provides a theoretical framework to assess the relationships between attitude, social pressures and perceived behavioural control (PBC) over the act of recycling, as determinants of intention to recycle as well as recycling behaviour.

By understanding attitudes, social pressures, behavioural control and intention, we are better able to understand people's recycling behaviour and the triggers that influence (or not) such behaviour. The understanding which is created through the application of the TPB and the resultant inferences can inform waste management decision-making and guide government and industry recycling initiatives at municipal and household level.

3.2.1 Descriptive statistics

Table 5 shows the descriptive statistics (the mean scores) for each of the constructs or measurements, as well as the values per percentiles. Table 6 – Table 10 include descriptive statistics for each of the items per construct, and Figure 7 – Figure 11 visual presentations of the distributions. The results from each construct are discussed in detail in the sections that follow, concluding with the TPB structural equation model.

Table 5: Descriptive statistics for the latent variables; mean scores and percentiles

Construct	$\bar{x}$	0.05	0.10	0.25	0.50	0.75	0.90	0.95
Recycling Behaviour	1.44	1.00	1.00	1.00	1.00	1.14	2.86	3.57
Intention to recycle	3.76	1.00	1.43	2.57	3.86	4.86	5.71	6.29
Attitude	3.86	1.45	2.00	2.96	3.86	4.71	5.67	6.00
Subjective norm	3.37	1.40	1.60	2.40	3.40	4.20	5.00	5.60
Perceived behavioural control	3.30	1.17	1.67	2.33	3.33	4.00	5.00	5.50

where   1=no recycling behaviour, and
         7=maximum possible recycling activity (n=2004)

3.2.2 Recycling Behaviour

Of the total sample group (n=2004), 540 of the respondents (26.9%) reported some level of recycling behaviour, including very little recycling of one type of recyclable material (i.e. recycling behaviour

scores >1) (Figure 7). The rest of the respondents (n=1464; 73.1%) with a recycling behaviour score of 1, engage in no recycling activity in their households.

About nineteen percent (18.5%) show very little recycling activity, which is indicated with a recycling score of 2 - 3. Another 5.2% of the respondents, with a recycling score of 4, on average recycle about half of their recyclable waste sometime. Only 3.3% of the respondents frequently recycle most of their recyclables (recycling scores of 5 - 7).

The low mean recycling behaviour score ($\bar{x}$=1.44) confirms the low percentage of households in which recycling behaviour, and in particular regular recycling behaviour, is reported (Table 6). The recycling behaviour measurement consists of three components or items: a recycling frequency item; a taking responsibility for recycling in the household item; and a recycling quantity item (Table 6). The latter, the recycling quantities, is measured by the average of the quantities reported to be recycled of each of the five recyclables, namely paper, plastic, glass, metal and compost. The average score for recycling frequency ($\bar{x}$=1.76) is higher than for the other two items in the recycling behaviour construct. The average scores for taking responsibility for recycling in the household and for recycling quantities is 1.44 and 1.35, respectively. (Refer to Annexure A for a full description of the measurement.)
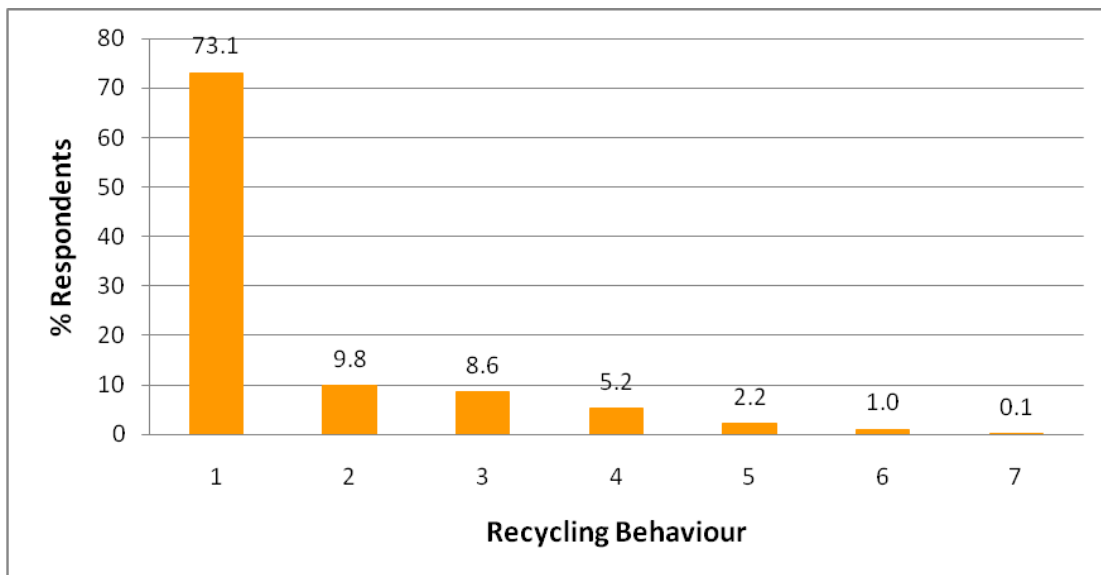
Figure 7.   Self-reported recycling behaviour of the respondents,

Note: Where 1 = no recycling behaviour (recycle nothing, recycle never and nobody takes responsibility for recycling in the household) and 7 = maximum possible recycling activity (always recycle everything that is recyclable and more than one person takes responsibility for recycling in the household).

Due to the random probability sampling method adopted for this study, the figures for recycling behaviour can be extrapolated to the population in South Africa's larger urban areas. Given that the self-reported recycling behaviour is expected to be higher than what it would be if measured (*self-reporting bias,* Armitage & Connor, 2001), the reported figures could be considered to be an optimistic reflection of the domestic recycling situation in South Africa. However, it should be noted that the purpose of this study was not to gather actual recycling rate data[7]. Although self-reported, the recycling

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[7]   Respondents show a higher probability that they intend to recycle than what their self-reported recycling behaviour suggests. In turn, self-reported behaviour is more optimistic than actual behaviour. In the behavioural sciences this is one of the challenges of predicting behaviour (Eagly and Chaiken 1993). There are many external factors that influence the path between intention and action. For example, a person might have the

behaviour figures provide valuable insight into recycling tendencies in South Africa at a given point in time – after the Waste Act came into effect but before separation of waste, as envisaged by the Act, has been widely implemented.

Table 6:   Descriptive statistics for the recycling behaviour measurement and the separate items that make up the construct.

Item	$\bar{x}$	SD
Recycling Behaviour construct (average of items below)	1.44	0.94
Recycling Frequency	1.76	1.55
Taking responsibility in household	1.44	0.89
Recycling Quantities:[8] (average of items below)	1.35	1.11
Paper	1.48	1.32
Plastic	1.44	1.24
Glass	1.41	1.17
Metal	1.27	0.95
Compost	1.27	1.06

Where: 1 represents no recycling activity; and,   7 represents the best possible mean value for recycling behaviour
Note: Recycling behaviour of the respondents (n=2004), consisting of three items: how often does your household recycle, is somebody taking responsibility for recycling in your household and how much does your household recycle of each of the five recyclable materials.

The results show that, at the time of the waste recycling survey (November 2010) by far the majority of South African households in large urban areas did not recycle (73.1%). Only a very small fraction of the urban households (3.3%) recycled most of their household waste on a fairly frequent basis.

The higher self-reporting for recycling frequency compared to recycling quantities is most probably because it is easier to over report recycling behaviour on a "soft" frequency measurement than on actual physical quantities of items recycled. Furthermore, the frequency question was asked first and thus before the respondents could do a reality check of thinking of the actual quantities recycled for each of the five recyclables.

3.2.3   Attitude towards recycling

The distribution of the respondents' mean scores of attitude towards recycling as presented in Figure 8 shows a very slight skewness towards a negative attitude (1-3 on x-axis). The descriptive statistics for the respondents' attitudes (Table 7) confirm the on average slight negative attitude towards recycling with the mean score for attitude towards recycling ($\bar{x}$=3.86) being less than the neutral point of 4.0. Thus, the majority of respondents do not have a positive attitude towards recycling.

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best intention to recycle, but if the person forgets to put the recyclables in the car, or if someone else has put the recyclables out with the general waste, then the actual action cannot be executed. The best intention might also be deliberately ignored if, for example, it is raining on the pre-determined recycling day. Thus, in the mind of the person, he considers himself a recycler, he had the intention to recycle, but according to recycling rate definition, the actual recycling would be zero. Recycling rate = (The recyclables household put out (kg))/(Total available recyclables per household (kg))*100 (DETR 1999)

[8]   Some respondents (3.4%) indicated that their households sometimes recycle, but they failed to indicate recycling quantities of any recyclable materials. The data was not changed and these 68 respondents form part of the 18.5% respondents that reported very little recycling activity.
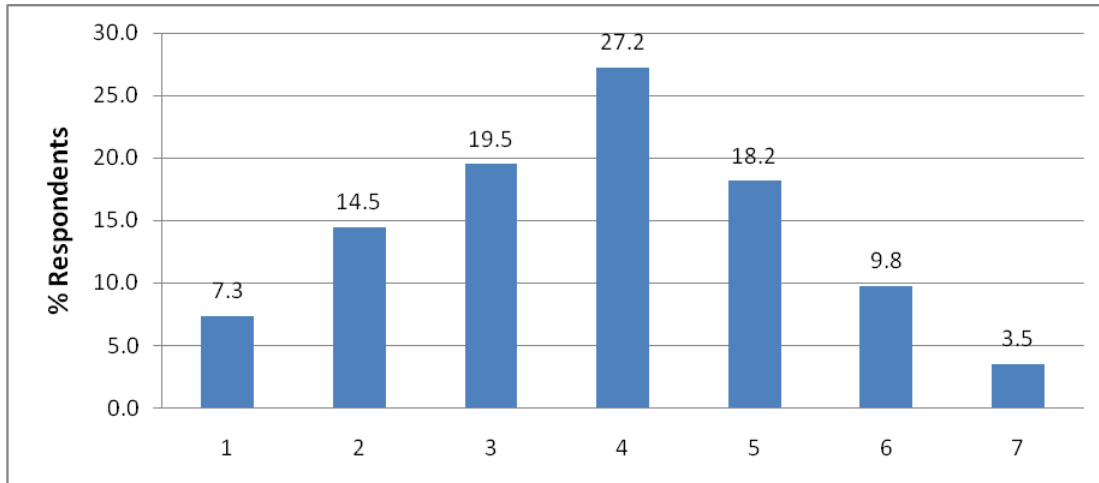
Figure 8. Simplified presentation of the distribution of the respondent's mean scores of attitude towards recycling (n=2004)

Where:　1 = worst (negative) attitude and 7 = most favourable (positive) attitude. A score of 4 is neutral, thus on average neither a negative nor a positive attitude.

Table 7:　Descriptive statistics for the attitude of respondents towards recycling.

Item	$\bar{x}$	SD
Attitude (average of items below)	3.86	1.34
For your household to recycle is ...		
Bad/good	4.12	1.60
Useless/useful	3.99	1.59
Unimportant/important	3.95	1.65
Awakens negative emotions/positive emotions	3.89	1.44
A waste of time/useful	3.82	1.64
Undesirable/desirable	3.76	1.67
A hassle/easy	3.48	1.58

Where:　1 implies a most negative attitude towards recycling; and,
　　　　7 implies a most positive attitude towards recycling

Within the attitude construct, the moral component as represented by the item "*for your household to recycle is bad/good*", shows the highest score ($\bar{x}$=4.12) of all the attitude items. The "*for our household to recycle is a hassle/easy*" item shows the lowest mean score ($\bar{x}$=3.48), and could be an indication of the influence of perceived convenience of recycling on householders' attitude towards recycling.

On average, the respondents hold a negative attitude towards recycling. Due to the random sampling method the results thus suggest that there is an overall negative attitude towards recycling amongst the urban households in South Africa. The relatively low mean score for attitude is higher than the very low mean score for recycling behaviour, confirming that the attitudes of respondents towards recycling do not result in recycling behaviour. This is in line with findings of Martin *et al.* (2006) that a positive attitude towards recycling does not guarantee recycling behaviour. The attitude-behaviour link proves to be strong where there is no "*resources and cooperation*" needed (Eagly and Chaiken 1993:187).

3.2.4　Social pressure to recycle (Subjective Norm)

The distribution of the respondents' mean scores of the subjective norm construct, as presented in Figure 9, shows the majority of respondent's experiencing a lack of social pressure to recycle. The descriptive statistics for the subjective norm construct Table 8 confirm the respondents' reported lack of social pressure to recycle ($\bar{x}$=3.37). The two items that shows the lowest mean score, "*most of the*

people important to you want you to recycle" and "*it is expected of your household to recycle*" could indeed be a true reflection of the situation in South Africa, with pressure to recycle at household level being minimal to non-existent.
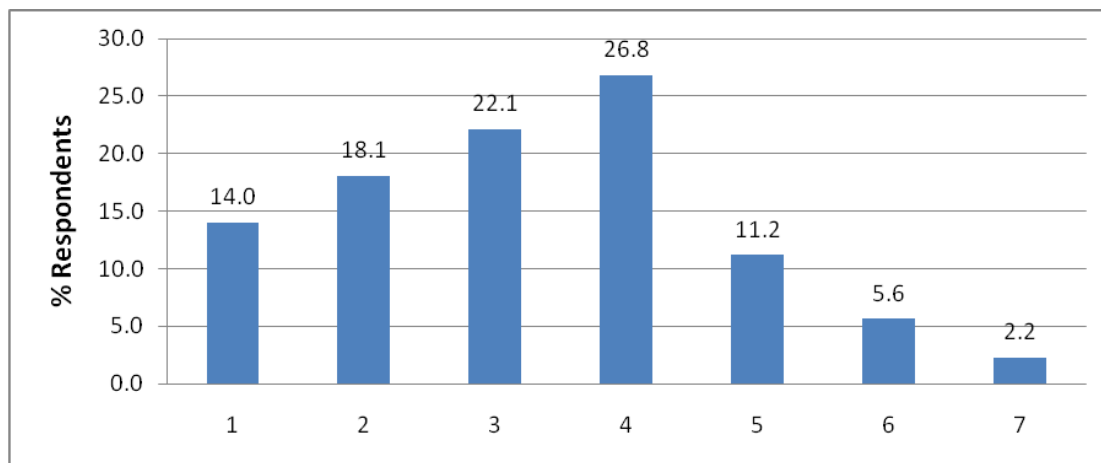
Figure 9. Simplified presentation of the distribution of the respondent's mean scores of the social norm construct (n=2004), where 1 = no perceived social pressure to recycle and 7 = most perceived social pressure.

Table 8: Descriptive statistics for the subjective norm variable.

Item	$\bar{x}$	SD
Social pressure to recycle (average of items below)	3.37	1.30
Your household does not want to recycle/wants to recycle	3.70	1.62
For your household to recycle is difficult/easy	3.55	1.55
Your municipality thinks it is important for your household to recycle: strongly disagree/strongly agree	3.37	1.75
It is expected of your household to recycle: strongly disagree/strongly agree	3.27	1.79
Most of the people important to you want you to recycle: strongly disagree/strongly agree	2.96	1.67

Where: 1 = no perceived social pressure to recycle; and, 7 = the most perceived social pressure to recycle

At the time of the survey, the percentage of respondents that reported that they recycle was relatively small. The chances that respondents' family, friends, neighbours and other significant people do not recycle are thus fairly large. Significant others that could act as recycling role models at the time of the survey were thus scarce or did not exist. In cases where significant others do not recycle, they cannot send out messages, even subtle, to promote recycling and respondents would thus not have perceived that it is expected of them to recycle. In fact, a recycler would fall outside the norm of this-is-how-things-are-done-around-here, which suggests that the descriptive norm would not be pro-recycling.

The low levels of perceived pressure to recycle should be interpreted in the context that there were not many (if any) recycling awareness creation drives at the time of the survey. There might have been a few areas where recycling has been advertised and promoted, but it cannot be taken as the norm. The low perceived pressure to recycle should thus rather be seen as an actual interpretation of the situation at the time, where the low recycling rates could be a consequence of the lack of social pressures. This is in line with the conclusion of Cialdini and colleagues (1991) that an intervention which focuses on the descriptive social norm will only be successful in cases where the majority of people already conform to the desired behaviour. If the majority do not recycle, the person who recycles would rather be considered and feel the odd one out. Minato (2012) also warns that the pressure through descriptive norms gets increasingly less due to degrading social networks. It is thus all the more important that a

strong organisational/governmental message is sent out with the accompanying recycling example to replace or substitute for the lack of societal role models.

Another angle to interpret the results is that one would suspect that the respondents with high recycling scores are represented by the high subjective norm scores (scores of 5-7; refer to Figure 7 and Figure 9), but this is not the case. A large percentage of recyclers also do not experience any social pressure to recycle. The pressure was minimal at household level to recycle and it can be argued that the recyclers tap their motivation to recycle from a source removed from what others expect of them. It can be speculated that injunctive norms (moral values) could be a driver for recycling behaviour, but since the questionnaire was weak on injunctive norm items, the possibility should be further researched.

3.2.5   Perceived control over the act of recycling (Perceived Behavioural Control)

The distribution of the respondents' mean scores of the perceived behavioural control construct are presented in Figure 10. The results show that the majority of the mean scores are less than 4 (1-3) reflecting a low level of perceived control over the act of recycling. The descriptive statistics show the overall mean of less than 4 ($\bar{x}$=3.30) and confirm that respondents do not feel that it is under their control to be able to recycle (Table 9). The item "*you know how to recycle*" representing a knowledge component, albeit still negative (<4.0), shows the highest mean score ($\bar{x}$=3.81) of all the items within the perceived behavioural control measurement (Also refer to Section 3.4.3). The item which addresses the perceived difficulty to recycle and also has an embedded knowledge component, "*to recycle is difficult/easy*", has the second highest score ($\bar{x}$=3.59) (Also refer to Section 3.4.3). While the respondents perceive the opportunity to recycle less positively ($\bar{x}$=3.49), the availability of recycling scheme items ($\bar{x}$=3.01 for both items) and the awareness of recycling schemes item fared the worst ($\bar{x}$=2.94) (Also refer to Section 3.4.1). The latter clearly indicate the need for focussed awareness creation initiatives.

Respondents feel that they do not have control over the act of recycling. The lack of feeling in control stems from not knowing where to recycle rather than not knowing how to recycle (Also see section 3.4.1). This is emphasised by the three items with the lowest mean scores: the two items describing availability of recycling facilities; and one item about the awareness of recycling facilities. The relatively high score of the knowledge item suggest that knowledge of recycling is not the biggest hurdle to overcome to ensure that people feel that they have control over their ability to recycle. Empirical studies by Godfrey *et al.* (2012) emphasises the positive effect of knowledge on waste behaviour, being embedded within the perceived behavioural control construct, as well as in attitudes towards recycling and the subjective norm constructs (Godfrey *et al.* 2012).
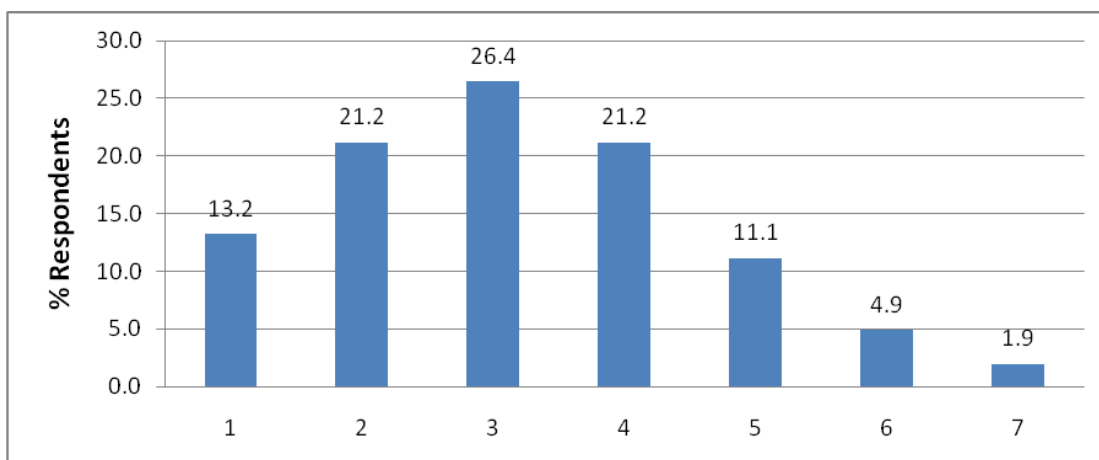
Figure 10. Simplified presentation of the distribution of the respondent's mean scores of their perceived behavioural control (n=2004), where 1 = the least perceived control over the act of recycling and 7 = the most perceived control.

Table 9: Descriptive statistics for respondents' perceived behavioural control over recycling behaviour.

Item	$\bar{x}$	SD
Perceived control over the act of recycling (average of items below)	3.30	1.25
You know how to recycle false/true	3.81	1.65
To recycle is difficult/easy	3.59	1.58
The opportunities for you to recycle are none/plenty	3.49	1.56
There are recycling schemes in your area: strongly disagree/strongly agree	3.01	1.74
The necessary resources and facilities are available that allow you to recycle: strongly disagree/strongly agree	3.01	1.68
You are aware of recycling schemes in your area: strongly disagree/strongly agree	2.94	1.74

Where: 1 = no perceived social pressure to recycle;   7 = the most perceived social pressure to recycle

3.2.6   Intention to recycle

Several statements measure respondents' intention to recycle under various circumstances (refer to Annexure A and Table 10 below). The distribution of the respondents' mean scores of the intention to recycle construct (Figure 11) shows the majority of respondent's either experiencing no intention or low levels of intention to recycle. The descriptive statistics for the respondents' intention to recycle (Table 10) confirm the respondents' on average low intention to recycle ($\bar{x}$=3.76).

The results also suggest that respondents are more likely to recycle if their recyclables are collected at kerbside ($\bar{x}$=4.21) than when they have to take recyclables to collection points ($\bar{x}$=3.42). The likelihood that respondents will recycle also decreases the further the recycling collection points are from their homes. The items that show the lowest mean scores ($\bar{x}$=3.33 – 3.42) are those that imply travelling to collection points to recycle. It should be noted that the items are phrased to capture 'perceived' distances, because a 2 km distance is just around the corner for someone who can drive there, but for someone walking who has to carry a bag of recyclables it is a far distance. The role of the convenience factor in intention to recycle is emphasised by the difference in mean scores of two of the items, namely "… *if kerbside collection for recyclables in area*" ($\bar{x}$=4.21) and "… *if to put recyclables our separately for kerbside collection*" ($\bar{x}$=3.92). The latter, through the use of the word "*separately*", implies multiple sorting of recyclables, which is not so explicitly expressed in the first item. The results thus suggest that people would be more willing to recycle in as few as possible bags which are collected at kerbside, compared to multi-separation of recyclables.

Table 10: Descriptive statistics for the intention of respondents to recycle.

| Parameter:	$\bar{x}$	SD
Intention to recycle (average of items below)	3.76	1.54
If kerbside collection for recyclables in area	4.21	2.01
If to put recyclables out separately for kerbside collection	3.92	1.91
If to sort your recyclable waste from rest of household waste	3.86	0.98
If have to take recyclables to a collection point in area close to house	3.81	1.91
If have to take recyclables to a collection point to support a charity initiative	3.75	1.86
If to take recyclables to collection points	3.42	1.77
If have to take recyclables to a collection point further away from house	3.33	1.73
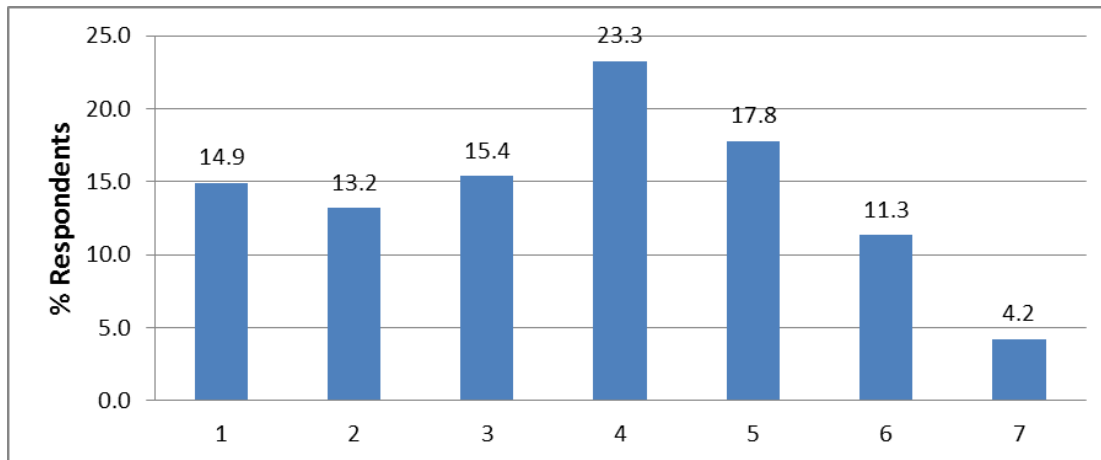
Figure 11.   Simplified presentation of the distribution of the respondent's mean scores of their intention to recycle (n=2004), where 1 = the least intention and 7 = the most intention.

3.2.7   Summary

Fitting the TPB model to the raw (unstandardised) survey data shows that the TPB explains 46.4% of the variation in intention to recycle and 26.4% of the variation in recycling behaviour (Figure 12). The subjective norm (β=0.589) has a greater influence than either attitude (β=0.275) or perceived behavioural control (β=-0.020) on intention to recycle.

3.2.7.1   The hypotheses

Attitude is overshadowed by the effect of subjective norm on intention to recycle and results in having a smaller (β=0.275), though significant (p<0.0001) effect on intention to recycle (H_1). The relatively strong and significant relationship (β=0.589; p<0.0001) between subjective norm and intention to recycle supports H_2. Perceived behavioural control shows an insignificant effect on intention to recycle (β=-0.020; p=0.54) (H_3). With R^2=0.464, the three variables attitude, subjective norm and perceived behavioural control together account for 46.4% of the variance in intention to recycle. Both intention to recycle and perceived behavioural control influence recycling behaviour (B), accounting for 26.4% of the variance in B (R^2=0.264), however perceived behavioural control has a more significant effect on recycling behaviour (β=0.276; p<0.0001) (H_5) than intention to recycle, which has a far smaller effect on recycling behaviour than expected (β=0.131; p<0.0001) (H_4).
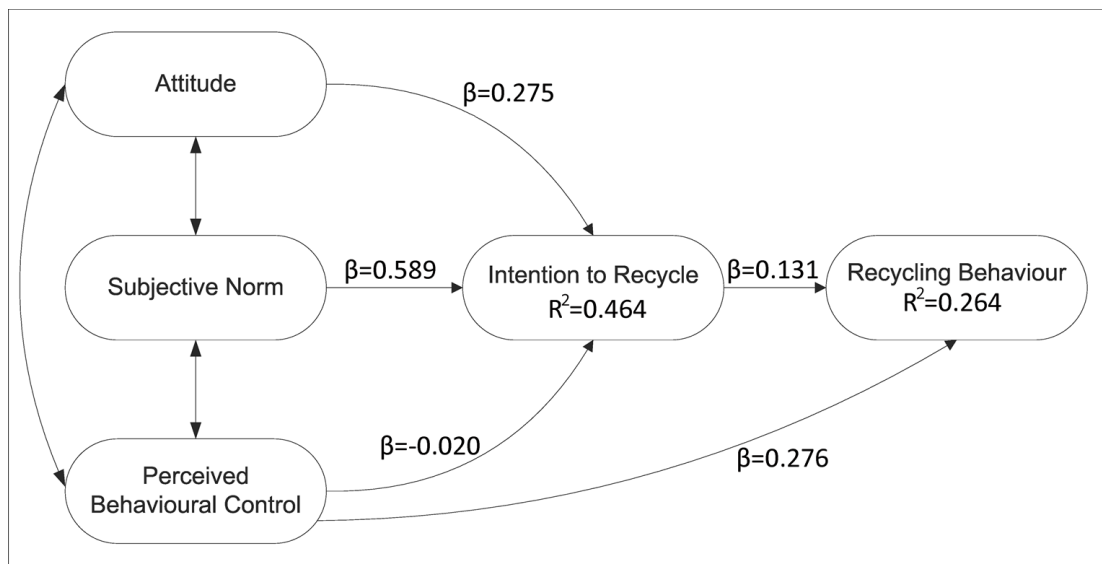
Figure 12. Path diagram of the Theory of Planned Behaviour (TPB) fitted to the raw (unstandardised) latent variables, showing regression coefficients (β) and proportion of variance explained (R^2 values) (n=2004).

3.2.7.2   Comparison with international studies

With the TPB explaining 26.4% of the variance in recycling behaviour, the results from this study compare well with the Armitage and Conner (2001) meta-analysis of 185 behavioural studies dated pre-1998. The meta-analysis found that on average the TPB explained 27% of the variance in behaviour and 39% of the variance in intention to behave (Armitage and Conner 2001). More recent recycling behaviour studies that tested the TPB model include:

- Knussen *et al.* (2004) – Attitude, perceived behavioural control and subjective norm (the latter to a lesser degree) explained 29% of the variance in the intention to recycle. Past recycling and perceived habit independently also contributed to the intention to recycle
- Tonglet *et al.* (2004) – Attitude, subjective norm and perceived behavioural control explain 26.1% of the variance in the intention to recycle. Other statistically significant contributions are past behaviour, consequences of recycling, and concern for the community
- Davis *et al.* (2006) – TPB components explained only 2% of the intention to recycle, but adding variables (outcomes of recycling, concern for environment, situational factors) explain 57.7%
- Davis and Morgan (2008) - Attitude, subjective norm and perceived behavioural control explain 11.9% of the variance in the intention to recycle, and with added variables (situational factors, consequences and waste minimisation factors) 30.9%
- Chen and Tung (2010) – The TBP variables together with two additional variables, moral norms and consequences of recycling, explain 41% of the variance in intention to recycle

Armitage and Conner (2001) point out that, over the years, researchers measured the intention to recycle construct in different ways. According to Ajzen (1991) the intention to recycle is a measure of "*how hard people are willing to try or how much effort they would exert to perform the behaviour*" (Armitage and Conner 2001:477). Armitage and Conner (2001) distinguish between intentions and self-predictions of behaviour where Sheppard *et al.* (Sheppard 1988, cited in Armitage and Conner 2001) argued that self-predictions (the likelihood to perform a behaviour) provide a better prediction of behaviour than intentions. The inclusion of likelihood to recycle statements in the intention to recycle construct is a possible explanation for this study's higher predictive value for intentions to recycle (46.4%) than Armitage and Conner's (2001) meta-analysis average of 39%.

Similar to what other studies showed (Gamba and Oskamp 1994, Barr 2007, Vicente and Reis 2008), this study with 26.4% of the variation in recycling behaviour explained by the TPB, confirms that there are other variables than those proposed in the TPB that appears to play a major role in recycling behaviour. These currently evading variables should be sought through interrogative qualitative research.

3.2.7.3   What the TPB means for improved recycling in South Africa

Although not the variable with the largest influence on behavioural intention and therefore recycling behaviour, attitude does contribute to the intention to recycle. Awareness raising initiatives to improve South African's attitudes towards recycling (e.g. communication strategies, awareness campaigns, social marketing) therefore have a better chance for success if they include a moral component, e.g. that it is a good to recycle and that it should be done. But, to only target the attitudes of people towards recycling would not have the desired effect on people's intention to recycle.

Social pressure (subjective norm) is the variable with the largest influence in explaining intention to recycle. Social pressure would include pressure from family, friends, neighbours and government. The majority of households in South Africa's large urban areas do not feel social pressure to recycle. Given the low percentage (3.3%) of dedicated recyclers in South Africa at the time of the survey, it is not surprising that people do not feel pressure to recycle – there are not enough recyclers around to exert such pressure. In the absence of social pressure to encourage recycling, clear statements from government are needed that it is important to recycle and that it is expected of households to recycle.

Results from this study show that perceived behavioural control has a larger influence than intention to recycle in explaining recycling behaviour. The results suggest that the intention to recycle is overruled by the practical reality of being able to recycle (capability and controllability). For example, the kerbside collection item is the only item with a mean score greater than 4 ($\bar{x}$>4.0) in the intention to recycle measurement (Table 10) and the majority of respondents feel negative about taking their recyclables to drop-off points ($\bar{x}$<4.0). The willingness to take recyclables to collection points decrease significantly the further the perceived distance to the collection point is. Since the majority of the respondents reported that they do not have a motor vehicle in the household (Table 1), longer distances to recycling points are problematic for recycling behaviour. The results show that convenience of recycling facilities is therefore an important issue to consider when designing and implementing community or municipal recycling programmes.

Typically, in studies where the behaviour is likely to not only be affected by personal motivation, but also by other factors such as the availability of resources and access to services, perceived behavioural control appears to have a greater influence on intention (Godin and Kok 1996). This is in line with Tonglet *et al*. (2004) who argue that the effect of perceived behavioural control varies with the availability of kerbside recycling schemes.

The importance of perceived behavioural control as the factor with the largest effect on recycling behaviour in the empirical study, confirms that people should feel in control of their ability to recycle. The best way to promote a sense of control is through buy-in. This can be achieved by providing, for example, recycling services or facilities which communities co-designed. Through co-designing of recycling schemes the necessary buy-in and awareness of the recycling facilities can be created. Co-designing also creates opportunities for establishing co-responsibility – a moral imperative (injunctive norm) which has the potential to fare better to create social pressure than descriptive norms in a society where recycling behaviour is very low. Co-designing of a recycling scheme would also serve as a direct communication of the importance of a community's participation in recycling and that the municipality/recycling company takes recycling seriously (descriptive norm). Another advantage of co-designing of recycling schemes would be that potential leaders of the recycling initiative in communities would be identified. Such community leaders could serve a valuable role in future communications and

in a way could make up for the degraded and in some areas total lack of social networks. In addition, recycling needs to be reinforced as a normative behaviour through, e.g. well targeted recycling advertisements, awareness creation, and the deliberate visibility of recycling bins. Korfmacher (1997) emphasises that a waste scheme that is acceptable and functional in one area might not be suitable for another area.

3.3   Reasons why urban households in South Africa do not recycle

As shown in Section 3.2.2, as at late 2010, only 3.3% of urban households regularly recycle their waste. This section further explores the perceived barriers to recycling. The challenge for decision-makers is to gain an understanding and insight into the reasons why so few South Africans recycle. In so doing, they can adapt policies and practices to address these barriers to domestic recycling and change people's mind-sets and behaviour to become more pro-recycling. Understanding the barriers to recycling, and finding ways to overcome these barriers, would be a first step towards mobilising South Africans to recycle, increasing the post-consumer recycling contribution, and achieving policy and management goals towards implementation of the Waste Act.

From the review of international literature provided in Section 1.3.2 it can be concluded that a wide range of possible barriers to recycling exist and that there is no clear and obvious barrier that is applicable to all case studies. There is rather a set or combination of barriers that, once removed or overcome, would support recycling behaviour.

The aim of this research has been to determine the status of domestic recycling in South Africa and to explore which interventions at household level would be the most successful to encourage and maximise domestic recycling in South Africa for implementing of the NEM:WA. Within this context, this section unpacks the main perceived reasons for non-recycling in the urban areas of South Africa's large cities. Identifying and understanding these barriers to household recycling will support government and the private waste sector in the design of recycling schemes and the development of communication strategies that would encourage maximum household recycling participation in line with policy objectives.

3.3.1   Perceived barriers to recycling

The most mentioned reasons why people do not recycle, in order of priority, are *no space* (15% of the responses) and *no time* (14.9%), followed by *dirty and untidy* (12.4%) and *lack knowledge* (12.3%) (Table 11). This is followed by *facilities inconvenient* (10.8%), *makes no difference* (8%), *no kerbside collection* (7.9%) and *no responsibility* (7.0%). The least mentioned reason for non-recycling is *recycling services poor/lacking* (4.8%).

The factors most cited by respondents for not recycling at household level include *no space, no time* and *dirty and untidy*. These results show that it is important to understand and consider the barriers experienced at household level, before implementing recycling programmes. The results presented in this report suggest that these barriers (or perceived barriers), which currently discourage the majority of South Africans to recycle, would be easier to overcome if the necessary recycling infrastructure was in place. For example, regular kerbside collections would address four of the five main reasons for not recycling and it would thus be a solution to the main problems that households currently experience towards recycling. If recyclables are regularly collected, less space would be needed to store the recyclables in people's houses or on their property and the feeling of dirty and untidiness would simultaneously become less problematic. A kerbside recycling scheme would also relieve households from the burden to drive to drop-off centres and would thus save time.

Table 11:   Perceived reasons why people do not recycle

Reasons why people do not recycle		% of Responses	Order of importance
Situational factors (household level)	They lack space to keep the recyclables	15.0	1
	They do not have the time	14.9	2
	Keeping the materials until it is recycled is dirty and untidy	12.4	3
Knowledge	They do not know what can and what cannot be recycled	12.3	4
Situational factors (recycling facilities)	Recycling facilities are inconvenient	10.8	5
	They do not have a kerbside collection service for recyclables	7.9	7
	Recycling services are poor or does not exist	4.8	10
Psychological factors	They think it will not make a difference whether they recycle or not	8.0	6
	They are not responsible for recycling in their households	7.0	8
	They cannot be bothered	6.9	9

Where: The ten options respondents could choose from, ordered into the four clusters of barriers; the percentage of responses for each of these items; and, the order of importance rated according to the number of times each option was selected.

Although not specifically tested for in this study, it can be assumed that a kerbside recycling scheme would be considered a convenient recycling option as explained by the following studies. Perrin and Barton (2001) showed that positive recycling participation results are obtained by introducing a kerbside recycling scheme. In the Borough of Burnley in England, a kerbside recycling scheme was preferred over recycling centres (Martin *et al.* 2006). The high proportion of households that make use of the kerbside collection of recyclables in a densely populated area in Greater London, is an indication that kerbside collection of recyclables is the most convenient ("least-effort") method for recycling (Robinson and Read 2005). McDonald and Ball (1998) reported similar results in Scotland with higher participation rates in a collection scheme than in a bring site scheme.

Lack of knowledge of what can and cannot be recycled is also an important reason why people do not recycle. While a waste recycling system, which requires less time for the sorting process and less space for storage has the best chance to be supported on household level, a recycling system should also be easy to use. The less recycling knowledge is needed the better the chance that households will participate. Perceptions that recycling would take too much time and space and that it would be dirty and untidy can also be the result of inadequate knowledge. With legislation stipulating separation of recyclables at household level, recycling could seem a daunting task to many. Lack of knowledge at this level can be addressed by sufficient well targeted information. However, providing the people with the best intended knowledge is often not successful (McDonald and Ball 1998, Robinson and Read 2005) and having the necessary knowledge is not a guarantee that it will lead to the necessary behaviour (Finger 1994, Nilsson and Küller 2000). Godfrey *et al.* (2012) confirms the importance of knowledge and show how knowledge underlay people's belief systems that ultimately result in recycling behaviour. However, they also show that the provision of knowledge is not a guarantee of successful behavioural change.

If all recyclables are separated from non-recyclables into one bag, to be sorted further down the recycling chain, less specialised knowledge is needed at household level, and less people will be discouraged to recycle. Recycling schemes should thus be designed to make it easy in households to recycle. Multiple sorting where more bags or bins are needed for the different recyclables would not only take up more space, but also more time to do the actual sorting and would thus discourage recycling. The results suggest that the less the sorting required the better the chance for buy-in from households. A 2-bag or 3-bag sorting system, which would take up less space and less time than a 4-bag or 5-bag system, has thus a better chance to encourage recycling at household level. Communication strategies and awareness creation drives should focus on the lack of knowing what can be recycled and what not. Given the ranked importance of situational factors at household level, suggestions and guidance on how to simplify recycling in homes should be considered.

There is a strong suggestion that respondents are in agreement that recycling facilities exist (lack of recycling facilities in 10th place is the least selected reason for non-recycling), but that the convenience of these facilities is not satisfactory (facilities inconvenient in 5th place). Further investigation is needed to determine whether the recycling facilities are inconvenient due to where they are situated or due to the way in which they are operated or structured.

Although not amongst the top five reasons, *make no difference* is the item which is mentioned the most of all the psychological factors, followed by *no responsibility*. This finding is promising for communication strategies and suggests that well targeted communications have the potential to encourage recycling behaviour. The focus of communications should be on how recycling can make a difference and how taking responsibility for recycling can make the good that stems from recycling a reality.

3.4   Awareness, willingness to pay and knowledge

Awareness of recycling facilities, willingness to pay for recycling services and knowledge of recycling are factors that can influence people's recycling behaviour. Awareness of recycling facilities and knowledge factors are underlain in the beliefs and perceived behavioural control of people (Section 3.2.5). Whether people know what can and what cannot be recycled is also posed as an option in the reasons why urban households do not recycle section (Section 3.3). However, more direct questions about awareness of recycling facilities and having the knowledge to recycle were also posed and these variables warrant a brief analysis of their own. The lack of people knowing where and how to recycle is confirmed in this section.

3.4.1   Awareness of recycling facilities

In some of South Africa's larger urban areas[9], several options for the collection or disposal of recyclable materials exist.

Figure 13 shows the perceived available options for the collection or disposal of recyclables in the areas where the respondents live. These perceived recycling services is an indication of what the respondents are aware of and not necessarily the services that exist[10].

On average a third (33.4%) of the respondents indicated that they do not know how recyclables are collected in the areas where they live. About another third (32.4%) of the respondents showed that recyclables are not recycled. On average 18.6% of the respondents indicated that they have a kerbside collection service for their recyclables: for paper 22.7%; plastic 19.7%; glass 19.3%; metal 15.9%; and, compost 15.4%. With 2.4% of the responses, compostable waste is the least reported to be collected by kerbside (15%) and communal or informal operations (2.4%). The other recyclables that are collected by communal or informal collections are paper (8.2%), glass (7.5%), metal (7.5%) and plastics (6.9%).

The results show that awareness of recycling facilities has a small (r = 0.286), but statistically significant (p<0.0001) effect on recycling behaviour (Table 12 and Table 13).

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[9]   While referring to the geographical area classified as urban, the reality of "my area" to a person is the area in which that person freely commutes on a frequent basis.

[10]   The purpose of this study was not to collect data on the actual availability of recycling options. The respondents can also not be linked to specific services in their areas.
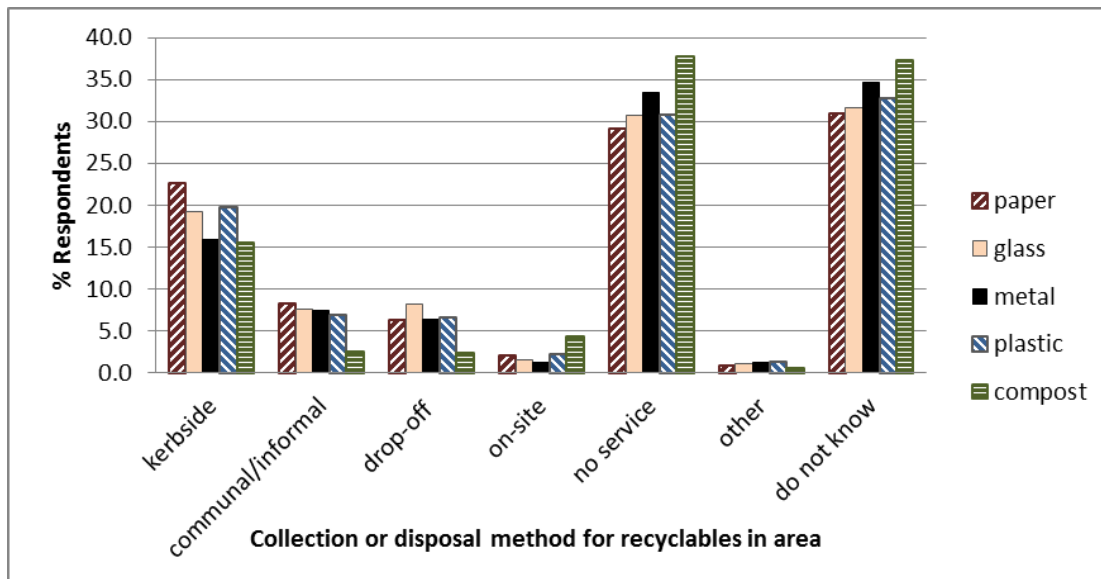
Figure 13. Collection or disposal methods for recyclables as perceived by the respondents (n=2004).

Table 12. Correlations of awareness of recycling facilities with recycling behaviour (B) and recycling quantities for all respondents (n=2004).

Variable	Recycling behaviour (B)	Recycling Quantity reported for …					
		All recyclables	Paper	Glass	Metal	Plastics	Compost
Awareness (all)	0.286	0.292	0.227	0.204	0.231	0.250	0.263
Aware (paper)	0.315	0.312	0.307	0.203	0.218	0.280	0.228
Aware (glass)	0.225	0.226	0.152	0.221	0.184	0.171	0.183
Aware (metal)	0.136	0.151	0.082	0.088	0.198	0.119	0.143
Aware (plastic)	0.257	0.252	0.210	0.159	0.179	0.257	0.196
Aware (compost)	0.239	0.256	0.176	0.162	0.175	0.202	0.323

Table 13. Correlations of awareness of recycling facilities with recycling behaviour (B) and recycling quantities for those respondents who indicated that they recycle (n=540).

Variable	Recycling behaviour (B)	Recycling Quantity for …					
		All recyclables	Paper	Glass	Metal	Plastics	Compost
Awareness (all)	0.297	0.335	0.192	0.147	0.258	0.256	0.342
Aware (paper)	0.293	0.311	0.320	0.097	0.184	0.264	0.221
Aware (glass)	0.188	0.218	0.059	0.233	0.186	0.112	0.198
Aware (metal)	0.116	0.167	0.016	0.035	0.288	0.104	0.182
Aware (plastic)	0.247	0.254	0.175	0.068	0.157	0.287	0.206
Aware (compost)	0.243	0.278	0.130	0.109	0.158	0.183	0.410

3.4.2   Willingness to pay for kerbside collection of recyclables

To what extent are households prepared and willing to pay more for waste collection and recycling services in general? While there are small differences in the responses to the three tested statements,

the majority of respondents (almost 60% in all cases) are not willing to pay more for waste related services – either continuing to receive their current waste collection service or for a recycling component added to their regular service (Figure 14, Table 14). About 17% of the respondents indicated that they are neither willing nor unwilling to pay more. Depending on the option, between 23.5% and 25.4% of the respondents indicated that they would be willing to pay or pay more.

Willingness to pay for recycling services correlates strongly with the social norm variable (r=0.520) and perceived behavioural control (r=0.480) (Table 15). These correlations suggest that social pressure could be used to encourage payment for recycling services and that people would be more willing to pay for services should they feel that such services provide the ability and the opportunity to recycle. However, willingness to pay is not a strong indication that recycling will happen (r=0.258), but correlates strongly with the intention to recycle (r=0.587).
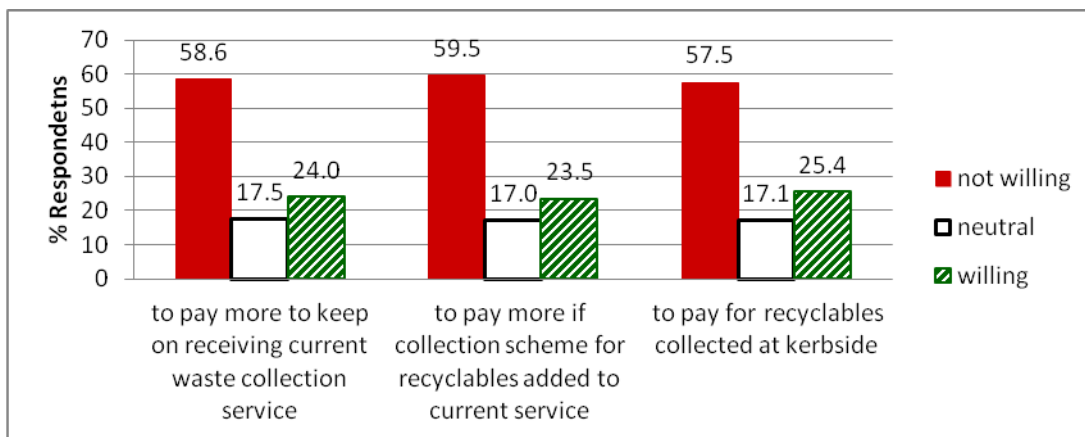
Figure 14. Comparing the willingness of respondents to pay for various waste collections service options.

Table 14. Comparing the willingness of respondents to pay more for current waste collection services with expanded waste collection service options which include collection of recyclables.

Willingness to …	$\bar{x}$	SD	n
... pay more to keep on receiving current waste collection service	3.14	1.76	2004
... pay more if collection scheme for recyclables added to current service	3.06	1.73	2004
... pay for recyclables collected at kerbside	3.17	1.76	2004

Table 15. Correlation of Willingness to Pay with recycling behaviour and other TPB variables.

Parameter:	B	IR	A	SN	PBC
Willingness to pay	0.258	0.587	0.389	0.520	0.480

p<0.0001

3.4.3 Knowledge

Not all behaviours have a strong knowledge prerequisite, for example, if the tested behaviour is reading a specific book, it is assumed that all respondents can read. When recycling behaviour is tested for it cannot be assumed that everyone knows how to recycle. Knowledge forms an integral part of people's

beliefs about the behaviour (Godfrey *et al.* 2012) In the PBC component of the TPB, knowledge scored the highest of all the items that make up this measurement (see Section 3.2.5), but still lower than a neutral 4. Results from a knowledge question that did not form part of the TPB questions, confirm that the majority of respondents disagree that they have the necessary knowledge that enables them to recycle (Figure 15).
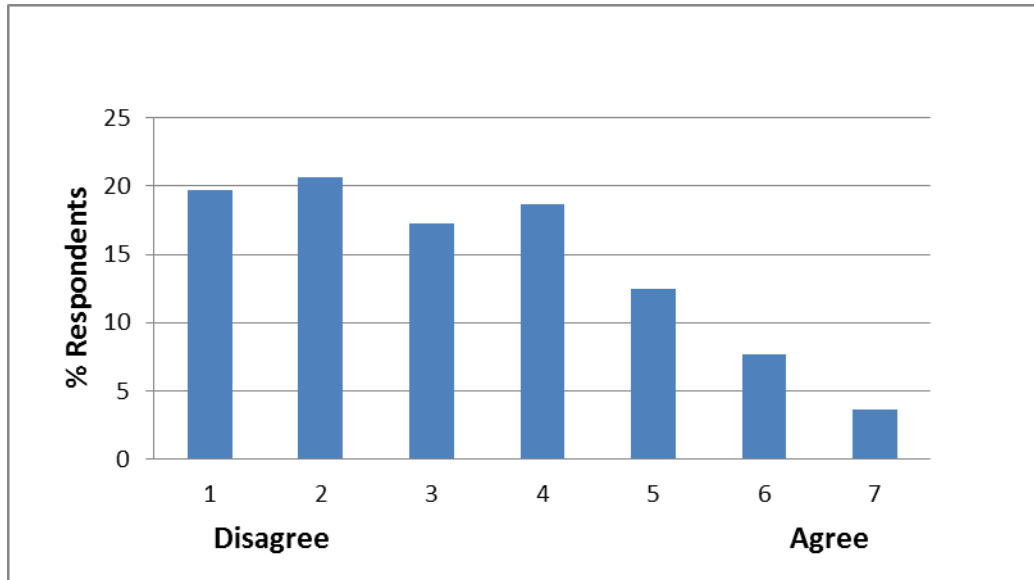
Figure 15. Respondents' level of agreement with the statement: "You have the necessary knowledge that enables you to recycle."

4   CONCLUSION AND RECOMMENDATIONS

The study shows that at a point in time, November 2010, before the household recycling requirements of NEMWA was implemented, about a quarter (26.9%) of South Africa's urban households engaged in some form of recycling. However, only 3.3% of the respondents are regular recyclers, reporting that they recycle a fair amount of recyclables on a frequent basis.

While the TPB remains a useful model for examining the variables that affects recycling behaviour, the theoretical framework explains only 26.4% of the variation in recycling behaviour and 46.4% of the variation in intention to recycle. Compared to intention to recycle, which has a far smaller effect on recycling behaviour than expected, perceived behavioural control (capability and controllability) appears to be the most important variable to explain recycling behaviour. This study confirms that there are other variables than those proposed in the TPB that appear to play a role in recycling behaviour. Follow-up studies are needed to fully understand the essence of recycling behaviour in South Africa.

It is encouraging that respondents are positive about their intention to recycle should they have a kerbside collection for their recyclables, especially given the very low self-reported recycling behaviour and negativity that is overwhelming in all the variables. The results also suggest that the least complicated separation and waste collection system to accommodate the collection of recyclables at kerbside has the greatest potential to be supported and thus to encourage recycling.

The results show that the situational factors at household level are the main reasons why people do not recycle, of the variables tested for, followed by lack of knowledge and inconvenient recycling facilities. Although the results suggest that recycling facilities exist, the convenience of these facilities is not satisfactory. Further investigation is needed to determine the reasons for this perceived inconvenience.

The situational factors at household level, which are perceived by both recyclers and non-recyclers as real barriers to recycling, are not necessarily captured in the perceived behavioural control variable. Situational factors include the space needed for recycling, the time it takes to recycle and the messiness associated with recycling (Tonglet *et al.* 2004, Barr 2007). The influence of these situational household factors, as well as the other barriers to recycling, on the variables of the TPB model, and the possible solutions to overcome these barriers, needs to be further investigated through qualitative research.

South Africans have the potential to become recyclers should an enabling environment to recycle be created. The results suggest that dedicated recyclers, albeit a small minority group (3.3%), are found across all population, language and gender groups. However, the percentage of recyclers from which this finding was deducted was relatively small and further research is needed to confirm that no culturally founded resistance to recycling exists. At the time of the study, urban dwellers experienced very little social pressure to recycle. There is thus a void space where government and industry needs to step in and send a clear message to the people of South Africa that recycling is important. The message should not only be through awareness creation communications, but also through setting a follow-worthy example and by creating an enabling environment for South Africans to recycle. Given South Africa's diversity, the ideal enabling environment would not necessarily be the same in all areas. Further research is needed to qualify the nature of the potentially most successful recycling scheme(s) per area according to the characteristics of the particular area.

People need to see that recycling will really make a difference before they will engage in an activity that could potentially inconvenience them in their homes (situational factors at household level) as well as most probably cost them money (lack of convenient recycling services such as kerbside recycling).

The results strongly suggest that awareness raising that has the greatest chance to influence recycling behaviour positively, should contain a balanced mix of moral values (injunctive norms) and information about available recycling schemes. However, such awareness raising would be meaningless without a positive contribution to householders perceived behavioural control over their ability to recycle. Regular kerbside collections could be a solution to both the time and space problem that households currently either experience or envisage to experience should they recycle. A recycling system with as few sorting bags as possible combined with regular informative communications and a kerbside collection for recyclables would have the best potential to encourage people living in urban areas to become involved in recycling activities.

One way to address the perceptions of limited control is through the provision of tailor-made recycling schemes to fit communities' particular needs. Although not specifically tested for in this study, the co-designing of recycling schemes has the potential to create opportunities for communities to buy-in recycling schemes and thus improve the possibility that such schemes will be supported with the resultant increase in recycling behaviour. This needs to be further researched.

Government and industry should send out a clear recycling message to all South Africans. The recycling community is currently too small to be able to compensate for the lack of a sector voice and to take over this role of providing social pressure. Both government and the waste sector have the potential to offset the lack of social pressure that non-recyclers experience due to the low percentage of dedicated recyclers. It is envisaged that once a critical mass of recyclers are reached, the social pressure on non-recyclers will increase.

All levels of government should unite and engage with the private waste sector to provide an enabling environment for South Africans to recycle. Such an enabling environment would include public participation processes to determine communities' recycling facilities of choice, to provide the recycling facilities of choice, to create the necessary awareness around the availability or schedules of such a recycling service, to provide the necessary knowledge about what is recyclable and how to recycle, and to provide regular feedback to continuously encourage people to recycle.

The implication of this research is that over time, with new inventions, the best possible ways to maximise waste recycling behaviour will change. As South Africans become more aware of recycling, recycling behaviour will shift from the current baseline of non-recycling, and the strategies to further improve recycling behaviour will have to be adapted to the needs at that point in time. It should also be acknowledged that South Africa is a country with much diversity which complicates generalisation. It can thus be dangerous to be prescriptive on how to improve recycling behaviour in the country without considering specific areas with their unique characteristics. Furthermore, given the quantitative nature of this study the findings should be further informed and clarified through selected qualitative research.

The challenge for waste management is to create an enabling environment in South Africa that would encourage recycling behaviour. To be able to create such an enabling environment, a better understanding of the drivers of domestic recycling behaviour is needed.

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7 ANNEXURE A: QUESTIONNAIRE – SECTION 1

	TPB variables							
Behaviour		1	2	3	4	5	6	7
1	Thinking of your household, would you say that your household recycles the recyclable materials from your household waste...	Never	Almost never	Seldom	Sometimes	Often	Almost always	Always
2	Who is mainly responsible for recycling in your household?	No one	Not me: Someone else	I am	I am and someone else is			
3	For each of the recyclable materials, choose the statement that best describes how much your household recycles each of the listed materials. My household recycle…	Nothing	Very little of what can be recycled	Some things that can be recycled	About half of everything that can be recycled	Most of everything that can be recycled	Almost all of what can be recycled	Everything that can be recycled
	Paper							
	Glass							
	Metal							
	Plastic							
	Compost							
	Other materials (specify) …………..							
Attitude*		1	2	3	4	5	6	7
4	For your household to recycle is	Undesirable						Desirable
5	For your household to recycle is	A waste of time						Useful
6	For your household to recycle is	Bad						Good
7	For your household to recycle is	Unimportant						Important
8	For your household to recycle is	Useless						Useful
9	For your household to recycle is	A hassle						Easy
10	For your household to recycle	Awakens negative emotions						Awakens positive emotions
Subjective Norm*		1	2	3	4	5	6	7
11	It is expected of you to recycle	Strongly disagree						Strongly agree
12	Most of the people important to you want you to recycle	Strongly disagree						Strongly agree
13	Your municipality thinks it is important for your household to recycle	Strongly disagree						Strongly agree

14	Your household	Does not want to recycle						Wants to recycle
15	For your household to recycle is	Difficult						Easy

Perceived Behavioural Control*		1	2	3	4	5	6	7
16	The opportunities for you to recycle are	None						Plenty
17	You know how to recycle	False						True
18	To recycle is	Difficult						Easy
19	There are recycling schemes in your area	Strongly disagree						Strongly agree
20	The necessary resources and facilities are available that allow you to recycle	Strongly disagree						Strongly agree
21	You are aware of recycling schemes in your area	Strongly disagree						Strongly agree
Intention to recycle*								
22	How likely would you be to recycle if there was a kerbside collection scheme for recyclables in your area?	Very unlikely						Very likely
23	How likely would you be to recycle if you would have to take your recyclables to a collection point in your area close to your house?	Very unlikely						Very likely
24	How likely would you be to recycle if you have to take your recyclables to a collection point further away from your house?	Very unlikely						Very likely
25	How likely would you be to recycle if you have to take recyclables to a collection point to support a charity initiative?	Very unlikely						Very likely
26	How willing are you to sort your recyclable waste from the rest of your waste in your household?	Not willing at all						Very willing
27	How willing are you to put recyclables out separately for kerbside collection at your household?	Not willing at all						Very willing
28	How willing are you to take recyclables to collection points e.g. drop-off or recycling centres?	Not willing at all						Very willing

* Rotate start point

8 ANNEXURE B: PRE-STUDY QUESTIONNAIRE

You are one of a small group that has been selected. By filling in this questionnaire, you assist with the drafting of a questionnaire on household recycling behaviour in South Africa. From the combined responses to the questions below, the project team will formulate the questions that would be crucial for our pilot study. Please spend a few minutes and answer what comes to mind ... no need to spend much time on this. However, if you later feel that you wish to change what you've initially sent us, you are welcome to re-send.

☐   I have been informed about the purpose of this pre study and I participate voluntarily on an anonymous basis.

1. Who is responsible for recycling in your household?
(Tick the boxes that describes the situation in your household the best)

☐   nobody

☐   the man of the house

☐   the woman of the house

☐   one of the children in the house

☐   the domestic worker

☐   a grandparent in the house

☐   other.

2.   For each of the recyclable materials, choose the statement that describes how much **your household** recycle the best.

Statement to test	Recyclable material					
Intensity of recycling (How much of your household's potential recyclables are recycled?)	Paper	Glass	Metal	Plastic	Compost	Other (specify)
My household recycle everything that can be recycled (**All)**						
My household recycle a lot but not everything that can be recycled (**a lot**)						
My household recycle some things that can be recycled (**not much**)						
My household recycle nothing (**nothing**)						

Do you have any comments on the above ....

3. How **often** does your household recycle each of the recyclable materials?

Statement to test	Recyclable material					
Frequency of recycling (How often does your household recycle?)	Paper	Glass	Metal	Plastic	Compost	Other (specify)
Never						
Almost never						
Seldom						
Sometimes						
Often						
Almost always						
Always						

Do you have any comments on the above ....

4. Complete the following sentence for each of the options below. Select the number that would portray how you feel about each of the statements the best. For example, if you feel that for your household to recycle is "wrong", mark the "7" and if your think that it is neither "wrong" nor "right", then mark the "4", or any other number in-between that would indicate how strongly you feel. You can mark the number by either using the bold or the highlight setting.

For my household to recycle is ......

Right 1   2   3   4   5   6   7   wrong
  _____

Positive   1   2   3   4   5   6   7   negative
_____

Harmful   1   2   3   4   5   6   7   beneficial
_____

Difficult   1   2   3   4   5   6   7   easy
_____

Possible 1   2   3   4   5   6   7   impossible
_____

Interesting   1   2   3   4   5   6   7   boring
_____

Desirable   1   2   3   4   5   6   7   undesirable
_____

A waste of time   1   2   3   4   5   6   7   useful
_____

Pleasant 1   2   3   4   5   6   7   unpleasant
_____

Good	1	2	3	4	5	6	7	bad

_____

Worthless	1	2	3	4	5	6	7	valuable

_____

Enjoyable	1	2	3	4	5	6	7	unenjoyable

_____

Important	1	2	3	4	5	6	7	unimportant

_____

Useless	1	2	3	4	5	6	7	useful

_____

Worth the time	1	2	3	4	5	6	7	a total waste of time

_____

Inconvenient	1	2	3	4	5	6	7	convenient

_____

A hassle	1	2	3	4	5	6	7	easy

_____

Meaningful	1	2	3	4	5	6	7	meaningless

_____

Useful	1	2	3	4	5	6	7	worthless

_____

Rewarding	1	2	3	4	5	6	7	not rewarding

_____

Responsible	1	2	3	4	5	6	7	not responsible

_____

Sensible	1	2	3	4	5	6	7	not sensible

_____

Hygienic	1	2	3	4	5	6	7	not hygienic

_____

A joyous experience	1	2	3	4	5	6	7	a disappointing experience

_____

A positive experience	1	2	3	4	5	6	7	a negative experience

_____

Awakens positive emotions	1	2	3	4	5	6	7	awakens negative emotions

_____

5. What do you believe are the advantages of recycling? ....

6. What do you believe are the disadvantages of recycling?.......................................

7. Do you have any other views of, or is there anything else that you associate with or comes to mind when you think about recycling?   ....

8. What do you think are the consequences of recycling? ....

9. What do you think are the consequences of not recycling? ....

10. Do you have any other ideas or something that comes to mind when you think about the consequences of recycling? ....

11. Are there any individuals or groups who would approve of your household recycling? ....

12. Are there any individuals or groups who would disapprove of your household recycling? ....

13. Is there anything else you associate with other people's views about recycling? ....

14. What factors or circumstances enable your household to recycle? ....

15.   What factors or circumstances make it difficult or impossible for your household to recycle? ....

16.   Are there any other issues that come to mind when you think about your household and recycling? ....

9   ANNEXURE C: RELIABILITY AND INTERNAL CONSISTENCY

Each of the TPB model constructs was examined for reliability (similar results likely to be obtained with a retest) and unidimensionality (the items in a construct work together to measure one latent trait). The Guttman's lambda 6 (λ_6) (Guttman 1945), as well as the criticised (Sijtsma 2009), but still widely used Cronbach alpha (α) (Cronbach 1951) report reliability, and Revelle's beta (β) report internal consistency (Revelle 1979) (Table 16).

With Cronbach α values above 0.9, the behaviour, intention to recycle and attitude constructs showed excellent reliability and internal consistency (Table below). Although there is room for improvement, the reliability and internal consistency of the subjective norm and perceived behavioural control constructs are reasonable to good (Cronbach α values between 0.8 and 0.9) and it was decided to keep all items.

Table 16.   Reliability and internal consistency of the TPB model constructs.

Construct	Reliability			Internal consistency
	α_{raw}	α_{std}	λ_6	β
Behaviour	0.901	0.965	0.965	0.944
Intention to recycle	0.918	0.931	0.938	0.897
Attitude	0.930	0.941	0.936	0.808
Subjective norm	0.832	0.853	0.839	0.760
Perceived behavioural control	0.852	0.873	0.884	0.711

10 ANNEXURE D: DEMOGRAPHIC VARIABLES

The correlations (r) between the demographic variables and recycling behaviour (B) and intention to recycle (IR) confirm that the demographics do not have an effect on either recycling behaviour or the intention to recycle (Table 17). It would have added value to include a correlation between recycling behaviour and financial status. However, more than a quarter of the respondents did not answer the question about their financial status and consequently the uncertainty factor from such an analysis would be high.

Table 17. Correlations of demographic parameters with recycling behaviour (B) and intention to recycle (IR) (n=2004).

Variable	B		IR	
Gender	0.017		-0.008	
Age	0.084	**	0.018	
Population group	-0.120	***	-0.147	***
Working status	-0.037		-0.048	
Education	0.104	***	0.127	***
Living standards measure (lsm)	-0.124	***	-0.074	**
Type of dwelling	-0.106	***	-0.072	*

*p<0.01; **p<0.001; ***p<0.0001