The continued quest to better recycling behaviour

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ABSTRACT

During 2010 a national survey on waste management service delivery and recycling behaviour amongst metropolitan households was conducted. WasteCon2010 conference attendees were also surveyed in parallel and on a voluntary basis. This paper reports on results from the WasteCon2010 survey and compare some of the findings with those from the national survey.

Awareness of the importance of recycling, and having the know-how, improves the possibility that respondents will recycle, but the effect size is medium to small (R^2=0.25). The Theory of Planned behaviour explains 44% of the variance in recycling behaviour, which could be ascribed to the more than 90% WasteCon delegates that recycle, compared to the less than 30% of the national survey sample. The effect of convenience on the likelihood to recycle is confirmed by the reasons why people do not recycle. Positive recycling behaviour is more likely if recyclables are collected at kerbside than when recyclables have to be dropped off at collection points. Further studies on the effect of knowledge and perceptions of convenience of recycling is needed in areas with different socio-economic status to be able to design recycling schemes and awareness creation drives for maximum recycling participation.

1.   INTRODUCTION

1.1   Background

The National Environmental Management: Waste Act (Act No. 59 of 2008) (Republic of South Africa 2008) came into effect on 1 July 2009. According to Section **22**(2) of the Waste Act, recyclable waste does not have to be placed in the receptacles for general waste and Section **23**(2) specifies the provision of "receptacles for the collection of recyclable waste that are accessible to the public" (Republic of South Africa 2008). Thus, implementation of the Waste Act implies the introduction of waste separation at household level, as well as changes in municipal waste collection services in support of this changed waste management practice. The successful implementation of the Waste Act is thus strongly reliant on people's attitudes and behaviour at household level.

Insight into waste management behaviour at household level, as well as the attitudes and perceptions that drive waste recycling behaviour, provides a platform on which effective waste management decisions can be based. During 2010, a baseline survey of post-consumer waste behaviour in South Africa was conducted. This baseline survey of post-consumer waste behaviour was a first attempt to obtain data on the recycling behaviour of people living in metropolitan areas in South Africa. Given the assumption that delegates to the WasteCon2010 conference have knowledge of recycling and understand the importance of recycling, also on household level, the question arose whether the waste fraternity would show recycling behaviour similar to or better than the average South African.

1.2   Purpose of the study

The objective of the study was, within the context of the national study for a baseline for household recycling behaviour at national level in South Africa, to obtain a data set on recycling behaviour which represents the waste community of South Africa. Assumptions that were made are that the delegates to the WasteCon2010 conference, due to the nature of their waste interest and affiliation:

- have knowledge of how and where to recycle and understand the importance of recycling;

- have relatively easy access to recycling centres; and,
- have certain perceptions about the barriers to recycling.

1.3   Literature review

An understanding of a complex set of behaviours, attitudes and drivers is needed to optimise recycling and the necessity of incentives and motivations is recognised to encourage recycling behaviour (DEFRA 2007a).

Knowledge
People need knowledge of where to recycle and access to kerbside recycling increases recycling behaviour (Barr 2007). Knowledge of how to sort recycles and how a recycling scheme works is also needed (Gurauskiené 2008). Efficient recycling behaviour relates to the type and design of the recycling scheme, the knowledge needed to recycle and the degree to which current behaviour needs to change to be able to adopt the required behaviour (Perrin and Barton 2001). Bolaane (2006) confirms that knowledge and experience in recycling, together with a change in attitude, is needed to ensure success of recycling initiatives. Bolaane (2006) also points out that it is not only the people (households) that need the knowledge and experience of recycling, but also the municipal officials who provide the waste management service.

Convenience
What might be a convenient way to recycle for people living in one area might not be equally convenient for people living in another area. While some householders prefer to have several bins for sorting of their household waste, others simply do not have the space to accommodate extra bins (MORI 2002). The use of a car to take recyclables to a collection point can also have an adverse effect on recycling behaviour (MORI 2002). The level of acceptance of a specific recycling option will thus differ between householders (Miafodzyeva et al. 2010). Implying that what is convenient to one community might not be considered convenient by another, Korfmacher (1997) argues that the design of a solid waste collection system should accommodate the needs of the community for whom it is intended.

Barriers to recycling
Several studies report on the reasons why people do not recycle. Perrin and Barton (2001) report on studies in two areas in the UK, before the introduction of a kerbside collection scheme. Householders indicated 'inconvenient/no time' as the most popular option (50% and 64%), followed by 'facilities too far away/inadequate' (49 and 43%) and 'storage/handling problems' (35 and 50%) (Perrin and Barton 2001). 'Lack of knowledge' was indicated by 28% of the respondents in both areas (Perrin and Barton 2001). Other reasons were: 'never really thought about it' (23 and 7%), 'not enough materials to recycle' (21 and 14%) and 'too much effort' (16 and 7%) (Perrin and Barton 2001). In the Robinson and Read (2005) study, almost 60% of the respondents indicated a lack of awareness of services as a reason for not recycling. Other reasons for non-recycling, with indication of the percentage responses are: disinterest 14.3%; lack of time 8.2%; inadequate provision/poor service 7.2%; lack of storage space 6.5%; and, insufficient waste 3.6% (Robinson and Read 2005). About 25% of the respondents in the Martin et al. (2006) study indicated that the recycling centres are too far away. Other studies also report lack of facilities (DEFRA 2007, McDonald and Ball 1998), no kerbside collection (DEFRA 2007), lack of knowledge (McDonald and Ball 1998), inconvenience factors (McDonald and Ball 1998, Suttibak and Nitivattananon 2008, Tucker 2001), lack of space (DEFRA 2007, McDonald and Oats 2003), forgetfulness (Tucker 2001) and not having enough recyclables (McDonald and Oats 2003, Tucker 2001).

2.   METHOD

2.1   Research method and questionnaire design

Following on an extensive literature review to guide the selection of questions, a questionnaire was developed for the national baseline survey on self-reported recycling behaviour in metropolitan areas in South Africa. A scientific process was followed for the design of the questionnaire and testing of the questionnaire in a pilot study (Babbie and Mouton 2001). The self-administered structured questionnaire standardised the process of gathering data from a relatively large sample within a short period of time and ensured that the same questions were posed in the same way (Kempton et al. 1996, Babbie and Mouton 2001). In addition to the national survey, this questionnaire was also available for completion during the three days of WasteCon2010. The purpose of the study was explained and the anonymity of the respondents guaranteed in the covering note which accompanied the questionnaire.

A wide selection of published scientific literature was consulted to draw up a questionnaire primarily based on Ajzen's 1985 Theory of Planned Behaviour model (Ajzen 1985). The consulted literature includes: Francis et al. (2004) which provided insight into the phrasing of statements for the TPB constructs; Eagly and Chaiken (1993) a

comprehensive read about attitudes and behaviour; and several case studies, which include, MORI (2002), Thomas et al. (2004), Tonglet et al. (2004), Ojala (2008), Miafodzyeva et al. (2010) and Seacat and Northrup (2010).

The questionnaire consisted of three sections. The first section measured respondents' behaviour, attitudes and perceptions related to household recycling, and the second, perceptions about household waste management in general. The third section collected demographic data and a shortened version of the demographic section of the national survey was used[1]. The behaviour questions preceded the attitude questions to avoid that the easier factual accounts of behaviour are biased by the responses to the attitude statements (Brace 2004). Where possible, questions were also phrased in a "face-saving way" (Brace 2004), e.g. "Why do people not recycle?" instead of "Why do you not recycle?"

Five sets of items measured constructs (Babbie and Mouton 2001), as per the Theory of Planned Behaviour (Azjen 1985) and were posed as statements to ascertain the participants' behaviour (self-reported), intention to recycle, attitude towards recycling, subjective norm and perceived behavioural control. Similar to other TPB studies, a 7-point Likert-like rating scale was used, either bipolar or anchored on both sides with strongly agree/strongly disagree (Ajzen 1985, Francis et al. 2004).

Other measures to obtain information about recycling from the respondents are knowledge (statement about knowing what and how to recycle), the effect of convenience on the willingness and likelihood to recycle (e.g. likelihood to recycle when kerbside collection vs. drop-off close or further from home), and the reasons why people do not recycle (10 options from which to choose three options).

2.2   Data analysis

The statistical analysis of the data was undertaken by the CSIR and Dr Mark Difford[2]. The statistical analyses included testing the directly measured constructs 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), and testing of the theory of planned behaviour (TPB) model (Ajzen 1985) using a structural equation model (SEM) fitted to the raw latent variables[3]. MS Excel was used for descriptive statistics (graphs, frequency tables, etc.); describing averages; and variability and relationships between variables additional to the above.

2.1   Treatment of missing data

Data were missing for the behaviour construct, especially in the questions dealing with recycling quantities of the specific types of recyclables. If these responses were excluded from the analyses it would have reduced the sample size to 58 responses, which is 61% of the original size of 95 respondents. For the purpose of fitting the data to the TPB model, imputed values were used to fill the gaps in the following manner: The relationships between the latent variables in the complete cases were used to predict the missing values, following a set of non-linear transformation that maximize the amount of variance explained for each latent variable whose missing values are being imputed. The primary latent variables were estimated using the known data.[4] For descriptive statistics and where indicated, a mean-based approach was followed, taking means of the available answers.

3.   RESULTS AND DISCUSSION

3.1   Sample profile

In total, 97 questionnaires were returned by the WasteCon2010 delegates; 94 in the sealed box provided for this purpose, and another three questionnaires per e-mail. Two responses were not sufficiently filled and could not be used. The demographic composition of the sample is shown in Table 1.

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[1] Markinor's standard demographic questions
[2] Mark Difford from the Nelson Mandela University
[3] Using standardised latent variables changed the estimated regression path coefficients ($β$ values) and 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.
[4] The method used by Mark Difford, Nelson Mandela University

Table 1. Demographic composition of the respondents (n=95).

Parameter	n	% Respondents
Gender:		
Male	46	48
Female	48	51
No answer	1	1
Age (years):		
16-17	0	0
18-19	3	3.2
20-24	6	6.3
25-29	9	9.5
30-34	17	17.9
35-39	15	15.8
40-44	14	14.7
45-49	17	17.9
50-54	2	2.1
55-59	8	8.4
60-64	2	2.1
65+	2	2.1
Refused	0	0
Population:		
Black	39	41.0
White	41	43.2
Coloured	5	8.4
Indian/Asian	8	5.3
No answer	2	2.1
Marital status:		
Single	29	30.5
Married	56	58.9
Other	10	10.6
Type of dwelling:		
House/cluster house	82	86.3
Flat	9	9.5
Room	2	2.1
No answer	2	2.1
Internet access:		
At work	18	18.7
At home	2	2.1
Via cell phone	3	4.2
No access	6	6.3
At work and/or home and/or cell phone	66	68.7

3.1   Knowledge about recycling

Although the results suggest that there is a correlation between knowledge about recycling and recycling behaviour (Figure 1), the regression analyses result of R^2 = 0.254 suggests a medium to small effect of knowledge about recycling on recycling behaviour (Cohen 1992)[5]. Past behaviour has a medium effect on recycling behaviour (R^2 = 0.379) (Table 2).

Table 2. Regression results for recycling behaviour with knowledge and past behaviour

Variable	R^2	Std. error	p-value
Knowledge	0.254	1.37	<0.001
Past Behaviour	0.379	1.25	<0.001

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[5] Cohen's (1992) guideline on the interpretation of effect sizes suggests that correlations of 0.10 to have a small effect size, 0.30 a medium, and 0.50 a large effect size.
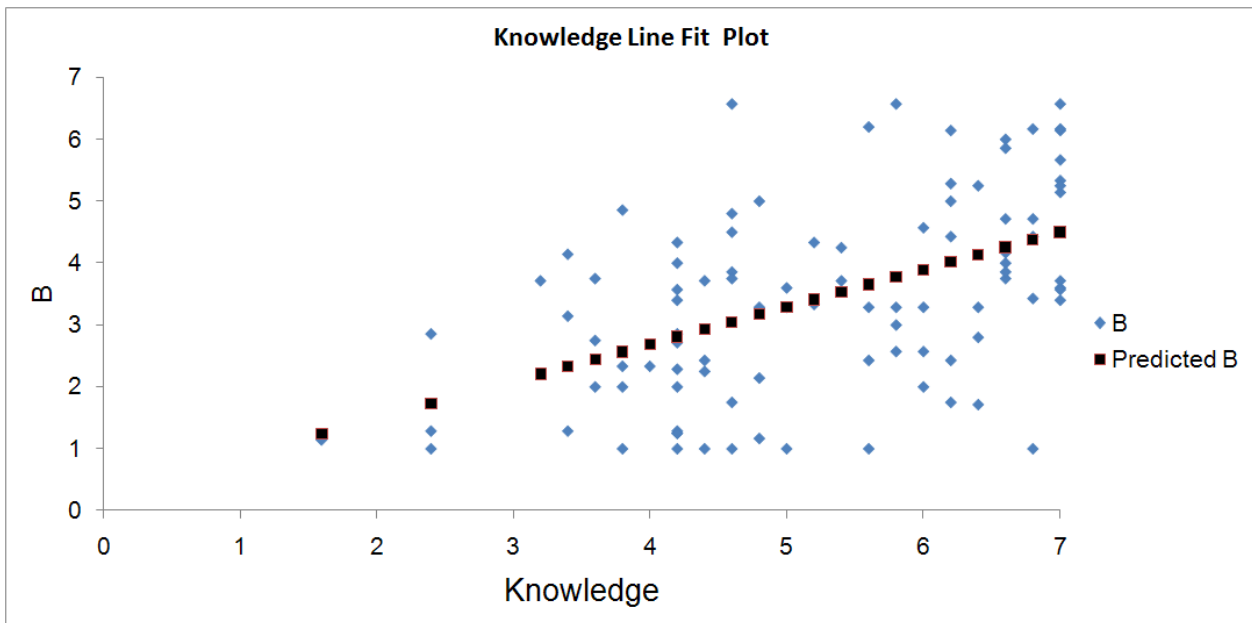
Figure 1. The line fit plot to describe the effect of knowledge on recycling behaviour.

The role of knowledge in behaviour has been debated for the past two decades (Denisov and Christoffersen 2001). Although knowledge about a certain action cannot guarantee behaviour that would execute such action, several recycling behaviour studies have shown that knowledge plays a part in recycling behaviour. For example, people need to have knowledge of local recycling services to be able to recycle (Barr 2007). Similarly McDonald and Ball (1998) suggest a knowledge gap as the reason why people do not recycle where recycling facilities are present.

3.2   The convenience factor

Respondents indicated that they would be more likely to recycle when they have a kerbside collection for recyclables than when they have to take recyclables to a collection point (Table 3). The further the collection point from their homes, the less likely they are to recycle. Respondents also indicated that they are more likely to recycle to support a charity cause than merely taking the recyclables to a conventional drop-off centre. Respondents are on average less willing to take recyclables to collection points than to sort recyclables and to put recyclables out separately for kerbside collection.

Table 3. Mean values comparing the likelihood and willingness of respondents to recycle under various posited circumstances.

Parameter	$\overline{X}$ [1]	SD	n
How likely to recycle if:			
Kerbside collection scheme in area	5.85	1.72	94
Have to take recyclables to collection point close to house	5.30	1.65	94
Have to take recyclables to collection point further away	4.13	2.03	94
Have to take recyclables to collection point to support charity	5.40	1.51	94
How willing to:			
Sort recyclables from rest of waste	5.67	1.54	95
Put recyclables out separately for kerbside collection at house	5.94	1.44	95
Take recyclables to collection points	4.91	1.73	94

[1]where 7 = very likely/willing; and,
    1 = not likely/willing

The convenience factor related to the distance to collection points for recyclables plays a role in the likelihood that such collection points will be used. The moral factor of doing good seems to outweigh the inconvenience of having to travel a distance to drop off recyclables at a collection point that supports a charity initiative. When designing recycling schemes, this finding should be recognised, as well as the fact that what would be convenient in one area might not be applicable to another.

3.3   Recycling Behaviour

The behaviour score per respondent is the average of the seven items that make up the behaviour construct as listed and explained in Table 4. While 91.6% of the respondents indicated that they engage in some recycling activity, the remaining 8.4% of the respondents with a behaviour score of 1, reported no recycling behaviour (Fig 2). A behaviour score that falls in the bracket >3-4 typically implies that a respondent takes responsibility for recycling in his/her household and often recycles about half of what he/she recognises as recyclable of three to five of the recyclable waste types, or recycles sometimes almost all of two of the five recyclable waste types. A recycling behaviour score of >6-7 indicates a household where all recyclables are recycled almost always and someone in the household, together with the respondent, takes responsibility for recycling in the household. Table 4 shows the mean scores for the behaviour construct as well as the items that make up the behaviour construct.

The results should be considered within the context that a relative large proportion of the respondents (39%) refrained from answering some of the questions related to behaviour. The non-responses for the taking responsibility item was 3.2% of the total number of respondents, and for quantities recycled of paper, glass, plastic, compost and metal, 6.3%, 8.4%, 16.8%, 31.6% and 23.2%, respectively. To calculate scores where data was missing, the mean based approach was followed. Thus, the mean scores are based on a subset which implies a bias for the cases where a response was omitted.
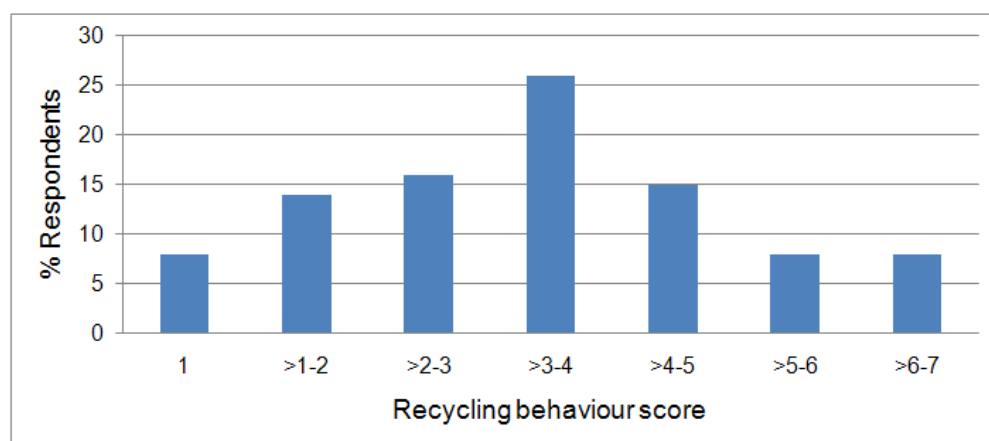

Figure 2. Recycling behaviour of the respondents, where 1=no recycling activity and 7=best possible recycling behaviour – recycling all recyclables always.

Table 4. Recycling behaviour of the respondents as measured by the behaviour construct consisting of three items: how often does your household recycle**, how much does your household recycle**** and who takes responsibility for recycling***.

Item	$\overline{X}$ [1]	SD	n
Recycling Behaviour (construct)*	3.43	1.58	95
Recycling Frequency**	4.70	1.81	95
Taking responsibility in household***	5.50	2.23	92
Recycling Quantities: ****			
Paper	4.41	2.06	89
Glass	4.18	2.07	87
Plastic	4.40	2.03	79
Compost	4.30	2.24	65
Metal	3.73	2.00	73

[1]where   7 = best possible recycling behaviour; and,
        1 = no recycling activity
**   Recycling frequency: Recycle never = 1; almost never = 2; seldom = 3; sometimes = 4; often = 5; almost always = 6; always = 7
*** Taking responsibility: No one = 1; not me, someone else = 2; I am = 3; I am and sometimes someone else is = 4
**** Recycling quantities: Recycle nothing = 1; very little = 2; some things = 3; about half = 4; most of = 5; almost all = 6; everything = 7

In the national survey, less than 30% of the respondents indicated that they recycle. Evident though, in the national survey few respondents (1.65% of the total sample) did not answer all the questions related to recycling behaviour and recycling frequency was the main non-answered question (1.45% of the total sample).

3.4   The Theory of Planned Behaviour

The Theory of Planned Behaviour (Ajzen 1985) provides a framework to understand the relationships between constructs to explain a certain behaviour. In this instance, the TPB model is fitted to determine to what extent the classic TPB model explains the variation in recycling behaviour. In short, according to the model, behaviour is determined by an intention to execute the behaviour, which in turn is determined by three latent variables, namely, attitude, subjective norm and perceived behavioural control. The attitude variable encapsulates the positive and negative feelings about the behaviour; the beliefs about, and the desirability of, the consequences. The subjective norm is the perception of the opinion of others important to the respondent and the motivation to comply with their wishes. The perceived behavioural control captures how difficult the respondent perceives performing the behaviour to be and how much control the respondent has over performing the behaviour. The mean values of the latent variables are shown in Table 5 and the fitting of the variables to the model in Figure 3.

Table 5. Mean-based scores for the latent variables of the Theory of Planned Behaviour, where the behaviour is recycling behaviour of WasteCon2010 delegates.

Latent variable	$\overline{X}$ [1]	SD	n
Intention to recycle	5.29	1.17	95
Attitude	5.71	1.14	95
Subjective norm	4.60	1.15	95
Perceived behavioural control	4.33	1.34	95

[1]where 7 = best possible; and,
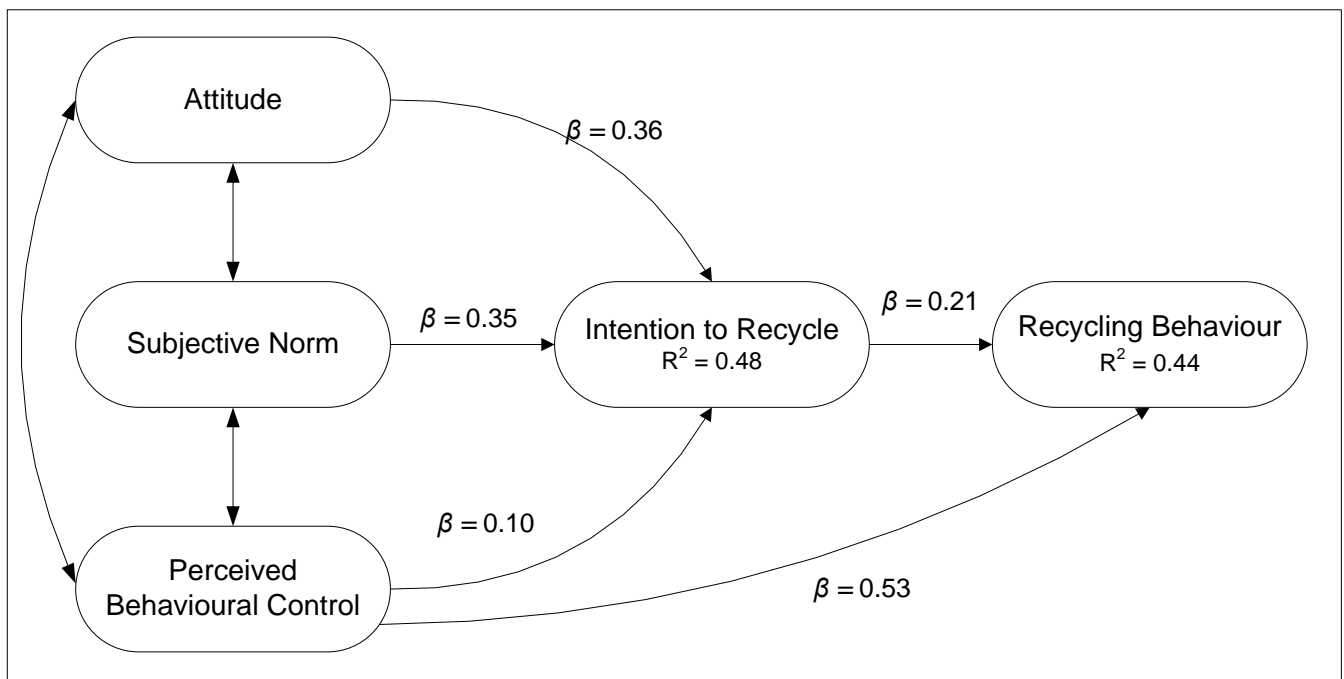   1 = worst possible

Figure 3. Fitting the classic Theory of Planned Behaviour, using a structured equation model and partial least squares path modelling.

Figure 3 shows that 44% of waste recycling behaviour can be explained using the TPB model (R^2 = 0.44). Recycling behaviour appears to be mostly influenced by the perceived behavioural control variable (PBC) (β=0.53), with intention to recycle (IR) having less of an influence on recycling behaviour (β = 0.21). The subjective norm (SN) and attitude (A) variables appear to be equal in their importance to predict intention to recycle (IR).

The results compare favourably with the findings from the meta-analysis of Armitage and Conner (2001) where the combined result from 185 independent empirical tests of the TPB explains 27% of the variance in behaviour (R^2=0.27). With 26% of waste recycling behaviour explained by the TPB, the national survey results are similar to the Armitage and Conner (2001) meta-analysis. The results From the Armitage and Conner meta-analysis it is also evident that the effect size of self-reported behaviour is normally higher than the effect size of observed

behaviour (R^2=0.31 compared to R^2=0.20). The uniformity of this study's sample (all with a common goal of being passionate about waste) together with the behaviour being self-reported, could contribute to the relatively high effect size of R^2=0.44.

With PBC having the greatest influence on recycling behaviour (β=0.53), the results suggest that the WasteCon delegates are more inclined to recycle because they feel that it is within their control to recycle; more so than the national sample group (β=0.37).

3.5   Reasons why people do not recycle

The reasons why people do not recycle, as the respondents indicated, are captured in Table 6. "Recycling facilities are inconvenient" were mentioned the most, followed by "they do not have a kerbside collection service for recyclables" and "they do not know what can and what cannot be recycled".

Table 6. Reasons why people do not recycle as indicated by the respondents.

Reason why people do not recycle	% Respondents[1]	% Responses[2]
Recycling facilities inconvenient	50.5	17.4
They do not have a kerbside collection service a for recyclables	47.4	16.3
They do not know what can and what cannot be recycled	33.7	11.6
They cannot be bothered	31.6	10.9
They lack the space to keep the recyclables	28.4	9.8
Recycling service is poor or does not exist	27.4	9.4
They think that it will not make a difference	26.3	9.1
They do not have the time	25.3	8.7
Keeping the materials until it is recycled is dirty and untidy	15.8	5.4
They are not responsible for recycling in their households	4.2	1.4

[1] Respondents could choose three reasons; therefore, this column will not add up to 100% (to use when comparing with the Perrin and Barton (2001) study).
[2] Expressed as a % of the total number of responses (to use when comparing with the Robinson and Read (2005) study).

These three most mentioned reasons is in line with the results from several international studies where inconvenience (McDonald and Ball 1998, Perrin and Barton 2001), facilities far away Martin et al. 2006, Perrin and Barton 2001), and lack of knowledge (McDonald and Ball 1998, Perrin and Barton 2001) were also indicated as important reasons why people do not recycle. Although lack of space features 5th on the list of reasons why people do not recycle, the allocated percentage is relatively high (29.5%), albeit lower than the Perrin and Barton (2001) figures of 35% and 50% for storage problems.

The three main reasons for non-recycling selected by the WasteCon delegates differ from the results from the national survey. In the national survey, where the majority of respondents (>70%) were non-recyclers, "they lack space" followed by "they do not have the time" and "keeping the materials is dirty and untidy" were the three most important reasons for not recycling. However, in the national survey, amongst the low recyclers (recycling behaviour scores of >1-2), the three most mentioned reasons for not recycling were "they do not know what can and what cannot be recycled" and "they lack space" sharing a first place, followed by "they do not have a kerbside collection service for recyclables" and "recycling facilities are inconvenient".

The respondents targeted in this survey, as previously indicated, belong to the waste fraternity and it, thus, can be suggested that they are aware of the difficulties related to recycling activity.

4.   CONCLUSION

Comparing the WasteCon delegate sample group with the national survey sample, a large percentage of the WasteCon delegates indicated that they recycle – more than 90% compared to less than 30%. The TPB explains 44% of the variance in recycling behaviour. Although this figure of 44% is higher than for the national survey and also higher than typically experienced for the TPB, it still suggest that there are other significant factors influencing waste recycling behaviour. It is suggested that the homogeneity of the sample group who have a common waste agenda and thus a fairly good knowledge of recycling, could have an influence on the results, but this was not tested for.

The large percentage of WasteCon delegates that recycle, suggests that knowledge of how and where to recycle and a feeling of control over the ability to recycle have a positive effect on recycling behaviour. Further studies on

the effect of knowledge on recycling behaviour are crucial to determine the awareness creation that is needed to maximise recycling participation at household level.

The mean scores related to convenience of recycling suggest that recycling is more likely to happen if recyclables are collected at kerbside than when it has to be dropped off at recycling centres. The further these drop-off points for recyclables are from place of residence, the less likely it is that recycles will be taken to these points. The indicated reasons why people do not recycle confirm that recycling facilities need to be convenient to use. Thus, recycling schemes should be designed to be as convenient as possible for the users of the scheme. Potential recyclers also need the necessary knowledge to enable them to take part in recycling. Further studies are needed in areas with differing demographics to ensure that the needs of communities related to recycling scheme and what would they perceive as being convenient can be accommodated in custom designed recycling schemes.

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