

Using the Theory of Planned Behaviour to determine recycling and waste minimisation behaviours: A case study of Bristol City, UK

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Many UK Local Authorities seeking to meet their regulatory recycling targets have adopted kerbside collection schemes for source-segregated recyclables from householders. The success of a recycling service is dependent on the number of people who participate in the service and the frequency and effectiveness of that participation. It is commonly accepted that recycling behaviour is strongly influenced and motivated by personal opinions as well as external issues such as access and convenience. This paper seeks to characterise the recycling attitudes amongst residents within Bristol City, UK, and compare them with the results from previously conducted identical studies in Brixworth (during 2003), and West Oxfordshire (2004), UK. For this study, the recycling attitudes and behaviour of 294 individuals from a cross-sectional socio-economic sample from Bristol City, along with the determinants of recycling and waste minimisation behaviour were investigated with a view to understanding the social impact that the expansion (addition of new materials) of the current recycling system would have on the local authority. The study was delivered via an online survey open to residents. Analysis of the survey results found that people were not satisfied with the current recycling system but had a positive attitude to the reduction of landfill sites, a key issue in reaching local authority targets. Significant differences in opinions were more prevalent amongst the demographic groups rather than socio-economic characteristics.

The number of separate kerbside dry-recycling and organic waste collection systems operated by UK Local Authorities (LAs) has risen sharply as a result of the implementation of the European Landfill Directive (99/31/EC) into UK legislation on the 16th July 2001, concerns over remaining available landfill void space, and statutory recycling targets set by central government. The Landfill Directive seeks to reduce the amount of biodegradable municipal waste (BMW) going to landfill in three successive stages, (eventually by 2020 to 35% of the 1995 total of BMW), because of the negative environmental impacts associated with leachate and methane production. Many LAs are currently conducting pilot trials, research projects and system reviews to determine the best possible way of segregating, collecting, transporting and processing their recyclable wastes and minimising disposal to landfill. However, few councils are canvassing their residents views or taking into account individual motivations prior to designing and implementing their recycling

schemes.

The introduction of the Wastes and Emissions Trading Act 2005 and the subsequent Landfill Allowance Trading Scheme (LATS) on the 1st April 2005, which enabled the trading of landfill allowances between LAs, resulted in a landfill allowance being granted to every UK waste disposal authority (WDA). For every tonne that is landfilled over the allowance, a fine of £150 is incurred (DEFRA, 2005). LATS was launched as a “tool to enable WDAs and England to meet the targets for the reduction of biodegradable municipal waste (BMW) sent to landfill in the most flexible and cost effective way” (DEFRA, 2005, p. 5). The legislation was designed to ensure that the UK meets its first Landfill Directive targets in 2010 and avoids non-compliance fines estimated at up to £0.5million per day (DEFRA, 2005). Our aim in this paper was to investigate the potential views and social impacts of expanding the current dry-

recycling (tins, glass and paper) system which has been in operation since March 1997, to also collect organic kitchen and garden wastes and cardboard from June 2006, by investigating the determinants of recycling and waste minimisation behaviour in Bristol.

Bristol City Council

Bristol is situated in the South West of England, on the English border with Wales. Bristol is a large UK City, with a population of approximately 393,000 in mid-2004, which was an increase of 2,400 since mid-2003. The population consists of all persons usually resident in Bristol, including students and school boarders at their term time address. Bristol City Council (BCC) predicts that Bristol's population will increase to just fewer than 426,000 by the year 2028. This population increase will result in an increase in the number of households; and, in turn, waste arising and the volume of material requiring recycling and disposal.

In March 1997, BCC introduced a city wide recycling collection of metal tins, glass and paper/magazines. From June 2006, this current recycling scheme was expanded to include additional materials - kitchen and garden wastes, and cardboard. In 2005, BCC handled 186,000 tonnes of household waste, of which 168,500 was landfilled (BCC, 2005). Bristol's overall reported recycling rate for 2004/05 was 12.44% and with a 2005/06 statutory recycling target of 18% (DEFRA, 2005), BCC anticipate that the collection of new materials will increase recycling rates allowing them to meet their targets whilst also diverting wastes from landfill. In addition to the £21 per tonne landfill tax the Council pays, £20 per tonne is spent on the waste's transportation. At the current quantities of landfill, the Council will have to pay £18 million in landfill taxes between 2006/7 and 2009/10 (BCC, 2005). The EU Landfill Directive has set an allowance of 76,500 tonnes for Bristol by 2009/10, well under half of that disposed of last year. If the Council does nothing, an overall fine of £14.4 million will be incurred, and could result in potential fines and taxes of £32.4 million by 2009/10 (BCC, 2005).

Theory of Planned Behaviour

There has been recent interest in exploring the use of models from social psychology to provide a theoretical framework for understanding householders' recycling behaviour (Davies, Foxall & Pallister, 2002). The literature indicates that environmental attitudes and situational and psychological variables are likely to be important predictors of recycling behaviour. Further investigation of the influence of these factors requires a theoretical framework.

The Theory of Planned Behaviour (TPB) (Ajzen, 1991) provides a theoretical framework for systematically investigating the factors which influence behavioural choices, and has been widely used to investigate behaviours, such as leisure choice (Ajzen & Driver, 1992), driving violations (Parker, Manstead, Strading, Reason & Baxter, 1992), shoplifting (Tonglet, 2002) and dishonest actions (Beck & Ajzen, 1991). The theory, which was developed from the earlier Theory of Reasoned Action (Ajzen & Fishbein, 1980), assumes that people have a rational basis for their behaviour, in that they consider the implications of their actions. The TPB hypothesises that the immediate determinant of behaviour is the individual's intention to perform or not to perform that behaviour. Intentions are, in turn, influenced by three factors:

1. Attitude, the individual's favourable or unfavourable evaluation of performing the behaviour.
2. The subjective norm, the individual's perception of social pressure to perform or not to perform the behaviour.
3. Perceived control, the individual's perception of their ability to perform the behaviour.

Factors external to the model, for example personality, past experience and demographic characteristics may also influence behaviour, but it is argued that this influence is indirect, mediated through the components of the model (Ajzen, 1991). The TPB has been used in several studies,

which investigate recycling behaviour (see Boldero, 1995; Chan, 1998; Cheung, Chan & Wong, 1999; Davies et al., 2002; Taylor & Todd, 1995; Terry, Hogg & White, 1999). Although there is considerable support for its use, there are concerns that it does not adequately explain recycling behaviour, and that additional variables should be included within the model (Boldero, 1995; Cheung et al., 1999; Davies et al., 2002; Macey & Brown, 1983; Terry et al., 1999). The TPB allows for the incorporation of additional variables, provided that these variables make a significant contribution to the explanation of behaviour (Ajzen, 1991). Thus, this study has incorporated a number of additional variables, including the moral norm; past experience; situational factors; consequences of recycling and attitudes to waste minimisation.

Research Design

The questionnaire used in Bristol to determine recycling behaviour was identical in design and length to a questionnaire previously used in Brixworth, Daventry, Northamptonshire (Tonglet et al., 2004) and West Oxfordshire (Davis et al., 2006). Daventry has consistently high recycling and composting rates, exceeding 40% (Read and Reed, 2003) and peaking at 45% in 2003. Whilst the recycling rate for West Oxfordshire was 11% in 2002/03 and 18% in 2005 (Davis et al., 2006).

The Brixworth study (Tonglet et al., 2004) was conducted between March and July 2003, and comprised of 290 householders that participated in a kerbside recycling scheme. Daventry County Council has a particularly high recycling participation rate (90%). This clearly had an effect on the results and the response rate to the recycling study; where people were already positively engaged in recycling. The survey received 191 responses. The West Oxfordshire District Council (WODC) study (Davis et al., 2006) sought to provide as similar study as possible to the one conducted in Brixworth. The study was conducted between July and August 2004, and rather than targeting recyclers, as in the Brixworth study, it targeted ACORN groups (a socio-economic classification system usually used in marketing – ‘A Classification of

Residential Neighbourhoods’), in particular geographical locations, identifying the different participation rates between areas. The survey received 74 responses. Both studies used the identical questionnaire to ensure consistency in the results. The Bristol study also used this survey, but the survey was ‘open’ to any Bristol City resident to complete.

The Brixworth and West Oxfordshire methodology: Questionnaire design

The Brixworth/West Oxfordshire questionnaire was based on the recycling research literature and previous applications of the TPB (see Beck & Ajzen, 1991; Boldero, 1995; Davies et al., 2002; Tonglet, 2002) and information obtained from the elicitation interviews. Seven-point rating scales were used throughout the questionnaire, with 1 indicating a positive view of recycling and waste minimisation issues, and 7 indicating a negative view. In addition to the components of the Theory of Planned Behaviour, the questionnaire contained questions on waste minimisation issues. The respondents were asked to indicate the extent of their agreement with a number of behaviours relating to the purchase or re-use/repair of household products. The questionnaire contained the following sections:

- *Personal recycling behaviour*—future recycling intentions, frequency of recycling, past recycling behaviour.
- *Recycling attitudes*.
- *The subjective norm*—the individual’s perception of social pressure to recycle household waste.
- *Perceived control*—the individual’s perception of their ability to perform the behaviour.
- *Situational factor*—physical factors which may facilitate or inhibit recycling behaviour.
- *Consequences of recycling*—the outcomes of recycling behaviour.
- *Attitudes to waste minimisation*—the respondents were asked the extent to which they engaged in a number of waste minimisation behaviours.
- *Demographic information*—age, gender,

Table 1
Predictors and example questions

| Predictor | Example Questions |
|---------------------------------|--|
| Attitude | "I think the recycling of household waste is good/ bad. |
| Subjective Norm | "Most people who are important to me think that I should recycle my household waste" |
| Perceived Behavioural Control | "I have plenty of opportunities to recycle my household waste" |
| Moral Norm | "I feel I should not waste anything if it could be used again" |
| Situational Factors | "Recycling is too complicated" |
| Consequences of recycling | "Recycling saves energy" |
| Attitudes to waste minimisation | "I buy long-life goods to save resources" |

marital status, education, occupation, household role, and number of children in household., ethnicity, education and occupation were asked for. A postcode was required for ACORN analysis. A form was also provided for any further comments on the subject of waste minimisation or recycling.

- Personal Recycling Behaviour – These are the three questions at the start of the survey used to test current, past and future recycling behaviour.

In the survey design, certain extra predictors could be added to the model, if relevant (Table 1). In this case the following were added in accordance with the previous studies: moral norm, situational factors, the consequences of recycling and attitudes to waste minimisation. The items are also randomly assorted so predictors were not grouped together, a recommendation by Ajzen (Francis et al., 2004). However, a clear structure was maintained, with answer scales grouped where possible.

The survey was delivered online as there are numerous advantages to an online format, including the enhanced use of images and colour, which can make the survey more appealing and accessible. The survey can be split into controlled pages, creating manageable sections. Users could not move to a new page without answering all the questions, a feature that can be programmed and guarantees complete responses. This also prevented users from moving ahead and being

discouraged from completing the survey due to the amount of material.

The electronic nature of the survey made the results easier to collate and process as it reduced user effort as there is no need for data input. The results could also be directly imported into the required processing software, reducing time and error in data input. The limitations of an online survey are that the respondents cannot be controlled in the same way that a postal survey targets specific households, and will only elicit response from computer users which may, by default, eliminate certain socio-economic and socio-demographic groups. The survey results were sorted into ACORN groups based on the provided postcode to measure the spread of responses.

The questions were entered into 'Snap', a specialised piece of survey software. Its internet module converted the survey into a web-browser format and was hosted onto Bristol City Council web site (<http://www.bristol-city.gov.uk/item/surveyrecycle.html>) between February and April 2006. Due to the specific nature of the survey delivery, a high level of promotion was required to raise awareness of the survey and encourage people to complete it. Promotion was mainly direct in an electronic format, as the user was already online and a clicked hyperlink gave direct access to the survey. However, it was noted that a non-electronic forms of promotion could often target more people. Council promotions

included:

- Hyperlinks were added to the Recycling and Waste pages on the Council Website.
- A hyperlink was added to the ‘Ask Bristol’ website, a consultation website for the citizens of Bristol.
- An email was sent notifying the ‘Ask Bristol’ panel about the survey.
- A press release was drafted and was featured in the ‘Bristol Evening Post’ (a local free-of-charge paper delivered directly to householders) alongside its online version.

Additional Promotions:

- Word of mouth.
- An article was featured in the Bristol University student newspaper, the ‘Epigram’.
- Leaflets were delivered to 600 houses within the City Centre area.
- Notices were placed in 3 libraries and 2 internet cafes situated across Bristol City.

As an added incentive to encourage survey completion, BCC offered £100 of shopping vouchers to one participant and two prizes of £50 to two further participants.

Results

Demographic composition of sample

Respondent characteristics included:

- 55% were female: 43% male (2% no response);
- 22% of the respondents were aged 18-24; 37% belonged to the 25-39 age group, 36% were aged 40-64, and only 1% were 65 and over;
- 56% were married/cohabiting, 34% were

single, 6% were divorced/separated, 2% were widowed;

- 9% had GCSE’s as the highest level of education, 15% had “other” qualifications, 16% has A-levels, and 56% a university degree;
- 24% skilled, 23% held managerial positions, 19% clerical, 16% student, 6% retired and 1% unskilled;
- 87% were British white, 15% other white, 3% Asian, 3% black Caribbean and 2% white Irish.

The ACORN classification of participants is included as Table 2.

Statistical analysis of the Theory of Planned Behaviour

Four questions were selected for focus, due to their relevance for a new waste management system:

1. ‘The local council provides satisfactory resources for the recycling of my household waste’,
2. ‘I would be more likely to recycle if the recycling system was less complicated’,
3. ‘Fewer landfill sites is important to me’,
4. ‘I would only recycle if my council tax increased if I did not recycle’.

Satisfaction with resources provided.

Question 1: ‘The local council provides satisfactory resources for the recycling of my household waste’ was selected as it assesses how people perceive the current recycling system provided. Figure 1 shows the ACORN category responses for this question. There was a tendency to disagree overall; the mean for the whole population is 4.37. The one-way

Table 2
ACORN classifications of respondents

| ACORN Category | Frequency | Percentage |
|-----------------------|-----------|------------|
| 1 – Wealthy Achievers | 22 | 7% |
| 2 – Urban Prosperity | 132 | 45% |
| 3 – Comfortably Off | 52 | 18% |
| 4 – Modest Means | 44 | 15% |
| 5 – Hard Pressed | 16 | 5% |
| Unclassified | 28 | 10% |
| Total | 294 | 100% |

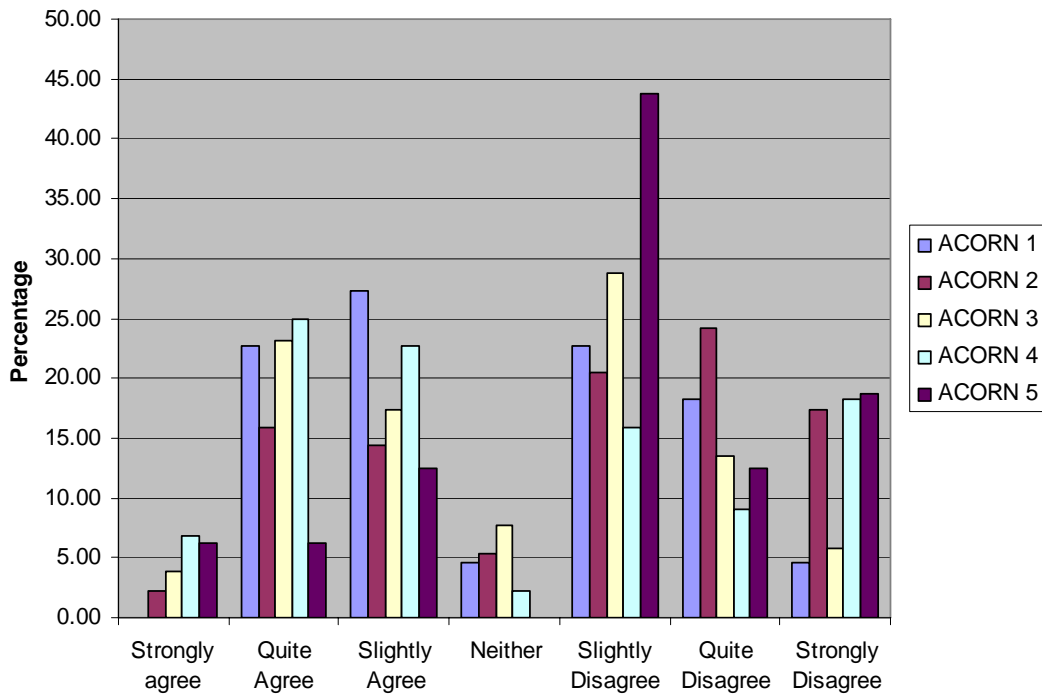


Figure 1
ACORN response for satisfaction with resources provided.

ANOVA test conducted on the ACORN data returned a significance of 0.035, showing that at least one ACORN category has statistically different opinions on the subject. The same tests were run for sex and age. Sex returned a significance of 0.076 and age 0.908, so these

groups were not statistically different in their divisions.

Simplicity of current system.

Question 2, 'I would be more likely to recycle if the recycling system was less complicated' was considered important as it demonstrates how

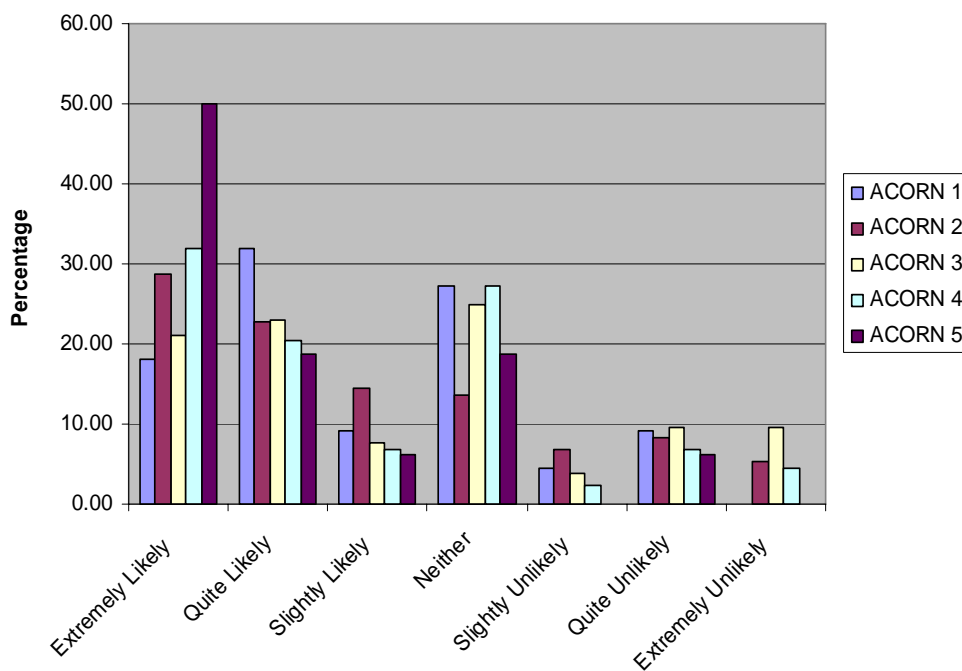


Figure 2
ACORN response for simplicity of current system.

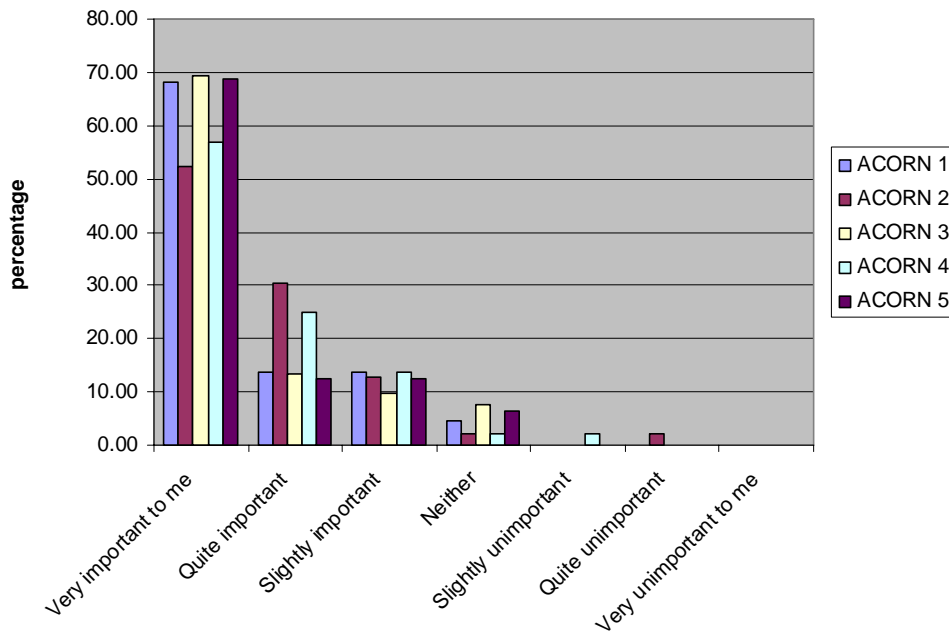


Figure 3
ACORN responses to opinions on landfill.

residents view the complexity of the current recycling system and if a new waste management system would need to focus on being simpler. Figure 2 shows the ACORN category responses for this question. It is shown that the population has a tendency to agree that they would be more inclined to recycle with a simpler system in place. The mean for the population is 3.01, settling around

the statement ‘slightly likely’. With one-way ANOVA, neither ACORN, sex or age proved statistically significant (0.256, 0.286 and 0.790 respectively), showing that opinions on this were general and did not differ for specific groups.

Opinions on landfill. Question 3, ‘Fewer landfill sites is important to me’ is important and determines if the population feels strongly

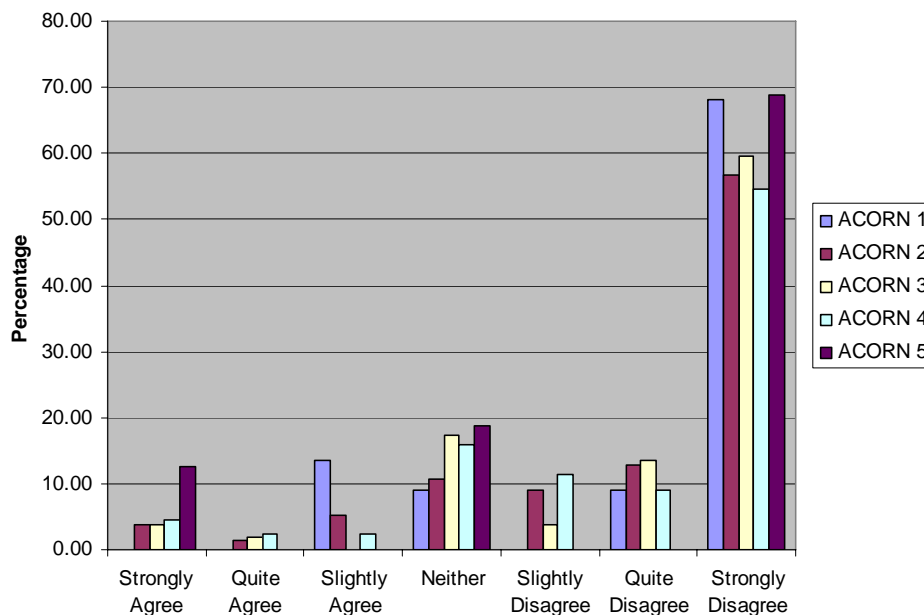


Figure 4
ACORN responses to financial incentives.

Table 3: Significant questions for all three categories

| Question | ACORN | Sex | Age |
|---|-------|-------|-------|
| If I recycle my household waste I will be helping to conserve natural resources | 0.005 | 0.005 | 0.001 |
| If I recycle my household waste I will be helping to protect the environment | 0.002 | 0.004 | 0.003 |
| Recycling saves energy | 0.002 | 0.032 | 0.000 |
| Clear instructions are provided on how to recycle my household waste | 0.004 | 0.002 | 0.000 |

about reducing landfill. As previously mentioned, BCC could face future fines if it fails to meet its landfill diversion targets. Figure 3 shows the ACORN category responses. As shown, all ACORN groups tend heavily towards 'very important', and the population mean is 1.67, reflecting this. ANOVA tests show that there is no statistical significance for the different ACORN categories (0.750) whereas sex and age both show statistical significance. This means there are significant differences in opinions for at least one group within sex and within age on this matter.

Response to financial incentive. The final question, individually analysed was 'I would only recycle my household waste if my council tax increased if I did not recycle'. This question investigated financial incentives, determining if people would recycle rather than pay a higher waste collection fee for not recycling. Figure 4 shows the ACORN category responses. The population mean is 5.92, showing a heavy tendency towards disagreement. With ANOVA, neither ACORN nor age proved statistically significant (at 0.914 and 0.133), but sex returned 0.005, showing that the difference in opinion on this issue was statistically significant.

ANOVA for all questions. The one-way ANOVA test was conducted on the remaining survey questions and the summaries of whether a question was statistically significantly different for ACORN, sex or age groups. Four questions were identified as statistically different for all three categories (Table 3). The one-way ANOVA for all questions found that many issues raised a significant difference in opinion in the demographic groups. However,

many more differences were noted in age and sex groups than ACORN groups.

The demographic data shows a good spread between males and females. The age categories were slightly underrepresented in the 18-24 and 65+ categories compared to the others. The 18-24 category could be explained by the fact that it is simply a smaller category, and the lack of 65+ could be associated with the online format of survey. Over half the survey population were educated to degree level and the majority held posts at managerial, clerical or skilled levels. Ethnicity was predominantly 'White British'. Analysis using the ACORN categories could prove inappropriate in categories 1 and 5 due to small sample sizes.

Theory of Planned Behaviour Analysis

Of the surveyed population, 88.1% responded that they recycled their household waste weekly or fortnightly and 91.5% said they were either quite or extremely likely to recycle in the next four weeks. This implies that the population is made up of predominantly active (self-proclaimed) recyclers with a continued intention to do so. The following analysis is based on the assumption that these statements are true.

Factor Analysis

A Kaiser-Meyer-Olkin measure of sampling adequacy test was carried out to check that the data was suitable for factor analysis. A result over 0.6 shows this is the case, and the data returned a KMO measure of 0.887. Factor analysis is carried out to group the variables into factors which represent separate and independent underlying measures of recycling behaviour (Tonglet et al., 2004).

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A Scree Test was undertaken to determine the number of factors from the Eigenvalues which represent the amount of variance explained by one more factor each time (Cattell, 1966, as cited in Tabachnick & Fidell, 2001). The scree plot for the survey data indicates that the plot starts to level out (the 'scree') between 5 and 8 components, so these will be assessed. Factor analysis is subjective, so whichever number of factors provides the best outcome will be used.

The factor analysis was carried out using principle component analysis with Varimax rotation. Any negatively worded questions were recoded first (such as 'Recycling takes up too much time'). Six factors provided the best factor analysis, as higher factors did not group together the main theory of planned behaviour predictors: attitudes, subjective norm and perceived behavioural control. The other 3 factors were defined as consequences of recycling, situational factors and waste minimisation factors. The only factor, which did not appear from the original survey design, was moral norm. The variables for each factor were tested for reliability using Cronbach's Alpha test. The alpha needs to be greater than approximately 0.7 to conclude that the scale is reliable (SPSS, 2003). Table 4 shows the variables defined for each factor and their reliability.

Multiple Regression analysis

Table 4
Reliability scores

| Factor | Reliability |
|-------------------------------|-------------|
| Attitudes | 0.845 |
| Subjective Norm | 0.768 |
| Perceived Behavioural Control | 0.695 |
| Situational Factors | 0.852 |
| Consequences of Recycling | 0.931 |
| Waste Minimisation Factors | 0.854 |

Hierarchical multiple regression analysis was then used, as in Brixworth and West Oxfordshire District County studies. Multiple regression analysis uses independent variables or factors to predict the outcome of a dependent variable. In this case the dependent variable was intention to recycle, using the question 'How likely is it that you will recycle your household waste over the next four weeks?'

Overall the TPB components explain 11.9% of the outcome, intention to recycle. All the entered factors account for 30.9% of the overall variance of intention to recycle. Attitude, perceived behavioural control, situational factors and waste minimisation factors are all statistically significant. Situational factors were most strongly correlated, then perceived behavioural control, followed by waste minimisation factors and attitude.

Comparison to other survey results (Brixworth and WODC)

The WODC study did not include waste minimisation factors in its analysis, so the regression was re-run without this construct for comparative purposes (Table 6). The Brixworth study (Tonglet et al., 2004), with all constructs considered, found that the Theory of Planned Behaviour components accounted for 26.1%, with the additional variables accounting for 33.3%. The WODC study (Davis et al., 2006) found that the TPB components only accounted for 2% of the outcome, with additional variables 57.7%.

Discussion of results

The number of factors found for the Bristol data was less than those in the Brixworth and WODC studies. However, the original survey design incorporated 7 factors, of which all were

Table 5
Multiple regression data

| | Theory of Planned Behaviour Adjusted R ² 0.119 | | | With additional variables Adjusted R ² 0.309 | | |
|------------------------------|--|----------|---------------|--|----------|---------------|
| | Beta | <i>t</i> | Sig. <i>t</i> | Beta | <i>t</i> | Sig. <i>t</i> |
| Attitude | 0.135 | 2.458 | 0.015 | 0.135 | 2.776 | 0.006 |
| Subjective Norm | 0.077 | 1.408 | 0.160 | 0.077 | 1.590 | 0.113 |
| Perceived Behavioral Control | 0.322 | 5.881 | 0.000 | 0.322 | 6.640 | 0.000 |
| Situational Factors | | | | 0.407 | 8.383 | 0.000 |
| Consequences | | | | 0.095 | 1.964 | 0.050 |
| Waste Minimisation Factors | | | | 0.142 | 2.920 | 0.004 |

identified apart from moral norm. Again, this factor was not identified in the WODC study. The theory of planned behaviour predictors did not explain as much of the variance for the Bristol study as was explained by the Brixworth study, however, it was more significant than was found in the WODC study. The TPB components within the WODC study only explained 2% of the outcome, intention to recycle; and according to the theory, "attitude and subjective norm and perceived control did not have a significant predictive power on intention to recycling in West Oxfordshire" (Davis et al., 2006). The amount of variance explained by all the factors was similar to the Brixworth study at just 3% less, but both of these studies predicted over 20% less of the variance than the WODC study

did. It is worth noting that the WODC study only received 74 responses, whereas Brixworth received 191 and Bristol 294 responses. According to Francis et al., (2004), a sample size of at least 80, assuming a moderate effect size, should be obtained when using a multiple regression procedure with the theory of planned behaviour.

The Bristol study found that situational factors were the strongest predictors of intentions to recycle. The Brixworth study did not find situational factors significant, whereas the WODC study did. Of the theory of planned behaviour predictors, the Bristol study found that perceived behavioural control, followed by attitude, were significant predictors of intention to recycle. The Brixworth study found that attitude alone was a significant predictor of

Table 6
Comparison of multiple regression data (source for external data: Davis et al., 2006)

| | Bristol | | | Brixworth | | | WODC | | |
|---------------------|---------|----------|---------------|-----------|----------|---------------|--------|----------|---------------|
| | Beta | <i>t</i> | Sig. <i>t</i> | Beta | <i>t</i> | Sig. <i>t</i> | Beta | <i>t</i> | Sig. <i>t</i> |
| Attitude | .135 | 2.740 | .007 | .434 | 5.493 | 0 | -.003 | -.832 | .408 |
| Subjective Norm | .077 | 1.570 | .118 | .039 | .575 | .566 | .097 | .172 | .864 |
| Perceived Control | .322 | 6.554 | .000 | .145 | 1.865 | .064 | -.060 | -.699 | .487 |
| Moral Norm | N/A | N/A | N/A | -.109 | -1.541 | .125 | N/A | N/A | N/A |
| Past Behaviour | N/A | N/A | N/A | .156 | 1.997 | .047 | -.114 | .137 | 0.175 |
| Situational Factors | .407 | 8.276 | .000 | 0.014 | 0.140 | 0.870 | 0.212 | 2.190 | 0.032 |
| Outcomes | N/A | N/A | N/A | 0.027 | 1.595 | 0.112 | 0.864 | 0.943 | 0 |
| Consequences | .095 | 1.939 | .053 | -0.299 | -4.073 | 0 | -0.180 | -1.876 | 0.065 |
| Concern | N/A | N/A | N/A | 0.156 | 2.189 | 0.030 | -0.276 | -2.809 | 0.007 |

intention; it also found it to be the most significant predictor out of all the factors. The WODC study did not find any of the theory of planned behaviour predictors to be significant, rating outcomes as the most strongly correlated to intentions, a factor not identified in the Bristol study. Interestingly, none of the three studies found subjective norm to be a significant predictor of recycling behaviour.

The analysis of the theory of planned behaviour was carried out under the assumption that the surveyed population's response to current and intended recycling behaviour was true. It has been shown in a previous study (Woollam et al., 2003), that prior to implementing a new kerbside recycling scheme, of the 95% of households that self-claimed that they would participate in a new scheme, only 27% actually did. This shows that both actual and intended recycling behaviour can be grossly exaggerated by survey respondents. If this had been the case in the Bristol response, it sheds doubt on the validity of the dependent variable, the 'intention to recycle'.

Conclusions

Analysis using the theory of planned behaviour found that attitude and perceived behavioural control were significant predictors of intention to recycle. However, the theory of planned behaviour predictors only explained 11.9% of the intention's variance, thus additional factors were entered, for example, situational factors made a significant contribution to improving the predictive ability of the model as was also found in the WODC study. It was observed that the propensity to recycle varied between individuals and socio-economic areas. It was determined that many socio-economic factors were not as significant as others in explaining recycling behaviour. As previously (Davis et al., 2006), the Theory of Planned Behaviour Model did not explain specific attitudinal variables that determine the intention to recycle amongst Bristol residents. New research which commenced January 2008, by the Department of Environment, Fisheries and Rural Affairs (DEFRA), UK, seeks to provide a more accurate framework for measuring and understanding a range of pro-environmental behaviours including

household recycling (DEFRA, 2008). This research uses a social marketing methodology which applies an environmental segmentation model, essentially dividing the public into seven clusters, "each sharing a distinct set of attitudes and beliefs towards the environment, environmental issues and behaviours" (DEFRA, 2008, page 8). This research will reach conclusion at the end of 2008 for publication early 2009. However, until this work is completed, the TPB remains one of the most widely applied models for determining waste minimisation and recycling behaviours, despite its limitations.

The TPB requires large data sets to facilitate a detailed analysis, thus the length and complexity of the survey tool is unattractive for many individuals to complete which is adverse for a method which is heavily reliant on high response rates and the completion of all questions. The online format of the survey worked well, with a high number of responses. However, given the different methods of promotion used, a survey question enquiring where the respondent had heard about the survey would have been useful in order to determine the effectiveness of each technique for future promotional activities. The survey incentive scheme proved useful, with a large majority of respondents choosing to enter the prize draw (85%).

The survey analysis indicated potential implications for a new wastes management system. The survey population would clearly welcome a simpler system, and did not believe the current system provided all the resources necessary to recycle. The issue of landfill is highly recognised by the survey population, giving a good scope for acceptance of higher targets. The ANOVA for all questions demonstrated a definite case for promoting waste minimisation and recycling issues differently to different demographic groups where, in many cases, differences in opinions were shown to be statistically significant. The occurrence of differences was much higher in sex and age groups than across ACORN categories. Tucker (2003), identified the problem of not knowing 'a-priori of what the actual

demographic influences might be'. Vencatasawmy (2000), found further links between demographic groups and propensity to recycle, for example, the propensity to sort waste increases with age. Given that people in different ACORN categories did not appear in most cases to have significantly different opinions, the use of ACORN in this field of work is not valid.

The theory of planned behaviour results show that if a new wastes management system is implemented, situational factors are the strongest predictors for future recycling behaviour. This means that the implementation of a simple, time and space efficient recycling system will have the greatest effect on recycling behaviour. Perceived behavioural control was identified as a significant predictor alongside attitude in terms of the theory of planned behaviour. If people think that they have control over their recycling actions and have positive attitudes towards recycling, they are more likely to recycle in the future. This can be controlled by clear and simple instructions for a new recycling system and continued promotion of positive reasons to recycle. Waste minimisation factors were also found to be significant predictors of recycling intentions; this was a positive finding as it means increasing awareness of waste minimisation should contribute to future recycling levels as well as the more direct effect of reducing the total waste generated in the first place. As the subjective norm was not shown to be a significant predictor of recycling intention, it should be noted that the influence of other people's opinions on personal recycling behaviour is not necessarily of importance. The results from this study can be used to help inform LAs that are considering the development of their recycling schemes in terms of the likely participation based on an appreciation of their own socio-demographic profile, and also highlights the importance of keeping a recycling system convenient and easily accessible to residents.

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