Determinants of Household Pro-Environmental Behaviour: An Exploratory Analysis

Shankar Murthy, National Institute of Industrial Engineering, India
Manoj Govind Kharat, National Institute of Industrial Engineering, India

The Asian Conference on Sustainability, Energy & the Environment 2016
Official Conference Proceedings

Abstract
What strongly influences or determines household pro-environmental behaviour (PEB) is a question of great curiosity across the globe. Solution to this research question has important implications for researchers, strategic planners and public policy makers. Multidisciplinary research seems necessary to answer this complex question identifying variables that influence PEB at individual level. In the light of recent work on environmental paradigms, the currents study attempts to explore and identify the relevant factors that contribute to PEB significantly. To achieve the stated objective, an in-depth literature review and qualitative analysis was carried out. A questionnaire was developed to measure the PEB construct and its determinants. Next, a pilot study was conducted to assess the reliability of the questionnaire. Following this, exploratory factor analysis was conducted to identify the major determinants. Construct validation using exploratory factor analysis showed an interpretable latent structure consisting of determinants of PEB. Results indicate that PEB comprises of nine dimensions viz., behavioural intention, attitude, personal moral norms, subjective norms, situational factors, perceived behavioural control, community concern, internal attribution and perceived consequences. Finally, the study integrates the internal and external determinants in an understanding framework to predict different types of PEBs. The results of the study provide insights for researchers, strategic planners and policymakers to help more people behave in environmentally responsible ways. On the theoretical side, the results of the study provide additional empirical evidence to researchers and a reliable scale to measure PEBs.

Keywords:Pro-environmental behaviour; Determinants of PEB; Reliability analysis; Exploratory factor analysis.

Introduction

Environmental problems are becoming more acute with each passing year. The world is facing serious environmental issues related to, amongst others, global warming, air pollution, waste management, energy shortage, on-renewable resource conservation, water conservation and scarcity of safe drinking water. The most serious long-term threat facing the world is the danger that human actions are producing irreversible, harmful changes to the environmental conditions that support life on Earth (da Costa Ferreira and Barbi, 2016). The ultimate impacts of these problems are drastic changes to quality and quantity of all forms of life. These problems are, at least partly, rooted in human behaviour (Gardner and Stern, 2002; Vlek and Steg, 2007; Koger and Winter, 201; De Leeuw et al., 2015), and can thus be managed by changing the relevant behaviours so as to promote environmental quality (Reddy et al., 2016). As individual behaviour plays an important role in the preservation of environment, individuals can choose to adopt behaviours that are comparatively better for the environment (Scott et al., 2015). These behaviours are called responsible environmental behaviours, sustainable environmental behaviours or pro-environmental behaviours (PEBs) (Turaga et al., 2010; Allen, 2016).

In order to promote PEB effectively, an essential first step is to enhance the understanding of the factors influencing individual's engagement in PEB supportive of a sustainable future, this will help to develop effective social marketing initiatives that promote PEBs (Larson et al., 2015). Thus, it is noteworthy and interesting to study, which factors influence individual PEB? How individuals can be encouraged to get engaged in pro-environmental actions? Which motivations can best be targeted to promote behavioural changes? Major emphasis is required to be placed on encouraging pro-environmental action by individuals for sustainability.To address this, the current study aims to determine the factors that influence PEB. An attempt is made with the help of exploratory factor analysis, to conceptualize PEB and its antecedents. Determinants considered in the study were taken from the theory of planned behaviour (TPB) (Ajzen, 1991), as well as from literature comprising of personal moral norms, community concern, perceived consequences, internal attribution and situational factors (van der Werff, and Steg, 2015; Allen, 2016). Data from the research study was used to provide further evidence for the impact of various psychosocial, informational and situational variables influencing PEB. By means of statistical techniques such as reliability analysis and factor analysis, the current study developed a reliable and valid scale of PEB.

To demonstrate the approach taken, a case of household waste minimisation was undertaken in the metro city of Mumbai, India. The management of municipal solid waste (MSW) is an ongoing problem. The simplest and most effective way of dealing with waste is at source. Hence, waste minimisation at the source is an important focus of the MSW management strategy. Understanding behaviour is the key to taking waste minimisation forward, but there are significant barriers, such as lack of knowledge, facilities, motivation and influences (Allen, 2016). Given the potential implications of waste minimisation behaviour in environmental and economic terms, there is much to be learned about the operating mechanisms of its social and psychological antecedents. Policy makers and researchers are increasingly interested in what factors are associated with individuals engaging in waste minimisation activities. Thus, the current study attempts to understand the household participation

in waste minimisation behaviour i.e. PEB.The household waste minimisation behaviour is taken as targeted behaviour as it involves physical as well mental efforts to engage in the behaviour (PEB). For the purpose of the current study, waste minimisation is defined as the actions taken by householders to minimise their waste by reducing, recycling and re-using or repairing products rather than replacing them (Corvellec, 2016).

Literature review

There is rising interest in the extent to which people behave in pro-environmental ways and what makes them behave in more environmentally friendly ways than others (Fielding and Hornsey, 2016; Allen, 2016). The specific focus is based on the premise that individuals' behaviour towards the environment is influenced by what they feel and think about the environment and pro-environmental action (Oregand Katz-Gerro, 2006; Allen, 2016).A number of researchers have drawn on environmental psychology to analyse internal and external influences such as values, beliefs, attitudes, or norms as underlying motivations, which have turned out to be more successful in predicting PEBs (Davies et al., 2002, 2008; Hoyos et al., 2009; De Groot and Steg, 2010; Morren and Grinstein, 2016; Reddy et al., 2016).

Several models have been proposed to study PEB (van der Werff, and Steg, 2015; Allen, 2016). The two most popular ones, which serve as a starting point for several other theories, are the TPB, which relies on the assumption that attitudes have a causal impact on behaviours via behavioural intentions (Ajzen and Madden, 1986; Ajzen, 1988, 2005; Thøgersen, 1994; Boldero, 1995; Taylor and Todd, 1995; De Leeuw et al., 2015; Graham-Rowe et al., 2015); and Schwartz's altruistic model (Schwartz, 1970, 1973, 1977; Vining and Ebreo, 1990, 1992; Guagnano et al., 1995; Bissing-Olson et al., 2016), which explains pro-environmental actions by favourable personal norms; and other approaches include, for example, the value-attitude-behavior model (McCarty and Shrum, 1994), which shows that attitudes and beliefs mediate between abstract values and specific behaviours; operant conditioning theories, which explore how behaviour can be altered by providing informational feedback, rewards or penalties (e.g., Katzev and Mishima, 1992; Werner et al., 1995); or self-regulation theory (Sansone et al., 1992), which proposes that people regulate their behaviour by changing related cognitions, emotions, or perceptions (Werner and Makela, 1998).

The TPB, an extension model of the Theory of Reasoned Action (Ajzen, 1985, 1991; Ajzen and Madden, 1986), is one of the most widely researched models for predicting behavioural intentions by social psychologists (Armitage and Conner, 2001; Collins and Carey, 2007; Norman et al., 2007; Fielding et al., 2008). In the domain of PEB intentions, many researchers (e.g., Lam, 1999; Terry et al., 1999; Bamberg and Schmidt, 2001; Bamberg et al., 2003; Chen and Tung, 2010; De Leeuw et al., 2015) also considered the TPB as an important theoretical basis to understand whether individuals intend to perform environmentally friendly behaviour. The TPB provides a theoretical framework for systematically investigating the factors which influence behavioural choices (Fielding et al., 2008), and has been widely used to investigate behaviours, such as leisure choice (Ajzen and Driver, 1992), driving violations (Parker et al., 1992), shoplifting (Tonglet, 2002), dishonest actions (Beck and Ajzen, 1991),travel choice mode (Bamberg et al., 2003), green purchasing behaviour (McLeod et al., 2015)and waste recycling behaviours (Barr et al., 2001; Tonglet et al.,

2004, Yau, 2012; Botetzagias et al., 2015) etc. The theory 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.

A number of recent studies have shed light on the behaviours in common dilemmas by accounting for other economic and social mechanisms such as economic incentives, communication, bio-spherism, altruism, reciprocity and social norms (Mulder et al., 2006; Thøgersen, 2008; Yau, 2010; Ostrom, 2014). Despite a considerable support of TPB, several authors have suggested that additional variables such as situational factors should be included within the model (e.g. Boldero, 1995; Cheung et al., 1999; Terry et al., 1999; Davies et al., 2008; Sniehotta et al., 2014; Conner et al., 2015). Consequently, some of the earlier studies combined and/or extended the TPB with other determinant factors into their research models. For example, Chen and Tung (2010) built an extended TPB research model that incorporated moral norms and consequences of recycling to explain individuals' recycling intentions and found that this extended TPB research model could explain individuals' recycling intentions well. Some studies rely on the development of the TPB to suggest that attitude is the main predictor regarding waste management intentions, and based on this positive intention, it is possible to predict the actual waste management behaviour of the individual (Tonglet et al., 2004; Barr and Gilg, 2005; Ghani, et al., 2013; Nguyen et al., 2015). Similar empirical evidence has been found in several studies regarding waste management behaviour (Chu and Chiu, 2003; Kanbar, 2005; Babaei et al., 2015; Botetzagias et al., 2015). In the pro-environmental context, Kaiser (2006) highlighted that a model predicting individuals' conservation behavioural intention may also contain a moral dimension, which is positively related to individuals' conservation behavioural intention.

The questions concerning how individual decisions are made and how defection problems are resolved have been addressed in various studies. The literature suggests that, the influences on PEB include experience; knowledge and education; personality; perceived behavioural control; values, attitudes, worldviews of various kinds; felt responsibility and moral commitment; norms and habits; goals; affect; and demographic factors (Tonglet et al., 2004; Barr and Gilg, 2005; De Groot and Steg, 2010; Ghani, et al., 2013). A number of previous studies have stressed the importance of environmental concern in predicting environmentally oriented behaviour (e.g., Laroche et al., 2001; do Paco and Rapose, 2009; Kim and Han, 2010; Dietz, 2015; Huddart Kennedy et al., 2015). Moreover, many previous studies indicate that PEB can be facilitated by convenience (Ando and Gosselin, 2005; Timlett and Williams, 2008; Sidique et al., 2010). This argument was supported recently by Bernstad (2014), who emphasised the importance of facilitating conditions and convenience and the existence of necessary infrastructure to participate in PEB specifically related to waste

management. For example, a convenient location of waste drop-off facilities was found to be a significant motivator (Lange et al., 2014). However, Yau (2012) suggested that the convenience of a floor-based system of waste separation facilities is by itself no guarantee of effective waste recycling in residential high-rises. On contrary, a study by Ghani et al. (2013) in Malaysia found that convenience was not a significant reason for not participating in waste recycling activities.

It is evident from literature that, there has been increasing interest in the use of socio-psychology models to provide a theoretical framework for understanding householders' PEB. However, in the existing literature, the measures of PEB do not always reflect the actual environmental impact of an individual or household. Most of the studies focus on relatively monotonous variables from an environmental point of view, that is, behaviours that have only a negligible effect on resource use and behaviours that do not significantly contribute to environmental problems. Consequently, the results of these studies provide little insight into variables that could be helpful in significantly reducing the environmental impacts of households. Thus, there is an utmost need to better understand what motivates people to adopt PEB. What are factors that encourage individuals to engage in pro-environmental actions? What are the drivers and determinants of PEB and the interactions between them?

The literature indicates that pro-environmental attitudes, psychological variables, and situational factors are likely to be important predictors of PEB, however, further investigation of the influence of these factors requires a theoretical framework, such as that provided by the TPB (Ajzen, 2015; Conner, 2015).Although TPB provides a logical outline of environmental behaviour, there are many concerns associated with the application of TPB such as, it does not adequately explain PEB (Sniehotta et al., 2014; Armitage, 2015, Conner, 2015).Further, it is recognised that factors external to the model, for example, altruistic and bio-spheric concern, situational factors, internal attributions (Bissing-Olson et al., 2016) and demographic characteristics (García, 2016)may also play a role in shaping behavioural intentioninfluencing behaviour, thus,suggesting incorporation of additional variables in the model (Barr and Gilg, 2005, Conner, 2015), provided that these variables make a significant contribution to the explanation of behaviour (Ajzen, 1991).In certain contexts, personal feelings of moral judgment, obligation to perform or refusal to perform a certain behaviour must be taken into account (Ajzen, 1991). Moral judgment and felt obligations are also identified as key variables in the Value-Belief-Norm theory developed by Stern et al. (1999). However, it is argued that the influence of additional variables is indirect, mediated through the components of the model (Ajzen, 1991, 2015).

Waste minimisation is a behaviour which requires considerable efforts on the part of individual, as household waste must be sorted, prepared and stored. Consequently the decision is likely to be complex and several factors to be taken into consideration. Thus, this study has incorporated a number of additional variables, including: the personal moral norms; community concern; situational factors; perceived consequences and internal attribution in the TPB framework.

Operationalisation of the constructs

The brief definition of the constructs (in the context of waste minimisation) included in the study is explained below:

Waste minimisation behaviour -frequency of minimisation, past behaviour.

Subjective norm - the individual's perception of social pressure to minimise household waste.

Perceived behavioural control - the individual's perception of their ability to perform the behaviour.

Situational factors- physical factors (infrastructure) which may facilitate or inhibit waste minimisation behaviour.

Perceived consequences of waste minimisation- the outcomes of performing the targeted behaviour.

Attitudes to waste minimisation - the respondents were asked the extent to which they engaged in a number of waste minimisation behaviours.

Community concern - Concern for the community and society in the daily behaviour.

Internal attribution-the feeling of guilt, shame of not behaving in environmental friendly way.

Personal moral norms – the moral norms of the person e.g. felt responsibility etc.

Behavioural intention – the intention of individual to engage or not to engage in PEB, future minimisation intentions.

Demographic information—age, gender, marital status, education, occupation, household role, and number of children in household.

Methodology

The purpose of the current study is to explore the factors that determine PEB and to develop, refine and validate a scale for measuring PEB.
In order to achieve the stated objectives, the following methodological steps were followed:

1. Item generation for the questionnaire with the help of extensive literature review and focus group interviews;
2. Data collection for pilot study;
3. Testing the scale for reliability and validity;
4. Analysing he item-to-total correlation and coefficient to assess the reliability of the scale and improve upon items to improve the reliability of the scale;
5. Large sample data collection;
6. Testing the scale was again for reliability; and

7. To conduct factor analysis assessing the construct validity of the scale.

Item generation

The first step in the scale development process was the generation of a pool of items for each variable in the conceptual framework. Development of the scales to measure each dimension of PEB proceeded through a series of steps. Multiple measures for each of the dimensions of PEB were developed on the basis of the items from related existing scales and focussed group interviews. Items to measure behaviour, behavioural intention, attitude, subjective norm and perceived behavioural control were developed on the basis of the procedures suggested by Ajzen and Fishbein (1980) and Ajzen (1985, 1991). While items to measure personal moral norms, perceived consequences (outcomes of performing or not performing the specific behaviour) were generated on the basis of norm activation model (Schwartz, 1970, 1973, 1977). The salient beliefs about waste minimisation were elicited from a convenience sample of 30 people using focus group interviews. The beliefs were mapped into measures of community or societal concern, complexity, internal attribution, situational/facilitating conditions and self-efficacy. In the next step, a separate sample of ratters were asked to rate the measures representing each of the underlying constructs. This procedure was used to refine the items prior to conducting the pilot test.

Content validity

In total, 52 items under ten factors were reviewed by ten experts comprising of academicians, psychologists, consultants and public authorities to assess the content and face validity. The experts evaluated the items for clarity, representativeness and possibility of misinterpretation. The experts suggested rewording/reframing of five items.

Scale and measurement

The current study used a measure of ten latent variables. The instrument used to measure latent variables is a self-reporting questionnaire. The questionnaire comprised two parts. In Part A of the questionnaire, the respondents were requested to furnish the demographic information related to age, sex, household income and educational level. In Part B of the questionnaire, the respondents were asked to rate on a five-point scale (1 representing “strongly disagree” to 5 representing “strongly agree”) their level of agreement for each statement of the ten dimensions of PEB. The final scales used for each construct are reproduced in the Appendix.

Questionnaire administration

Questionnaires were administered personally to the household respondents. Doubts and queries raised by the respondents with regard to any question were clarified instantly on the spot. Stratified random sampling technique was used for the data collection. The method comprised three types of strata i.e. high, middle and low income groups. Almost, equal numbers of respondents were chosen as per the convenience from each of the strata.

Data collection

A sample of one hundred respondents completed the pilot test. The questionnaire was tested for reliability. On the basis of the results of the pilot test, the questionnaire was further modified and shortened. In the next stage, the modified shortened questionnaire was used to collect data. A new sample of 250 households completed the survey. Again the questionnaire was subjected to reliability testing, validity and exploratory factor analysis.

Data analysis and results

The data that were collected was analysed through the use of a statistical package – Statistical Package for Social Sciences (SPSS Version 20). The data were analysed using reliability, validity and exploratory factor analysis (EFA) to assess the psychometric properties of the scale.

Reliability and item analysis

As recommended by Churchill (1979), the first and the foremost step to refine the scale is the computation of coefficient a, i.e. Cronbach alpha (Cronbach, 1951). Reliability was assessed through the following means –
(a) item-to-item correlation is more than 0.3,
(b) item-to-total (summated scale) correlation is more than 0.5, and
(c) Cronbach's alpha is at least 0.7.

For all factors of PEB, Cronbach alpha was computed, that ranged from 0.70 to 0.94 (pilot study, n=100). According to Nunnally's criterion, the minimum satisfactory value of Cronbach alpha is 0.7 (Nunnally, 1974). Although the criterion of alpha was satisfied, further to improve the value of alpha, corrected item-to-total correlations for each cluster of items were computed. Items possessing very low correlations and/or items whose correlations produce sharp drop among the corrected item-to-total correlations and/or items whose removal improves the value of alpha, were deleted. This iterative sequence was repeated numerous times which resulted in the form of 49 items and three items being deleted. The improved values of Cronbach's alpha for all 10 factors ranged from 0.81 to 0.97 specifying good internal consistencies among all the items. Further, the combined reliability was computed for all the 49-items (Nunnally, 1978) and it was found to be quite high, i.e. 0.91. Finally, total 49 items for all the 10 factors were retained for the next stage.

After item analysis, the questionnaire was used to collect data from new sample (n= 250). Again the reliability was computed and the improved values of Cronbach's alpha for all 10 factors ranged from 0.89 to 0.96. These values are shown in the Table 1.

Table 1: Reliability of Constructs

Construct	Reliability	Item to total Correlation (above 0.5)
Behaviour	0.890	All
Behavioural Intention	0.891	All
Perceived Behavior Control	0.957	All
Situational Factor	0.937	All
Subjective Norms	0.960	All
Personal Norms	0.961	All
Internal Attribution	0.933	All
Attitude	0.914	All
Perceived Relative Advantage	0.930	All
Complexity	0.934	All
Community Concern	0.944	All

Construct validity

After this, the EFA was performed on the remaining 49 items using principal component analysis and the Varimax rotation without specifying the number of factors to be extracted (Costello and Osborne, 2011). A minimum cut off criteria for the deletion of the items was: factor loadings (<0.50) (Karatepe et al., 2005), cross loadings (>0.40) or communalities (<0.50) (Hair et al., 2010). The appropriateness of the analysis was determined by the examination of Kaiser-Meyer-Olkin (KMO) statistic of sampling adequacy. For good factor analysis, the value of KMO must be at least 0.60 and above (Tabachnick and Fidell, 2001).

The following points relate to factor analysis (Williams et al., 2012).
Normality, linearity, homoscedasticity and homogeneity of the sample were assumed.
The following criteria were satisfied:
(a) The minimum sample size is 50.
(b) The minimum respondents-to-variables ratio is 5.
(c) There exist significant correlations among many of the variables.
(d) Partial correlations among most of the variables are 0.5 or less.
(e) The measures of sampling adequacy (MSA), overall and for individual variables, are at least 0.5.

The number of factors was decided based on the following criteria –

(i) Empirical evidence,
(ii) Eigen value is more than 1, and
(iii) Cumulative percentage of total variance extracted is at least 60%.
(iv) To consider an item to load on a factor, a minimum absolute factor loading of 0.65 is required.
(v) Unidimensionality is assessed in terms of items loading on a single factor and nonexistence of significant cross-loadings.

The results of the analysis revealed that Eigen value of all 10 factors was greater than 1 (Kaiser, 1960), therefore, none of the factors can be eliminated from the study. The Kaiser-Meyer-Olkin measure of sampling adequacy (MSA), a measure of the data set's appropriateness for factor analysis, was 0.89. The results depicted a 10 factors solution explaining 82.44 percent variance among the analysed items. The Bartlett's test of sphericity proved to be significant. All communalities ranged from 0.50 to 0.83. No items were dropped after inspection as all items fulfilled the minimum cut-off criteria mentioned above. The results of EFA are summarised in Table 2.

Table 2: Result of EFA

Constructs	B	BI	ATT	PN	SN	PBC	SF	CC	IA	PC
B1	0.883									
B2	0.877									
B3	0.886									
BI1		0.792								
BI2		0.769								
BI3		0.792								
ATT1			0.945							
ATT2			0.868							
ATT3			0.875							
ATT4			0.882							
PN1				0.884						
PN2				0.877						
PN3				0.883						
PN4				0.870						
PN5				0.880						
PN6				0.879						
SN1					0.954					
SN2					0.861					
SN3					0.848					
SN4					0.862					
SN5					0.864					
SN6					0.866					
SN7					0.863					
SN8					0.847					
PBC1						0.955				
PBC2						0.867				
PBC3						0.889				
PBC4						0.878				
PBC5						0.881				
PBC6						0.880				
PBC7						0.873				
SF1							0.876			
SF2							0.881			
SF3							0.856			
SF4							0.873			
SF5							0.878			
CC1								0.907		
CC2								0.900		
CC3								0.910		
IA1									0.906	
IA2									0.840	
IA3									0.953	
IA4									0.882	
IA5									0.898	
PC1										0.901
PC2										0.951
PC3										0.912
PC4										0.921
PC5										0.911
N = 250										
Eigenvalues	2.502	1.825	3.417	6.498	6.531	5.094	4.105	1.724	4.211	2.648
KMO = 0.893										
Bartlett's Test = Chi-Square(df=1225)=28790.273, P=0.000										

Criterion-related validity

The criteria-related validity is established when a criterion external to the measurement instrument is correlated with the factor structure (Nunnally, 1994). Criteria-related validity of the dimensions of PEB was measured by finding the correlation of each one of them with aPEB measure. All the correlations were significant at 0.05 significance level. The results of the correlation analysis are shown in the Table 3.

Table 3: Pearson's correlation analysis of the constructs

	B	**BI**	**PBC**	**SF**	**SN**	**PN**	**IA**	**AT**	**CC**	**PC**
B	**1.000**	0.374	0.497	0.148	0.215	0.222	0.113	0.217	0.076	0.151
BI	0.374	**1.000**	0.332	0.271	0.339	0.366	0.162	0.364	0.182	0.195
PBC	0.497	0.332	**1.000**	0.185	0.229	0.201	0.142	0.148	0.157	0.134
SF	0.148	0.271	0.185	**1.000**	0.143	0.197	0.163	0.197	0.131	0.114
SN	0.215	0.339	0.229	0.143	**1.000**	0.224	0.051	0.208	0.059	0.130
PN	0.222	0.366	0.201	0.197	0.224	**1.000**	0.126	0.213	0.096	0.085
IA	0.113	0.162	0.142	0.163	0.051	0.126	**1.000**	0.096	0.055	0.095
AT	0.217	0.364	0.148	0.197	0.208	0.213	0.096	**1.000**	0.105	0.186
CC	0.076	0.182	0.157	0.131	0.059	0.096	0.055	0.105	**1.000**	0.082
PC	0.151	0.195	0.134	0.114	0.130	0.085	0.095	0.186	0.082	**1.000**

Common method bias

The potential problem with self-reported, single respondent data is the possibility of common method variance (CMV). The current study conducted Harmon's one-factor test suggested by Podsakoff et al. (2003) to investigate the bias of CMV in the data set. This test assumes that if a substantial amount of CMV is present, either a single factor will emerge from the un-rotated factor analysis or one general factor will account for the majority of the covariance in the independent and dependent variables (Hair et al., 2010). Harmon's single-factor test showed that the ten factors were extracted from the entire set of variables. The results highlight that there is more than one factor in the un-rotated PCA solution of all variables and that the first factor explained22.68 percent of the variance out of total 82.44 percent.

Discussion and conclusions

The present study was primarily a psychological investigation of the intrapsychic relationship between affective, cognitive and behavioural components of pro-environmental actions. Cognitive psychological modelling can provide the means to identify the driving forces behind waste minimisation behaviour (PEB), and in a given area determine the main likely success factors. Once these factors have been established, cost-effective campaignscan be designed to maximise the outcome. The TPB provided a cognitive framework to understand and explain behaviour, and its use in this study has provided valuable insights into the factors which underpin waste minimisation behaviour. The results indicate that the affective, cognitive experiences and situational factors are involved in developing the highest level of environmentally responsible action.

The purpose of this study was to examine the antecedents of PEB. Inclusion of the additional factors of the moral norm, situational factors, perceived consequences,

community concern and internal attribution, resulted increase in the percentage of variance explained. This information can then be used to develop and implement waste minimisation schemes which are user friendly. Additionally, this information can be used as the basis for the marketing communication campaigns which advocate the use of such schemes. The individuals who were more likely to engage in waste minimisation behaviour were more likely to be concerned about environmental issues and the impact of waste on the environment and their community. The survey demonstrates that the individual has positive intention in participating provided the opportunities, facilities and knowledge on waste minimisation at source are adequately prepared by the respective local authorities. Good moral values and situational factors such as storage convenience and collection times are also found to encourage public's involvement and consequently, the participations rate. Furthermore, local authorities should take into consideration of individuals personal beliefs about the moral correctness and incorrectness of performing waste minimisation and factors that may motivate and inhibit waste minimisation behaviour. The findings from this study may provide useful indicator to the waste management authorities in identifying mechanisms for future development and implementation of waste source minimisation activities in household programmes and communication campaign which advocate the use of these programmes.

The scale developed in this study provides practitioners and researchers with a reliable and valid analytical tool for the measurement of household perceptions about PEB. This can be used as a diagnostic tool that allows identifying and solving problems that occur in the process of service provision. Based upon the feedback, the practitioners can reframe their management strategies and tactics to redesign the waste management system. In summary, the study outlines the development and validation of the scale of household waste minimisation and PEB. The results of the reliability, validity and EFA indicate that the scale is psychometrically sound. Overall, the utility of the framework, based on social-psychological constructs, has considerable potential to advance the academic and practical understanding of PEB. Although this study has provided useful information about the factors, which influence PEB of those who minimise their household waste on a regular basis, there are limitations to the approach taken. Firstly, a small sample size of participants restricts the extent to which the findings can be generalised throughout. The current study was confined to households in India, and thus, the results cannot be generalized. A potential limitation in the approach of current study is the lack of consideration of past experience.

References

Ajzen, I. (1985). *From intentions to actions: A theory of planned behavior.* In: Kuhl, J.,Beckmann, J. (Eds.), Action Control, From Cognition to Behavior. (pp. 11-39). Springer Berlin Heidelberg.

Ajzen, I., & Madden, T. J. (1986). Prediction of goal-directed behavior: Attitudes, intentions, and perceived behavioral control. *Journal of Experimental Social Psychology*, *22*(5), 453-474.

Ajzen, I. & M. Fishbein (1980). *Understanding Attitudes and Predicting Social Behavior*. Englewood Cliffs, NJ: Prentice-Hall, Inc.

Ajzen I. (1988). *Attitudes, personality and behaviour*. Milton Keynes: Open University Press.

Ajzen, I. (1991). The theory of planned behaviour. Organizational behaviour and human decision processes, 50(2), 179-211.

Ajzen, I., & Driver, B. L. (1992). Application of the theory of planned behavior to leisure choice. *Journal of Leisure Research*, *24*(3), 207.

Ajzen, I. (2005). *Attitudes, personality, and behavior*. McGraw-Hill Education (UK).

Ajzen, I. (2015). The theory of planned behaviour is alive and well, and not ready to retire: a commentary on Sniehotta, Presseau, and Araújo-Soares. *Health Psychology Review*, *9*(2), 131-137.

Allen, M. (2016). Understanding Pro-Environmental Behavior: Models and Messages. In *Strategic Communication for Sustainable Organizations* (pp. 105-137). Springer International Publishing.

Ando, A. W., & Gosselin, A. Y. (2005). Recycling in multifamily dwellings: does convenience matter?.*Economic inquiry*, *43*(2), 426-438.

Armitage, C. J., & Conner, M. (2001). Efficacy of the theory of planned behaviour: A meta-analytic review. *British journal of social psychology*, *40*(4), 471-499.

Armitage, C. J. (2015). Time to retire the theory of planned behaviour? A commentary on Sniehotta, Presseau and Araújo-Soares. *Health Psychology Review*, *9*(2), 151-155.

Babaei, A. A., Alavi, N., Goudarzi, G., Teymouri, P., Ahmadi, K., &Rafiee, M. (2015). Household recycling knowledge, attitudes and practices towards solid waste management. *Resources, Conservation and Recycling*, *102*, 94-100.

Bamberg, S., & Schmidt, P. (2001). Theory-Driven Subgroup-Specific Evaluation of an Intervention to Reduce Private Car Use1. *Journal of Applied Social Psychology*, *31*(6), 1300-1329.

Bamberg, S., Ajzen, I., & Schmidt, P. (2003). Choice of travel mode in the theory of planned behavior: The roles of past behavior, habit, and reasoned action. *Basic and Applied Social Psychology*, *25*(3), 175-187.

Barr, S., Gilg, A. W., & Ford, N. J. (2001). A conceptual framework for understanding and analysing attitudes towards household-waste management. *Environment and Planning A*, *33*(11), 2025-2048.

Barr, S., &Gilg, A. W. (2005). Conceptualising and analysing household attitudes and actions to a growing environmental problem: Development and application of a framework to guide local waste policy. *Applied Geography*, *25*(3), 226-247.

Beck, L., & Ajzen, I. (1991). Predicting dishonest actions using the theory of planned behavior. *Journal of Research in Personality*, *25*(3), 285-301.

Bernstad, A. (2014). Household food waste separation behavior and the importance of convenience. *Waste Management*, *34*(7), 1317-1323.

Bissing-Olson, M. J., Fielding, K. S., &Iyer, A. (2016). Experiences of pride, not guilt, predict pro-environmental behavior when pro-environmental descriptive norms are more positive. *Journal of Environmental Psychology*.

Boldero, J. (1995). The prediction of household recycling of newspapers: The role of attitudes, intentions, and situational factors1. *Journal of Applied Social Psychology*, *25*(5), 440-462.

Botetzagias, I., Dima, A. F., &Malesios, C. (2015). Extending the theory of planned behavior in the context of recycling: The role of moral norms and of demographic predictors. *Resources, Conservation and Recycling*, *95*, 58-67.

Chen, M.F., Tung, P.J. (2010). The moderating effect of perceived lack of facilities on consumers' recycling intentions. *Environment and Behavior,* 42(6), 824-844.

Cheung, S. F., Chan, D. K. S., & Wong, Z. S. Y. (1999). Re-examining the theory of planned behavior in understanding wastepaper recycling. *Environment and Behavior*, *31*(5), 587-612.

Chu, P. Y., & Chiu, J. F. (2003). Factors Influencing Household Waste Recycling Behavior: Test of an integrated Model1. *Journal of Applied Social Psychology*, *33*(3), 604-626.

Churchill Jr, G. A. (1979). A paradigm for developing better measures of marketing constructs. *Journal of Marketing Research*, 64-73.

Collins, S. E., & Carey, K. B. (2007). The theory of planned behavior as a model of heavy episodic drinking among college students. *Psychology of Addictive Behaviors*, *21*(4), 498.

Conner, M. (2015). Extending not retiring the theory of planned behaviour: a commentary on Sniehotta, Presseau and Araújo-Soares. *Health Psychology Review*, *9*(2), 141-145.

Corvellec, H. (2016). A performative definition of waste prevention. *Waste Management*, *52*, 3-13.

Costello, A. B., & Osborne, J. W. (2011). Best practices in exploratory factor analysis: four recommendations for getting the most from your analysis. Pract Assess Res Eval 2005; 10. *URL http://pareonline. net/getvn. asp*, *10*, 7.

Cronbach, L. J. (1951). Coefficient alpha and the internal structure of tests. *Psychometrika*, *16*(3), 297-334.

da Costa Ferreira, L., &Barbi, F. (2016). The Challenge of Global Environmental Change in the Anthropocene: An Analysis of Brazil and China. *Chinese Political Science Review*, 1-13.

Davies, J., Foxall, G. R., & Pallister, J. (2002). Beyond the intention–behaviour mythology an integrated model of recycling. *Marketing Theory*, *2*(1), 29-113.

Davis, G., & Morgan, A. (2008). Using the Theory of Planned Behaviour to determine recycling and waste minimisation behaviours: A case study of Bristol City, UK. *Special Edition Papers*, *20*(1).

De Groot, J. I., & Steg, L. (2010). Relationships between value orientations, self-determined motivational types and pro-environmental behavioural intentions. *Journal of Environmental Psychology*, *30*(4), 368-378.

De Leeuw, A., Valois, P., Ajzen, I., & Schmidt, P. (2015). Using the theory of planned behavior to identify key beliefs underlying pro-environmental behavior in high-school students: Implications for educational interventions. *Journal of Environmental Psychology*, *42*, 128-138.

Dietz, T. (2015). Environmental value. *Handbook of Value: Perspectives from Economics, Neuroscience, Philosophy, Psychology and Sociology*, 329.

doPaço, A., &Raposo, M. (2009). “Green” segmentation: an application to the Portuguese consumer market. *Marketing Intelligence & Planning*, *27*(3), 364-379.

Fielding, K. S., McDonald, R., & Louis, W. R. (2008). Theory of planned behaviour, identity and intentions to engage in environmental activism. *Journal of Environmental Psychology*, *28*(4), 318-326.

Fielding, K. S., & Hornsey, M. J. (2016). A social identity analysis of climate change and environmental attitudes and behaviors: Insights and opportunities. *Frontiers in Psychology*, *7*.

García, N. L. M. (2016). Gender differences, theory of planned behavior and willingness to pay. *Journal of Environmental Psychology*, *45(1),* 165-175.

Gardner, G. T., & Stern, P. C. (2002). *Environmental problems and human behavior* (2nd ed.). Boston, MA: Pearson Custom Publishing.

Ghani, W. A. W. A. K., Rusli, I. F., Biak, D. R. A., & Idris, A. (2013). An application of the theory of planned behaviour to study the influencing factors of participation in source separation of food waste. *Waste Management*, *33*(5), 1276-1281.

Graham-Rowe, E., Jessop, D. C., & Sparks, P. (2015). Predicting household food waste reduction using an extended theory of planned behaviour. *Resources, Conservation and Recycling*, *101*, 194-202.

Guagnano, G. A., Stern, P. C., & Dietz, T. (1995). Influences on attitude-behavior relationships a natural experiment with curbside recycling. *Environment and Behavior*, *27*(5), 699-718.

Hair, J. F., Black, W. C., & Babin, B. J. (2010). RE Anderson *Multivariate data analysis: A global perspective*, Pearson Prentice Hall.

Hoyos, D., Mariel, P., &Fernández-Macho, J. (2009). The influence of cultural identity on the WTP to protect natural resources: some empirical evidence. *Ecological Economics*, *68*(8), 2372-2381.

Huddart Kennedy, E., Krahn, H., &Krogman, N. T. (2015). Are we counting what counts? A closer look at environmental concern, pro-environmental behaviour, and carbon footprint. *Local Environment*, *20*(2), 220-236.

Kaiser, H. F. (1960). The application of electronic computers to factor analysis. *Educational and Psychological Measurement*, 20(1), 141-151.

Kaiser, F. G. (2006). A moral extension of the theory of planned behavior: Norms and anticipated feelings of regret in conservationism. *Personality and Individual Differences*, *41*(1), 71-81.

Kanbar, N. N. (2005). Analyzing individual behavior in commons dilemmas: A study of collective action in source separation of wastes (Dissertation). George Mason University.

Karatepe, O. M., Yavas, U., &Babakus, E. (2005). Measuring service quality of banks: Scale development and validation. Journal of Retailing and Consumer Services, *12(5),* 373-383

Katzev, R., &Mishima, H. R. (1992). The use of posted feedback to promote recycling. *Psychological Reports*, *71*(1), 259-264.

Kim, Y., & Han, H. (2010). Intention to pay conventional-hotel prices at a green hotel–a modification of the theory of planned behavior. *Journal of Sustainable Tourism*, *18*(8), 997-1014.

Koger, S. M., &Winter, D. D. (2011). *The psychology of environmental problems: Psychology for sustainability*. Psychology press.

Lam, S. P. (1999). Predicting intentions to conserve water from the theory of planned behavior, perceived moral obligation, and perceived water right1. *Journal of Applied Social Psychology*, *29*(5), 1058-1071.

Lange, F., Brückner, C., Kröger, B., Beller, J., & Eggert, F. (2014). Wasting ways: Perceived distance to the recycling facilities predicts pro-environmental behavior. *Resources, Conservation and Recycling*, *92*, 246-254.

Laroche, M., Bergeron, J., &Barbaro-Forleo, G. (2001). Targeting consumers who are willing to pay more for environmentally friendly products. *Journal of Consumer Marketing*, *18*(6), 503-520.

Larson, L. R., Stedman, R. C., Cooper, C. B., & Decker, D. J. (2015). Understanding the multi-dimensional structure of pro-environmental behavior. *Journal of Environmental Psychology*, *43(1)*, 112-124.

McCarty, J. A., & Shrum, L. J. (1994). The recycling of solid wastes: Personal values, value orientations, and attitudes about recycling as antecedents of recycling behavior. *Journal of Business Research*, *30*(1), 53-62.

McLeod, L. J., Hine, D. W., Please, P. M., & Driver, A. B. (2015). Applying behavioral theories to invasive animal management: Towards an integrated framework. *Journal of Environmental Management*, *161*, 63-71.

Morren, M., & Grinstein, A. (2016). Explaining environmental behavior across borders: A meta-analysis. *Journal of Environmental Psychology, 47(1),* 91-106.

Mulder, L. B., Van Dijk, E., De Cremer, D., & Wilke, H. A. (2006). Undermining trust and cooperation: The paradox of sanctioning systems in social dilemmas. *Journal of Experimental social psychology*, *42*(2), 147-162.

Nguyen, T. T. P., Zhu, D., & Le, N. P. (2015). Factors influencing waste separation intention of residential households in a developing country: Evidence from Hanoi, Vietnam. *Habitat International*, *48(1)*, 169-176.

Norman, P., Armitage, C. J., & Quigley, C. (2007). The theory of planned behavior and binge drinking: Assessing the impact of binge drinker prototypes. *Addictive Behaviors*, *32*(9), 1753-1768.

Nunnally, J. C. (1978). *Psychometric Theory*, McGraw-Hill, New York, NY.

Nunnally, J. C., & Bernstein, I. (1994). *Psychometric theory*. New York, NY: McGraw-Hill.

Oreg, S., & Katz-Gerro, T. (2006). Predicting proenvironmental behavior cross-nationally values, the theory of planned behavior, and value-belief-norm theory. *Environment and Behavior*, *38*(4), 462-483.

Ostrom, E. (2014). Collective action and the evolution of social norms. *Journal of Natural Resources Policy Research*, *6*(4), 235-252.

Parker, D., Manstead, A. S., Stradling, S. G., Reason, J. T., & Baxter, J. S. (1992). Intention to commit driving violations: an application of the theory of planned behavior. *Journal of Applied Psychology*, *77*(1), 94.

Podsakoff, P. M., MacKenzie, S. B., Lee, J. Y., &Podsakoff, N. P. (2003). Common method biases in behavioral research: a critical review of the literature and recommended remedies. *Journal of Applied Psychology*, *88*(5), 879.

Reddy, S. M., Montambault, J., Masuda, Y. J., Gneezy, A., Keenan, E., Butler, W., &Asah, S. T. (2016). Advancing Conservation by Understanding and Influencing Human Behavior. *Conservation Letters (In press)*.

Sansone, C., Weir, C., Harpster, L., & Morgan, C. (1992). Once a boring task always a boring task? Interest as a self-regulatory mechanism. *Journal of Personality and Social Psychology*, *63*(3), 379.

Schwartz S. H. (1970). Moral decision making and behavior. In: Macauley J, Berkowitz L, editors. *Altruism and helping behavior.* Academic Press; p. 127-41, NY.

Schwartz, S. H. (1973). Normative explanations of helping behavior: A critique, proposal, and empirical test. *Journal of Experimental Social Psychology*, *9*(4), 349-364.

Schwartz S. H. (1977). Normative influences on altruism. *Advances in Experimental Social Psychology*, 10, 221-79.

Scott, A., Oates, C., & Young, W. (2015). A conceptual framework of the adoption and practice of environmental actions in households. *Sustainability*, *7*(5), 5793-5818.

Sidique, S. F., Lupi, F., & Joshi, S. V. (2010). The effects of behavior and attitudes on drop-off recycling activities. *Resources, Conservation and Recycling*, *54*(3), 163-170.

Sniehotta, F. F., Presseau, J., &Araújo-Soares, V. (2014). Time to retire the theory of planned behaviour. Health Psychology Review, 8, 1–7.

Stern, P. C., Dietz, T., Abel, T. D., Guagnano, G. A., &Kalof, L. (1999). A value-belief-norm theory of support for social movements: The case of environmentalism. *Human ecology review*, *6*(2), 81.

Tabachnick, B. G., Fidell, L. S., & Osterlind, S. J. (2001). Using multivariate statistics, Pearson Education Limited, New York.

Taylor, S., & Todd, P. (1995). An integrated model of waste management behavior a test of household recycling and composting intentions. *Environment and Behavior*, *27*(5), 603-630.

Terry, D. J., Hogg, M. A., & White, K. M. (1999). The theory of planned behaviour: self-identity, social identity and group norms. *British Journal of Social Psychology*, *38*(3), 225-244.

Thøgersen, J. (1994). A model of recycling behaviour, with evidence from Danish source separation programmes. *International Journal of Research in Marketing*, *11*(2), 145-163.

Thøgersen, J. (2008). Social norms and cooperation in real-life social dilemmas. *Journal of Economic Psychology*, *29*(4), 458-472.

Timlett, R. E., & Williams, I. D. (2008). Public participation and recycling performance in England: A comparison of tools for behaviour change. *Resources, Conservation and Recycling*, *52*(4), 622-634.

Tonglet, M. (2002). Consumer misbehaviour: an exploratory study of shoplifting. *Journal of Consumer Behaviour*, *1*(4), 336-354.

Tonglet, M., Phillips, P. S., & Read, A. D. (2004). Using the Theory of Planned Behaviour to investigate the determinants of recycling behaviour: a case study from Brixworth, UK. *Resources, Conservation and Recycling*, *41*(3), 191-214.

Turaga, R. M. R., Howarth, R. B., &Borsuk, M. E. (2010). Pro-environmental behavior. *Annals of the New York Academy of Sciences*, *1185*(1), 211-224.

van der Werff, E., & Steg, L. (2015). One model to predict them all: predicting energy behaviours with the norm activation model. *Energy Research & Social Science*, *6*, 8-14.

Vining, J., &Ebreo, A. (1990). What makes a recycler? A comparison of recyclers and nonrecyclers. *Environment and Behavior*, *22*(1), 55-73.

Vining, J., &Ebreo, A. (1992). Predicting recycling behavior from global and specific environmental attitudes and changes in recycling opportunities1. *Journal of Applied Social Psychology*, *22*(20), 1580-1607.

Vlek, C., & Steg, L. (2007). Human Behavior and Environmental Sustainability: Problems, Driving Forces, and Research Topics. *Journal of Social Issues*, *63*(1), 1-19.

Werner, C. M., Turner, J., Shipman, K., Twitchell, F. S., Dickson, B. R., Bruschke, G. V., & Wolfgang, B. (1995). Commitment, behavior, and attitude change: An analysis of voluntary recycling. *Journal of Environmental Psychology*, *15*(3), 197-208.

Werner, C. M., &Makela, E. (1998). Motivations and behaviors that support recycling. *Journal of Environmental Psychology*, *18*(4), 373-386.

Williams, B., Brown, T., &Onsman, A. (2012). Exploratory factor analysis: A five-step guide for novices. *Australasian Journal of Paramedicine*, *8*(3), 1.

Yau, Y. (2010). Domestic waste recycling, collective action and economic incentive: The case in Hong Kong. *Waste Management*, *30*(12), 2440-2447.

Yau, Y. (2012). Stakeholder engagement in waste recycling in a high-rise setting. *Sustainable Development*, *20*(2), 115-127.