

Investigating household recycling behaviour through the interactions between personal and situational factors

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Abstract

In recent years household recycling behaviour (HRB) has become a focal point in social science research to understand the concept of household waste recycling management. Household recycling systems involve two main actors: households and municipalities. This paper reports on an empirical study of the interaction between HRB and household waste recycling systems provided by municipalities. A convenience sample of 412 households was selected to complete a survey on recycling initiatives with personal and situational factors and also their interaction. Results showed that personal factors have a significant relation with situational factors (availability, accessibility, awareness and convenience) ($p < 0.01$) and vice versa; with a positive correlation ($r(412) = +0.41$). In addition, personal factors correlated positively to availability, accessibility, awareness and convenience at a p-value below 0.01. Furthermore, situational factors interact with demographical factors such that personal factors may be predicted (overall HRB). This study uses both an interdisciplinary and multi-methods approach to answer its research questions and is also accessible to both practitioner and academic domains.

Keywords: recycling, reverse logistics, recycling behaviour, symbiosis effect, household recycling waste management, interaction, sustainability.

1 Introduction

Despite progress in waste recovery during the last 15 years in the UK [1], waste management remains a challenging policy area. By 2020 the population in the UK is estimated to be around 67 million people, and is expected to reach



73 million by the year 2030 [2]. In addition to the continued population growth and the projected increase in consumption, waste per capita is expected to significantly increase [3].

The essence of the waste problem explored in this research is that if by definition something that is not wanted; achieving a sustainable solution requires a combination of regulatory responsibilities and appreciation of social norms [4] to formulate a coherent solution. Thus, waste management moving towards sustainable refuse options require more than mechanistic innovation but also changing social norm [5]. These allow the municipalities channel the waste effectively using recovery options that could contribute to renewable energy [6].

In waste management literature, household waste is considered as an alternative energy source [7] and with technological innovation, most waste could potentially be recycled back to main production streams. Household recycling systems involve two main players, which are householders and municipalities. Understanding both of these players is crucial for developing sustainable refuse options, possibly enabling them to be less dependent on other fuel energies. Alternately they could create energy from daily waste [6].

The purpose of this paper is to contribute to the theoretical understanding of the relationship between UK municipalities (or local councils) and their constituents, focusing on the interaction between householders' personal and situational factors. A proposition can be made in a study that the interaction between those two factors encapsulates a symbiotic relationship and thus reflects a "symbiosis effect" between municipalities and householders. Similarly, Ehrenreich [8, p. 258] found a symbiosis effect in subordinating systems where concomitant individuals in an organizational setting had to "*mutually sustain each other in complex, symbiotic ways*". Therefore, household or individual behaviours are affected by interaction with situational factors whether in an internal or external environmental setting. The paper's central research objective is to examine this symbiosis effect between recycling systems and recycling behaviour in pursuing sustainability and as it tries to explain various factors, both situational and personal, that encapsulates the interaction between municipalities and households.

2 Literature review

In HRWS, household behaviour is influenced by situational and personal factors. The projection of the recycling behaviour is derived mainly within personal state of mind of the households. There are many factors that contribute to households' recycling behaviour (HRB), including:

- a. Reverse logistics (types of disposals, accessibility, method of disposals, level of difficulty, level of separation/sorting) [9];
- b. Marketing (awareness, information, advertising, household engagement) [10];
- c. Social norms or values (perceived pressure, community intervention, local interest group, public pressure) [11];
- d. Individual demographic background (age, education, income, location);



- e. Knowledge (product, package, environmental impact, product life cycle, recycling method and self efficacy) [12]; and
- f. Policy instruments (directives and economic incentives/benefits) [13].

2.1 Personal factors

Personal factors include most demographic profiles but also extend to values, culture, religion, and life experiences [14, 15]. The factors can be both predisposed attitudes and personal capabilities that project a form of behaviour [14, 16]. Besides attitudinal factors, household perceptions of situational factors such as recycling schemes and convenience factors also influence their HRB [17, 18]. Additionally, other studies have suggested that a households' predisposition to environmental actions have strong intention to participate in recycling [19, 20]. Furthermore, Ajzen [16] argued that when a households' behaviours change (attitudinal and personal capabilities); it has meaningful behavioural justification [21] that suggests reasoning of individuals' decision and causes either positive or negative actions. For example, when environmental behaviour (households decide to start to recycle) is manifested in a household by certain situational factors (e.g. accessibility), this will in turn lead to higher HRB [22].

2.2 Situational factors

Situational factors such as convenience, improved recycling facilities and councils' communication tend to yield high household recycling levels [23, 24]. The behavioural literature refers to these aspects or conditions of recycling systems as 'situational factors' [25, 26].

In the UK, municipalities are responsible for waste management as collection and/or disposal authorities, which include responsibility for meeting recycling targets. Thus, the flow of reverse logistics in HRWS (Fig. 1) starts from households back to recovery options (ROP).

In the UK, HRWS comprises of many situational factors that may contribute to effective recycling participation. Table 1 presents the different aspects of recycling systems and their influences on HRB, which are derived from previous literature.



Figure 1: Illustration by the authors based on ROP.

Table 1: The situational factors based on thematic review.

Situational Factor	Aspects of Situational Factors
Accessibility and Availability	<u>Facility</u> <ol style="list-style-type: none"> 1. Collection/Delivery Operator 2. Household Waste and Recycling Centres (HWRC) 3. Customer Services Centre
Difficulty and Conveniences Frequency	<u>Kerb side Scheme Options</u> <ol style="list-style-type: none"> 1. Kerb side-Sort 2. Co-mingled 3. Collection Frequency 4. Bins (Type, Numbers and Size) 5. Distances
Frequency and Coverage User friendliness	<u>Marketing and Education</u> <ol style="list-style-type: none"> 1. Advertising 2. Information 3. Public Engagement 4. Education
Incentive or Disincentive	<u>Incentives</u> <ol style="list-style-type: none"> 1. Monetary Rewards 2. Non monetary Rewards 3. Penalty Fee

2.2.1 Accessibility and availability

In logistics theory, accessibility and availability of services and facilities are crucial for seamless product movement from the point of origin until the point of consumption [27, 28]. It is reasonable to suppose that these would also apply to reverse logistics (RL) flows, especially in HRWS. In other words, the recycling scheme design impacts the 'reverse' movement of recyclates back to primary or secondary markets for value capture [29, 30]. The ease with which households can follow these schemes and the availability of facilities and services (e.g. drop-in centres, bring out to kerbside, and customer services centres) as well as the responsiveness of the municipality in respect of the availability of scheme provision (e.g. bin bags, additional bins, pick-up services, and collection times) influenced their HRB [19, 31].

2.2.2 Difficulty, convenience and frequency

Difficulty and convenience have been found to be the most significant factors in determining participation levels in most recycling research. Difficulty and convenience refer to the level of hardship in undertaking household recycling [5, 32]. Household-friendly schemes such as co-mingled recyclates are more preferable than schemes that pre-sort by the type of recyclates. More frequent collections of recycling bins encourages households to recycle more [33, 34].

2.2.3 Marketing and education

Using effective marketing and education that addresses environmental awareness has been found to have a positive impact on household's recycling engagement [23, 35]. In its expanded role, marketing becomes a key facilitator in building

critical relationships needed to effectively implement RL and thereby promote sustainability [36, 37]. The use of applicable marketing communication tools (e.g. advertising, public engagement, and labelling) is useful in conveying the right way to dispose of waste and motivate households to be more engaged in recycling activities [38].

2.2.4 Symbiosis effect

Some recycling studies have determined that the effects of a novel recycling system design cannot account for any changes to households' recycling attitudes and behaviour [39, 40]. The symbiosis effect has to date been rarely explored in interactions between households and recycling systems. In ecotourism, Fennell and Weaver [41] investigated symbiosis between tourism and conservation and argued that in order for an ecosystem to be sustainable many factors would be in interaction including community engagement and the availability of an eco-support system. However, most studies on HRB empirically test both factors in isolation where the interaction is neglected in main analyses therefore; in this study the symbiosis affect between households and recycling systems are the focus of analysis.

This study follows Ehrenreich [8] who posits interactions and interdependencies as important elements in a symbiotic relationship. Therefore, symbiosis had been defined as two entities having a mutually close relationship and living together in benefit for each other [42]. Most *a priori* research has focused either on technical aspects of recycling systems (situational factors) (schemes, type of bins, distances etc.) or purely behavioural (personal factors) aspects (pro-environmental, norms, and values). Thus, HRB depends not only on situational factors but also on personal factors.

3 Methods

The target population for this study consisted of residents from two municipal areas: the East Riding of Yorkshire and the City of Hull. The unit of analysis was the household. A postal-survey questionnaire was sent to 500 households from each area. In addition to allow for the impact of the low response rate normally associated with postal surveys, an online survey was published via the University of Hull's social media platforms, the local councils' affiliated community networks, public community online news network (e.g. 'This is Hull and East Riding') and under the discretion of selected companies within the population parameters (e.g. Kingston Communications, East Yorkshire Motor Services, and Jackson's). The final realised sample included a total of 212 usable questionnaires from postal surveys and a total of 200 usable online questionnaires. Table 2 provides a socio-demographic profile of the respondents who participated in the study. The sample was slightly dominated by female respondents (61.9 percent) and the majority of the respondents fell in the 51 or older age group. Most respondents have more than four years of recycling experience (74.5 percent) and were living in the same property for more than four years (69.4 percent).



Table 2: Demographic background ($n = 412$).

Item	<i>N</i>	%
Age		
20 or under	21	5.1
21-30	85	20.6
31-40	96	23.3
41-50	59	14.3
51 or older	151	36.7
Gender		
Male	157	38.1
Female	255	61.9
Recycling Experience (years)		
More than 4 yrs	307	74.5
Less than 4 yrs	105	25.5
Living in current property (years)		
More than 4 yrs	286	69.4
Less than 4 yrs	126	30.6

4 Results

This study used a mixed method approach in answering the research questions. It uses the Sequential Explanatory Design (SED) [43] that involves a sequence of phases of research inquiry. As for this study, it started with qualitative inquiry, then thematically analyzed for themes extraction follow-up with quantitative inquiry in which reported in this paper. The frequency analyses showed more than 90 percent of households were clearly aware why they recycled; the majority of households recycled because they believed recycling improve the environment and they served in an environmentally conscious society. The study also looked at any differences with the municipalities regarding their reasoning for recycling. It found the number for main reasons (environmental concerned) for City of Hull constituents were somewhat higher that those living in the East Riding of Yorkshire (Fig. 2). In the 'others' option, City of Hull constituents were inclined towards 'up-cycling' such as reusing most of the recyclable items or giving those items to extended families or friends. The East Riding of Yorkshire households were more likely to send their reusable items to various charities.

Furthermore, this study seeks the reasons behind the householders' recycling initiative by examining confounding variables (demographic factors). Logistic regression was used to test of the full model against a constant model. The results from full model indicate that householders reasoning for HRB depends on changes in some demographic factors (one unit increase); they are likely to change their reasoning for HRB based on regulation if they are double occupants: $Wald = 4.48, p < 0.05$ with $df = 1$ or a student: $Wald = 7.76, p < 0.01$ with $df = 1$; they are also likely to change their reasoning based on the environment if they are living at their current address for more than 4 years: $Wald = 4.44, p < 0.05$ with $df = 1$, or if they started recycling when the

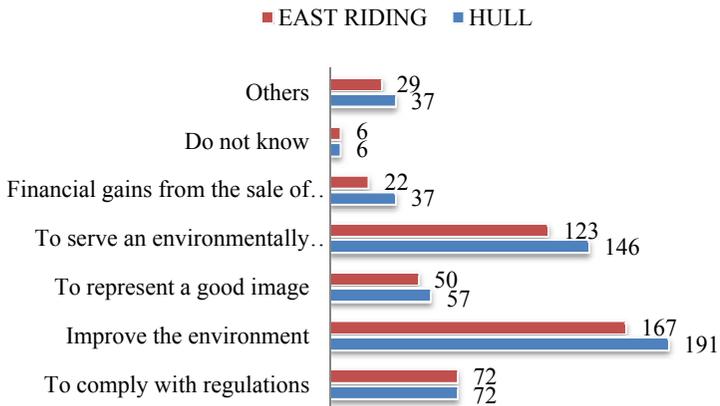


Figure 2: *I recycle because “_____” based on municipality.*
(n=412)

scheme was introduced: $Wald = 4.47, p < 0.05$ with $df = 1$; and they are also likely to change their reasoning based on self-image if they are working: $Wald = 4.49, p < 0.05$ with $df = 1$, or unemployed/on benefit: $Wald = 3.99, p < 0.05$ with $df = 1$. The overall model is significant at the 0.05 level according to the Model chi-square statistic. The model predicts reasoning for regulation (65%), environment (86.9%) and image (74.3%) of the responses correctly and the Nagelkerke’s measure for regulation ($R^2 = 0.12$), environment ($R^2 = 0.13$) and image ($R^2 = 0.09$).

A Pearson’s correlation was used to analyse the relationship between situational and personal factors. Firstly, all items that constituted personal or situational factors were formed into relevant composite factors, and then a statistical correlation was tested between these composite factors including all demographic items. The ones that were more than a 0.05 significance level were omitted from further analysis. Table 3 is the correlation table between these two composite factors. It showed that personal factors have a significant relation with situational factors ($p < 0.01$) and vice versa; with positive correlation ($r (412) = +0.41$). Four demographic items (Table 3) were also found to have positive relation with both factors ($r (412) > +0.07$) and correlation between personal factors with those four demographic items have a significant relation ($p < 0.01$). However, households’ employment has a significant level at ($p < 0.01$) on situational factors, thus; households’ age and marital status were at ($p < 0.05$) significant level and recycling experiences had no significant relation with situational factors. The analyses indicate that a socio-demographic profile of a resident in municipality has a positive correlation with factors contributing to HRB.

Table 3: Correlation table.

Factors	PEARSON CORRELATION					Sig. (2-tailed)
	Situational	Age	Marital Status	Employment	Number of Year Recycling	
Personal*	0.41	0.24	0.20	0.23	0.15	0.00
Situational*	1	0.10	0.12	0.17	n.s	0.01

*Both factors are formed into composite factors (i.e. item 1 + item 2+....).

Additionally, the study correlated composite personal factors with individual items of situational factors. The results show that the personal factors have significant relation with engagement ($p < 0.01$) with positive correlation ($r(412) = +0.71$); as well as convenience ($p < 0.01$) with positive correlation ($r(412) = +0.44$) and accessibility and availability ($p < 0.01$) with positive correlation ($r(412) = +0.27$). In order to examine whether personal factors interacted with situational factors (engagement, availability and accessibility), the study applied multiple regression analysis to examine the assumptions. This analysis is relevant as it is addressing assessment on relationship, using the information from independent variables will improve the accuracy in predicting values for the dependent variable as recommended by Greene [44] and Field [45]. These analyses also reveal the existence of confounding variables (demographic items) in association with either personal or situational factors (engagement, accessibility and availability). Thus, when personal factors were predicted; it was found that engagement ($\beta = +0.36$, $p < 0.01$), convenience ($\beta = +0.11$, $p < 0.01$), and accessibility and availability ($\beta = -0.13$, $p < 0.01$) were significant predictors of recycling behaviour (Table 4).

The overall model fit was $R^2 = 0.838$. The main effect of all situational factors were significant, $F(5, 406) = 191.61$, $MSE = 12.06$, $p < 0.01$. In a nutshell, for the multiple regression analyses as its required assumptions had been met; these analyses have shown that both situational and personal factors in interaction manifest HRB.

Table 4: Coefficients table.

Model 1	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	15.093	1.851		8.154	0.000
Engagement	0.316	0.032	0.359	9.890	0.000
Convenience	0.156	0.048	0.106	3.225	0.001
Accessibility and Availability	-0.125	0.031	-0.126	-3.994	0.000

5 Discussion

This study demonstrated personal and situational factors in interaction in the projection of HRB. Particularly, the reasoning for HRB indicated that changes in demographic profiles have an effect on householders' intention of recycling. The inference statistical model significantly explained the existing interaction between accessibility and availability as well as convenience and awareness, with personal factors as main predictors. This is consistent with Bhate [23] in juxtaposing the existence of situational factor to enable HRB and Woodard *et al.* [46] who implied that the existence of situational factors without abandonment of the personal factors reflected positive HRB [5, 20]. To project or manifest HRB, households must be motivated by the right stimuli such as the availability, accessibility, awareness/engagement and convenience of HRWS in order to increase households recycling rates [40]. In addition, households' knowledge of recycling and how long they have been recycling positively interacted with situational factors and contributed to an improvement in HRB per Thogersen [22]. The symbiosis effect suggested by this study tries to explain vis-a-vis the 'hygiene' factors conveying HRB which mean these two factors investigated have to interact with each other in order for HRB to be projected.

6 Conclusions

This paper has reported on a quantitative study examining the relationship between householders' behaviour and local authority recycling practices. The findings indicate that a symbiosis effect exists between the two major factors driving councils' household recycling performance. The quantitative analysis demonstrates and validates the first phase finding (i) the higher interactions and engagement will result in increases of HRB; (ii) higher spatial coverage of service provision and availability of recycling facilities will increase the councils' performance in waste and recycling initiatives. Thus, this study was embryonic in nature to investigate this "symbiosis effect" therefore further replications should be done in difference geographical setting (other municipality and countries) for future researches.

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