

THE UNIVERSITY OF HULL

**Reverse Logistics Symbiosis in Waste Recycling: Investigating Municipal
Systems and Household Behaviour in England**

being a Thesis submitted for the Degree of Doctor of Philosophy (Ph.D.) in
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ABSTRACT

Municipality Solid Waste management services are reverse logistics (RL) operations of significant scale and importance throughout the developed world, and yet the topic has only received limited attention within the logistics and supply-chain management literature, despite an increasing policy focus on sustainability issues. An interdisciplinary approach was chosen for this study to explore the interaction between municipality household recycling waste systems and household recycling behaviour, which is represented by situational and personal factors in this study. A mixed methodology approach was used, based on a *Sequential Exploratory Design* that uses a mixed method typology (*Qual-Quan-Qual*) to explore the proposition that there is a symbiosis effect between the recycling behaviour of households and municipality household recycling waste systems. A non-probability sampling was drawn from the population of two adjacent councils in Northern England: the East Riding of Yorkshire and the City of Hull. The three stages of the research design show a consistent and similar outcome for the interaction between households and household recycling waste systems, represented by personal and situational factors respectively. The interaction clearly demonstrates a symbiotic effect between households and household recycling waste systems. The nature of household recycling behaviour was found to be affected by accessibility, availability and convenience, and where these diminish, the personal engagement of households in recycling is likely to diminish. Logistical factors, such as accessibility and availability are therefore considered to be strong predictors in the projection of household recycling behaviour, together with marketing factors, such as engagement and education. In addition, demographical elements are considered as moderating factors in the projection of household recycling behaviour. Moreover personal factors are found to be equally strong predictors when the situational factors are established and formed in accordance with the residential requirement. A robust theoretical framework has been developed during this study, which may be accessible for future studies, incorporating the relationship between situational and personal factors, and focusing primarily on the interaction between the respective factors. However, the conceptualization of the symbiosis effect requires further investigation and replication to clarify and understand the interaction in different scopes and perceptions. With regards to the methodological implication, this study supports earlier logistic literature by diversifying the research approach in its contribution to the literature. Thus, the application of mixed methodology addresses the incongruities between mono-paradigm in relation to recycling and waste literature, and reveals some clarity on the underpinning factors that explain behavioural changes in household recycling performance. As for the practical implications, in order to increase recycling performance, the mediating factors such as engagement and education are important contributions from this study with respect to changing HRB. The study also reveals that accessibility, availability and convenience are important precursors. Therefore, it was useful to design a sustainable reverse logistics system in waste management by considering the precursory factors to appropriate engagement that represents the public needs. The outcome of this study indicates that the nexus between HRWS and HRB has to be focused on their symbiotic relationship, and looks at current HRWM from a symbiosis perspective. The caveat may be for policymakers and local authorities to come up with a sustainable backward movement that addresses 'awareness, acknowledgement and action' from the households' perspective.

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Abbreviation

Abbreviation	Meaning
3 R's	Reduce Reuse Recycle
4 R's	Reduce Reuse Recycle Recover
ANOVA	Analysis of variances
BPM	Behavioural Perspective Model
CIWM	Chartered Institution of Wastes Management
CLM	Council of Logistics Management
COPA	The 1974 Control of Pollution Act
CSR	Corporate Social Responsibility
DEFRA	Department for Environment, Food and Rural Affairs
df	Degree of freedom
DfT	Department of Transport
EU	European Union
EU27	European 27 Member
EUROSTAT	European Statistics by European Commission
ERY	East Riding of Yorkshire
EXP	Exponential
H-L	Hosmer and Lemeshow goodness of fit test
HRB	Household Recycling Behaviour
HRWM	Household Recycling Waste Management
HRWS	Household Recycling Waste System
Hull	City of Hull
HWRC	Household Waste and Recycling Centres
KMO	Kaiser-Meyer-Olkin
LACMW	Local Authority Collected Municipal Waste
MANOVA	Multivariate analysis of variance
MC	Monte Carlo Simulation
MRF	Materials Recovery Facility
MSE	Mean Squared Error
MSW	Municipal Solid Waste
OECD	Organization for Economic Co-operation and Development
ONS	Office of National Statistics
PwC	Price-Waterhouse and Cooper
RL	Reverse Logistics
ROP	Recovery Option Pyramid
RQ	Research Questions
S.E	Standard of Error
SCM	Supply Chain Management
SED	Sequential Explanatory Design
Sig.	Significant
TPB	Theory Planned Behaviour
TRA	Theory of Reasoned Action
WCED	World Commission on Environment and Development
WEEE	The Waste Electrical and Electronic Equipment

WRAP	Waste and Resources Action Programme
Years	Yrs.

Associated Publications

Publication, presented and submitted manuscript resulting from PhD research programme

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A-Jalil, E., Grant, D., Nicholson, J. & Deutz, P. (2014), "Investigating household recycling behaviour through the interactions between personal and situational factors." <i>Waste Management and the Environment VII</i> , Vol. 180, No.113.
A-Jalil, E., Grant, D., Nicholson, J. & Deutz, P. (2014), A 'Symbiosis Effect' Perspective to Understand Reverse Logistics and Household Waste Recycling Systems. 19th International Symposium on Logistics (ISL2014). Ho Chi Minh Vietnam.
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1. Circular Economy: Innovative thinking for a sustainable future. 2011, University of York, York, UK.
2. Sustainability in Transport Research. 2012, University of Newcastle, Newcastle, UK.
3. CILT 3rd Reverse Logistics Forum. 2012, Birmingham, UK.
4. Hearts and Minds-Changing Attitude or Changing Behaviour. 2013, University of Plymouth, Plymouth, UK.
5. Sustainable Supply Chain - Rethink and Redesign. 2013, University of Huddersfield, Huddersfield, UK.
6. Can "Green" Power Offer Land, Sea and Air Transport Realistic Alternatives to Conventional Fossil Fuel? 2013, Sheffield Hallam University, Sheffield.

7. Early Career Academics' Research Development Programme. 2013, University of Hull, Hull, UK. (Presented)
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10. CIWM North East England Regional Meeting. 2014, University of Hull, Hull, UK. (as an Invited Speaker) "Investigating household recycling behaviour through the interactions between personal and situational factors."
11. CIWM Annual Conference. 2014, London, UK.
12. The Yorkshire Postgraduate Festival. 2014, University of Leeds, Leeds, UK. (Presented). "*The Symbiosis Effect between HRWS and HRB*".

"Solid wastes are the discarded leftovers of our advanced consumer society. This growing mountain of garbage and trash represents not only an attitude of indifference toward valuable natural resources, but also a serious economic and public health problem".

- Jimmy Carter (1977)

CHAPTER ONE: THE STUDY

1.1 Introduction

This study is focused on the complexity of household recycling waste management (HRWM). The growing amount of pressure from policymakers and state agencies across the globe has motivated stakeholders to increase the recycling rate among householders and to divert most of the waste from landfill. In particular, municipal solid waste (MSW) has been an environmental issue since the beginning of the industrial era (Dimitrova, 2014; Olsen & Zusman, 2014).

The logistics literature has had a significant interest in matters of sustainable and green logistics for some time (Murphy & Poist, 2003; Carter & Easton, 2011; Grant et al., 2015). Much work has also been done on reverse logistics (RL) concepts since the late 1990s (Carter & Ellram, 1998), which are a crucial element in green supply chain management (Hazen et al., 2011). In addition, this study adopted Tibben-Lembke and Rogers' definition of RL as *"the movement of product or materials in the opposite direction for the purpose of creating or recapturing value, or for proper disposal"* (2001: 271).

One under-investigated area in RL is how to deal with 'end-of-life' or 'end-of-use' goods (Bing et al., 2014, Xie & Breen, 2014), particularly regarding recycling or disposal (Mishra et al., 2012). Wright et al. (2011: 10) suggested that *"little attention has been given to the best methods to develop overall recycling channels"*.

However, the significant attention to the recycling and management of waste has followed the increasing dominance of end-of-life take-back laws (Toffel, 2003), e.g. the European Union's Waste Electrical and Electronic Equipment (WEEE) directive, which stipulates that all such goods must be recycled and not disposed of (Grant et al., 2015). The management of HWRS recycling can be defined as:

"...the process of systematically collecting, sorting, decontaminating and returning of waste materials to commerce as commodities for use or exchange" (Wiard & Sopko, 1991: 3)

Households have a critical role in determining whether end-of-life goods are captured by an RL system, or are disposed of as waste. This is especially true for mundane household waste items such as food and beverage packaging, as opposed to the more durable electronic items covered by take-back regulations. However LA waste systems are relatively neglected in the RL literature compared with commercial RL systems.

Similar to other suppliers, an LA must treat consumers and/or households as an external element in an exchange relationship. However, there is no direct association of cost and service: financial penalties and rewards are not usually applied to households to incentivise recycling behaviour. The question becomes how to motivate them to separate waste, which is cheaper for LAs than post-source separation of co-mingled waste, but risks lower participation rates. A range of logistics design factors influence recycling behaviour (i.e. the situational factors), which are controlled by the LA and which influence the extent to which customers or households comply. These may be considered as 'hard' factors that can be quantified and measured (Caplice & Sheffi, 1994). Strategically, physical aspects affect the degree to which consumers can be motivated to create multiple streams of separated recyclables, the alternative being a single stream, or a fully co-mingled supply of recyclables (Woodard et al., 2006; Abbott et al., 2011).

Prior studies have ascertained that 'soft' RL factors (Caplice & Sheffi, 1994), such as convenience, perceived improvement in recycling facilities communication and financial incentives from LAs, tend to lead to higher household recycling levels (Abbott et al., 2011; Keramitsoglou & Tsagarakis, 2013; Wright et al., 2011). Given the many and varied RL schemes deployed by LAs in the UK, it is difficult to separate the effects of hard and soft factors; hence we combine them as situational factors. All are controlled by the LAs in their effort to engage with the household as supplier-consumer.

The behaviour and attitudes of households towards recycling are also important in the design of successful RL systems for MSW, and it is the consumer's role as a first-stage supplier to the municipal RL system that is the focus of this study. A key question is the degree of voluntary involvement that consumers are willing to exhibit in delivering recyclable items to a point where the LA RL service provider accepts ownership of them. In sharp contrast to conventional supplier-customer relationships, many households do not attach a value to their waste. Thus, HWRSs need to consider that the primary desire of consumers or households is to discard their tins, plastic, bottles, etc. within the bounds of culturally acceptable behaviour (Deutz & Frostick, 2009).

Household characteristics can also be precursors to effective recycling behaviour. Certain demographic personal factors, such as nationality, cultural background, socio-economic contexts (e.g. property type, socio-economic level and residential type), age and income level have been found to be significant in affecting recycling performance (Abbott et al., 2011; Bekin et al., 2007; Keramitsoglou & Tsagarakis, 2013; Saphores et al., 2012; Woodard et al., 2005). HWRSs not only rely on situational factors, but also on personal factors. Importantly, the aforementioned studies do not consider personal and situational factors in conjunction with one another, and to date studies that integrate insights into sustainable RL in the context of HWRSs are rare.

Research exploring the first-stage of the HWRS has focused on the effective design and implementation of a recycling system, i.e. situational factors regardless of the effects of personal factors in enhancing positive HRB (Dahlén & Lagerkvist, 2010). Equally, other studies that have focused on personal factors in recycling performance contain limited discussion of situational factors (Saphores et al., 2012; Keramitsoglou & Tsagarakis, 2013). To date, the closest empirical study to look at these two sets of factors holistically was Bhate (2005), who examined pro-environmental attitudes in the consumption of consumer goods.

1.2 The Complexity

Municipalities (local authorities) are heavily burdened by landfill costs and environmental directives which are constantly pressurizing them to collect and recycle household waste more efficiently and effectively. Thus, it is essential for the municipalities to improve the condition of their waste recycling systems in order to boost the efficiency of both financial and environmental elements. This requires the engagement of the local population (Botetzagias et al., 2015; Kalamas et al., 2014). In many countries, household waste has always been under the responsibility of municipalities (OECD, 2008), and statistically the improvement of recycling rates depends on the recycling systems provided by the municipalities, as well as the participation of the households (Barr et al., 2013; Abbott et al., 2011). For example, Barr and colleagues highlighted the implication of attitudinal factors when considering the various types of situational factors affecting stakeholders, especially municipalities (Barr et al., 2013).

The result implied the importance of situational factors (even though in their work, these were depicted as structural and general environmental concerns) as considerations which will influence non-recycling participation. Furthermore, this study also highlighted the interaction of situational and personal behaviour in the cultivation of recycling participation. In addition, Abbot and colleagues found that the HRWS collection schedule is inversely related to the recycling rate.

This finding implies that the situational factors that are managed by the municipalities have an implication on recycling participation, as the authors claimed that when households are faced with fewer residual waste collections, this creates an indirect motivation to pre-sort and separate their recyclates. Furthermore, situational factors, such as the type of bins offered by the municipalities, either encouraged or discouraged predisposition of households recyclates in this study (Abbott et al., 2011).

The advantages of using household waste for recycling depends strongly on the participation of householders in source-separation collection, and this study suggests changes of supplier node points from the point of origin to point of consumption, especially in HRWM. This study looks at the householders and municipalities that are working together as concomitant social actors in a 'symbiotic' manner (Ehrenreich, 2002), and illustrates in part the existence of a sustainable way of living, where householders depend on municipalities' assistance in managing recyclates as much as municipalities depend on householders' action in separating and sorting at the pivot point.

The dependency between two or more social actors was supported by Fennell and Weaver (2005) in explaining that ecosystem conservation is a mutual responsibility between the surroundings and visitors. Hence, the surroundings in Fennel and Weaver are dependent on the facilities and services provided by the environmental authorities, municipalities and NGOs (2005). The authors further explained the need for facilitation by certain authorities (i.e. environmental authorities, municipalities and NGOs), and the acknowledgement of the visitors, on the act of preserving the ecosystem. Hence, the areas visited are mutually dependent on the role of facilitation by the authorities, as well as the role of preservation by the visitors. This is quite different from exchange network theory, which focuses on the strength of exchanges between dyadic relations (Cook et al., 1983), and which is not the focus of this study.

This study focuses on the explicit symbiotic nature of a relationship, demonstrating that behavioural change happens when there is activation of a certain stimulus in order to create social normalization, i.e. household recycling behaviour (HRB) and conservation roles (Botetzagias et al., 2015). The stimulus can be formed by a facilitation system, such as a recycling system that relates to the interests or values of the residents – reaching out to the existing perceptions or behavioural tendencies of the population.

Facilitation systems such as sustainable recycling waste systems typically receive scant attention from policymakers (Stewart, 2011), but, paradoxically, the need for a sustainable HRWS has resulted from a growing number of socio-environmental concerns such as improper landfilling, fly tipping, littering etc. (Kamuk & Haukohl, 2013). In addition, pressure from governmental bodies, and the UK having been a member of the European Union, has contributed to the financial burden on UK municipalities to develop sustainable recycling waste systems in their localities. The current economic and social impact of the EU waste policy is to promote innovation in re-cultivation of waste streams from the localities level. However, with the austerity period of 2012-13, the facilitation system required financial assistance for most of the municipalities. Therefore, harmonization of waste policy among EU members is required to avoid fragmentation in waste policy and the costs incurred in solid waste management, especially for UK companies operating on a European scale.

In the UK, household waste is regarded as part of the municipal solid waste (MSW), the *Department for Environment, Food and Rural Affairs* (DEFRA), in parallel with the European Union waste framework directive, (EC, 202011) defining household waste as:

“LACMW (Local Authority Collected Municipal Waste) refers to the previous ‘municipal’ element of the waste collected by local authorities. That is household waste and business waste where collected by the local authority and that is similar in nature and composition as required by the Landfill Directive” (DEFRA, 2011c).

The overall aim of this study focuses on LACMW as the reverse logistics flow from households, managed by municipalities. The municipalities use household recycling waste systems to manage the recyclates and other final waste, sorted by product, in order to recover the usability and channel the recyclates to the secondary market for further usage (UNEP; 2012). The key players in providing a seamless transaction of recyclates are both the householders and their municipalities. Understanding the characteristics of both players is crucial when developing sustainable refuse management options, which should subsequently lead to the reduction of landfill usage.

Furthermore, sustainable refuse management systems could be extended to energy recovery opportunities within the HRWS (Cass & Walker, 2009; Lindquist, 2013). If, by definition, waste is considered as a rejected commodity, the need to achieve a coherent sustainable solution for its management requires a combination of regulatory responsibilities and appreciation of social norms (Deutz & Frostick, 2009). Thus, the RL of waste management towards sustainable refuse options requires more than technological or operational innovation; it also involves changes to the social norms (Barr et al., 2005).

Recycling rates across the UK municipalities are varied. An average compared to some EU counterparts is given in Figures 1.1 and 1.2, in accordance with the European Environment Agency (2013). The operational efficiency of HRWS may be attributed to the under-performing recycling initiatives in the UK compared with other parts of the EU (CIWM, 2013). The problem of achieving a sustainable HRWS may be resolved by focusing solely on the operational issues of HRWSs (which this study deems to be situational factors) (Barr, 2013). However, it is as important to understand the behavioural aspect of the HRWS, which involves the householders. The performance of recycling initiatives does not solely depend on the situational factors; it also depends on the personal capabilities of households, and attitudinal factors (Barr, 2013), which in this study, may be referred to as 'personal factors'.

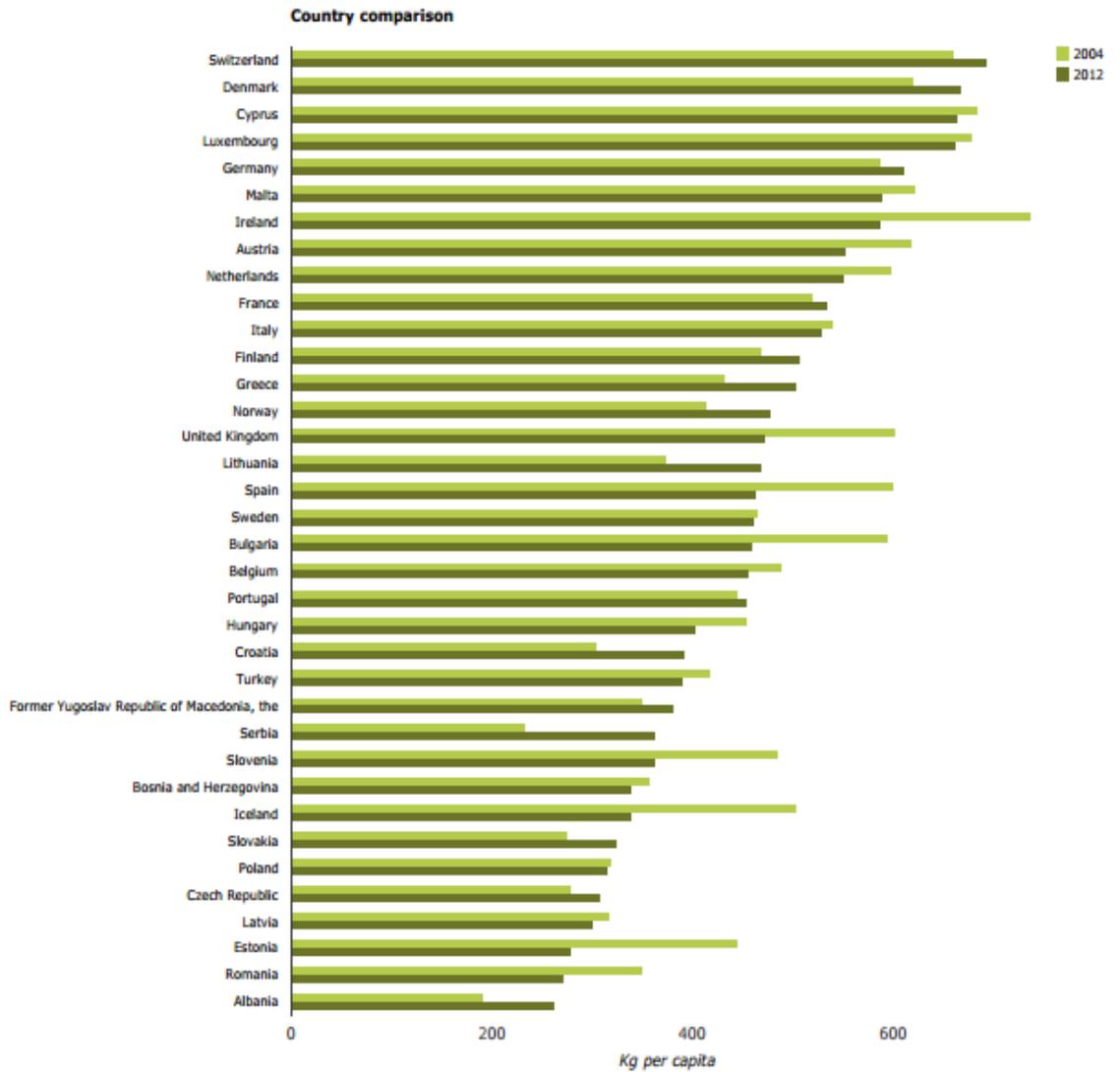


FIGURE 1.1: Municipal Waste Generation per Capita (EUROSTAT, 2013)

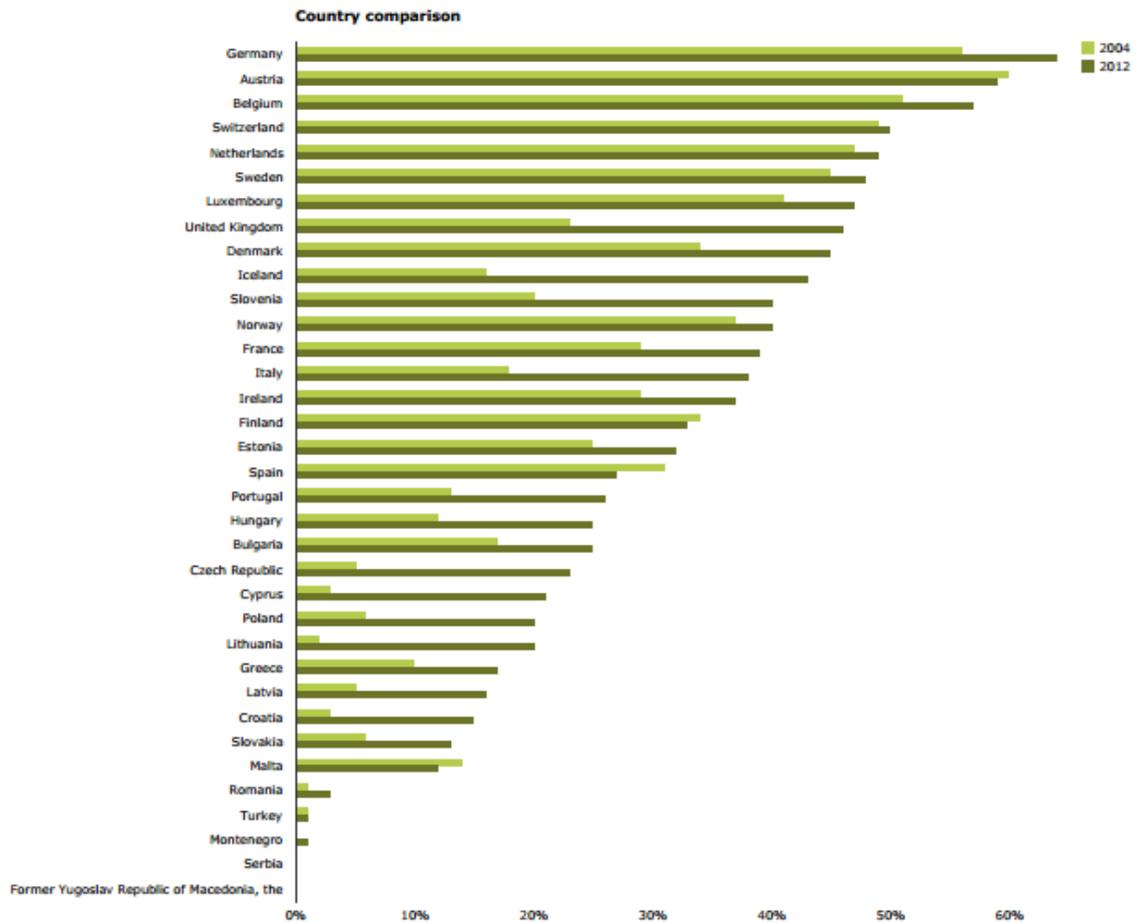


FIGURE 1.2: Municipal waste recycled and composted in each European country (EUROSTAT, 2013)

In order to address the HRWM challenges and issues, there is a need for HRWM to be environmentally efficient, economically effective and socially acceptable. Environmental efficiency requires HRWSs to conform to the waste hierarchy, and for households to acknowledge their own role in conforming to waste hierarchy. Economic effectiveness requires HRWSs to be affordable for household usage, and, to be socially acceptable, they should address households' needs and priorities. Therefore, the relevance of this study is to unfold the nexus between municipalities (HRWSs) and households, which is represented by situational and personal factors respectively.

1.3 Theoretical gaps

The investigation of the relationship between municipalities and households may lead to the understanding of systems and behavioural aspects within the HRWS. This thesis specifically focuses on the HRWS initiatives in two localities: the East Riding of Yorkshire (ERY) and the City of Hull (Hull). The research focuses on the household recycling waste systems and the municipalities' efforts to promote household recycling behaviour (HRB).

Various factors, such as collection times, accessibility and availability of facilities and services, including domestic disposal processes, levels of separation/sorting and time consumption (Williams & Cole, 2013; Abbott et al., 2011; Dahlén & Lagerkvist, 2010) represent situational factors, and have been identified as moderating factors on household recycling levels. The behavioural literature refers to these operational aspects or conditions of recycling systems as 'situational factors' (Schultz et al., 1995; Bhate, 2005; Lyas et al., 2005; Barr et al., 2005; Tonglet et al., 2004; Tucker et al., 2000), and prior studies have ascertained that situational factors such as convenience of participation from source to separation (Wagner, 2013), also have a part to play. Facilitation of HRWSs, such as improved recycling facilities and communication from municipalities, tends to yield higher household recycling levels (Keramitsoglou & Tsagarakis, 2013; Woodard et al., 2006; Woollam et al., 2003).

Reverse logistics (RL) includes situational factors such as accessibility and availability, referred to in prior research as being similar to HRWS. These operational/situational factors were found to be strong predictors in prior research; nonetheless the aforementioned studies somewhat neglected the potential for interaction between the situational and behavioural aspects of RL (i.e. personal factors). Despite the variety of theoretical approaches used in reverse logistics, little attention has been paid to the theorization of reverse logistics in HRWM, particularly the interaction between HRWS and HRB (Jahre, 1995).

In addition, underpinnings and knowledge lenses in reverse logistics flow (Carter & Ellram, 1998) still remain ambiguous as to how HRB and HRWS interact with each other exactly. The ambiguity of theoretical underpinning derives from the lack of theory within RL scope (Dowlatshahi, 2000). Dowlatshahi theorized that customers are the external force of the reverse logistics system, whereas other factors, such as transportation, warehousing, supply chain management, recycling and packaging are internal factors, which depend on the willingness of end-users to support the reverse logistics system or process (2000). The willingness and needs of end-users are related to the facilitation of reverse logistics systems.

Understanding such interaction, which might be conceived as a symbiosis effect, may help to identify effective ways of handling household waste issues, by cultivating a more amicable attitude towards recycling on the part of households. The 'symbiosis effect' proposed in this thesis as a pre-condition (precursor) phase required a variety of conceptual lenses (theoretical frameworks and underpinnings), and an interdisciplinary approach (Carter & Ellram, 1998). Personal factors are influenced by values, culture, religion, education and income level, including working status or life experiences (Thøgersen, 2006; Stern, 2000; Ajzen, 1991). Prior studies have shown that personal factors, such as environmental attitude, perceived behaviour and personal capabilities, tend to influence household recycling levels (Barr et al., 2005; Tonglet et al., 2004; Barr et al., 2003; Tucker & Speirs, 2003).

In prior studies, personal factors, such as working status and social norms regarding situational factors, were not conclusive evidence with regards to symbiosis effect (Keramitsoglou & Tsagarakis, 2013; Woodard et al., 2006; Lyas et al., 2005; Woollam et al., 2003). Previous recycling studies mostly focused on either operational/situational factors (Woodard et al., 2005; Jahre, 1995), or purely behavioural/personal factors (Tonglet et al., 2004; Thøgersen, 1994). Consequently, recycling studies conducted to determine the effects of a novel recycling design are normally unable to clarify the reason behind why, and if such households' recycling attitudes and behaviour have truly changed (Woodard et al.,

2005; Lyas et al., 2005; Jahre, 1995). Woodard et al.'s study was concerned with the level of recycling rates before and after the introduction of recycling schemes, whereby the findings showed a positive relationship between the facilitation of recycling schemes with the participation of selected residences (2005). This was similar to the studies of Lyas et al. (2005) and Jahre (1995), which showed a positive change in the level of recycling participation when better or more effective HRWS were introduced.

However, while behavioural studies may provide a deeper understanding of households' attitudes and behaviour, they seldom conceptualize the 'pre-condition' aspects of HRWSs, which are required for HRB to be effectively manifested. According to norm-activation theory (Biel & Thøgersen, 2007), individuals living in a property have certain beliefs and attitudes towards recycling, and their recycling behaviour can be triggered by different stimuli from particular situational factors (effective facilities and services, consistent collection schedules, accessibility and availability, as well as informative communication packs). This is considered to be the 'pre-condition' phase, where the householders firstly have to undergo the process in order for HRB to be manifested effectively. Therefore, it is crucial for municipalities to engage with householders, and to understand how different households react to certain situational factors.

The thought process by which householders become accepting of recycling can be conceptualized as a symbiosis effect between householders and the local authority organizing the recycling system. *Symbiosis* is an interaction between two different entities in close physical association, typically to the advantage of both (Oxford Dictionaries, 2013). The key element from the Oxford definition of symbiosis is the element of interaction between two different entities. The *symbiosis effect* suggested in this study is an interaction between situational and personal factors, which are represented respectively by the municipalities' HRWSs and the household recycling behaviour.

The symbiosis effect between the recyclers (householders) and providers (municipalities) instigates the recovery of materials which can ultimately re-enter the supply chain.

If the householders respond positively to recycling systems, the municipalities may further refine them to achieve the next level of recycling rate. Alternatively, if one condition (either situational or personal factors) diminishes, the other conditions and anticipated recycling performance will both remain low. This study's aim is to contribute to the theoretical platform underpinning behavioural and operational aspects in the logistics field, which still has areas that need to be explored and examined (Stock, 1997).

The novel contribution of this study is to suggest the existence of a symbiosis effect between situational and personal factors, and to inform current research threads in the environmental sciences, behavioural and logistics literature, identifying consumers as being an important pivot point between forward and reverse logistics flows. The theoretical purpose of this thesis is to mark an early contribution to the study of symbiosis in HWRS and HRB pertaining to RL, and to identify the key situational and personal factors that interact to affect enhanced HWRS. It also offers insights beyond those available in current multi-disciplinary literature, which has largely examined such factors in isolation. The multiple theories from multiple bodies of knowledge are blended together in order to give a robust understanding of a certain phenomenon (Alvesson & Sandberg, 2011).

1.4 Theoretical Foundation

Much work has been done on reverse logistics (RL), or product recovery management concepts since the late 1990s (Carter & Ellram, 1998). In particular, studies have suggested two main streams in discussing the handling of end-of-life products or outbound flows. These are commercial management and local authority (LA) management, particularly MSW management (Zhang et al., 2011). These streams or channels can also be sub-divided according to their inbound flows from commercial or domestic origins (Belien et al., 2014). In the latter classification, there are situations where household consumers form a key stage in the RL system, as both recipients of inbound flows, and initiators of outbound flows.

The degree to which the success of RL operations is affected by household recycling behaviour is determined by the extent to which RL design involves collection of co-mingled recyclates, or whether source-separation within the household is encouraged by LAs (Bing

et al., 2014), which involves the supplier (i.e. consumer) presenting pre-sorted recyclates for collection. Post-collection separation of co-mingled recyclates, on the other hand, occurs at a separation centre.

The physical aspects of RL channel design for source-separation starts with the provision of waste containment for the supplier or consumer, e.g. wheelie bins, kitchen food waste baskets and biodegradable recycling bags. However, there is little research to date regarding this phenomenon at the supply chain 'pivot point' from forward to reverse logistics. This omission seems odd, given the current global prioritisation of resource recovery from MSW (Dovidio, 2013). This is a problem for logistics research in general, and RL service design and implementation in particular. The integrative approach proposed for this study is to understand the pivotal point of reverse logistics in HRWM, which is household recycling behaviour in conjunction with HRWS (RL service design and implementation), in order to have a sustainable flow back to the proper channel of waste hierarchy (Cherret et al., 2010; Jahre 1995; Kopicki et al., 1993).

An extensive literature review was conducted in order to identify research gaps and find a robust model to replicate or extend the proposed conceptual model. The research question has to address two distinct aspects: the operational (situational or system), and the behavioural (personal or behavioural). Thus, the proposed 'symbiosis effect' model is an embodiment of many theories (avoiding the mono-theory stance of Alvesson and Sandberg) (2011). Firstly, it applies the *Theory of Planned Behaviour* (Ajzen, 1991), which explains that human behaviour depends on personal and situational factors, although the theory lacks explanations on behavioural change (Sniehotta, 2009). Secondly, it applies the *Norm Theory* (Stern et al., 1999) which explains that personal norms are activated by situational cues, such as facilitation of recycling schemes. However, this does not describe the interaction processes between situational cues and individuals' norms.

Thirdly, this study applies the *Environmental Significant Behaviour* model (Thøgersen, 2006), which in this case, demonstrates that environmental behaviour can be affected by the

degree of social and personal norms. On the other hand, this latter model excludes the level of 'presence' from situational factors, the work of Thøgersen being mainly centralised on the environmental behaviour of an individual, which goes beyond the sphere of recycling behaviour itself.

The three theories (Ajzen, 1995; Stern, 2000; Thøgersen, 2006) are robust for developing a behavioural, conceptual model in social science research, but inadequate for this particular study. The three aforementioned theories suggest that the behavioural aspects of recycling, such as attitudinal and personal factors, are considered important to elevate the recycling rate; however, the situational aspects, such as facilitation of the recycling schemes, are not clearly defined as improving the recycling rate. Therefore, the combination of the three theories with the *Behavioural Perspective Model* (Foxall, 1999a), could somehow explain the changes that evolve in the situational factors, and influence behavioural factors, as well as using a reverse logistics framework (Carter & Ellram, 1998) as a fundamental nexus on the development of symbiosis framework. Carter and Ellram's framework is insufficient to underpin the whole concept of interaction between situational and personal factors from the end-user's perspective. However, Carter and Easton (2011) found the trend of supply chain management research was towards the convergence of many perspectives in understanding the various sustainable issues in the supply chain management area, including waste management and reverse logistics.

The symbiosis framework developed for this study followed Carter and Ellram (1998) in applying an interdisciplinary approach to compensating for the multifaceted perspective in addressing the 'end-of-pipeline' issues. The 'end-of-pipeline' issues are the reverse logistics factors (situational) and behavioural changes which capture back values from the backward movement (De Brito & Dekker, 2004). This framework will be used to explore the role of the two major players in HRWS in pursuance of sustainability (Fig. 1.3). The dotted arrows in Figure 1.3 propose the emergence of a symbiosis effect arising from the interactions between situational and personal factors, as a pre-condition phase. The framework illustrates that firstly situational factors need to be visible (1), and then personal factors to

conform (2), leading to the pre-condition phase (symbiosis effect). The outcome of the HRB (3) will depend on the degree to which situational factors co-exist in the concomitant setting.

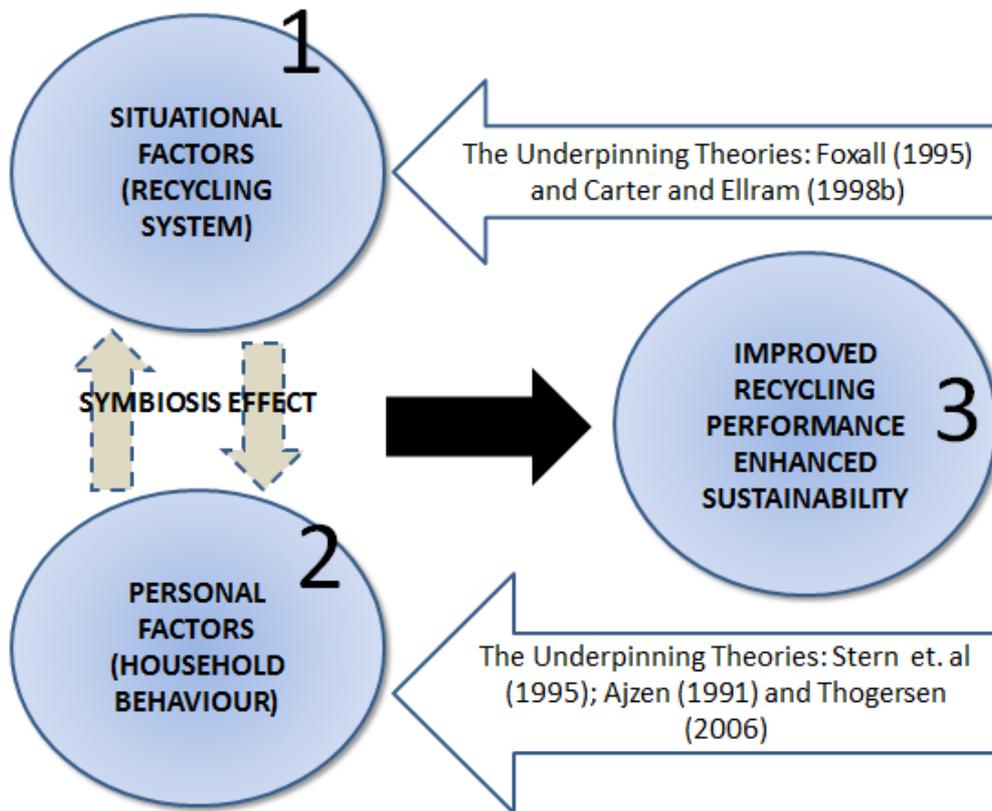


FIGURE 1.2: Proposed theoretical framework - Author Conceptualization

The proposed theoretical framework, underpinned by multiple theories that complement each other in addressing the theoretical gap and current weaknesses in the understanding of reverse logistics in waste management, may address the research questions and achieve the research objective more effectively. This is consistent with the problematization approach of Alvesson and Sandberg (2011) on research questions development in a particular study. This study looks at the inconsistencies in the current performance of household recycling in the UK, which may derive from the pertaining factors (either situational or personal) in isolation, rather than looking at the factors symbiotically.

1.5 The objectives of the thesis

The aim of this study is to examine the relationship between householders and municipalities in the delivery and use of recycling services. The existence of a 'symbiosis effect' between situational and personal factors as a pre-condition phase in order to manifest HRB more effectively is suggested to effectively understand the multi-fragmented views on the antecedents of recycling performance. The study uses an interdisciplinary approach, as suggested by Carter and Ellram (1998) to interpret 'the backward flow' of HRWS.

According to the interdisciplinary approach of the study, the thesis draws on several overlapping theoretical and empirical constructs from within and beyond the confines of reverse logistics, including resources from the behavioural literature as well as waste management and marketing empirical works. Recycling initiatives of households are social awareness practices involving habitual processes and interactions of social actors in shared surroundings. In order to understand local authorities' facilitation of domestic waste collection, based on their local constituents, this study proposes the symbiosis effect in relation to the transformation of sustainable recycling behaviour of households in HRWSs. Based on the above rationale, the study aims to explore and explain the suggested symbiosis effect between the HRWS and HRB. This aim is achieved with two objectives, using three fundamental research questions (RQ):

1.5.1 Objectives of this study

- *Objective₁ (O₁)* To reveal how household recycling behaviour affects the provision of HRWS by the municipalities
- *Objective₂ (O₂)* To reveal and explain the symbiosis effect between the HRWS and HRB

1.5.2 Research questions (RQs)

RQ1 and RQ2: Addresses *O₁*

RQ1: What is the reasoning behind the HRB between different municipalities?

RQ2: What are the different factors associated with HRWSs that may affect HRB, and how do they affect HRB?

RQ3: Addresses O_2

- RQ3: What are the interactions (symbiosis effects) and the conditions that support the symbiosis between HRWSs and HRB?

The proposed theoretical framework, together with the ROs and RQs may provide answers and new understanding in approaching an interdisciplinary study, and give some clarity in understanding the epistemology bridges between two distinct dichotomies. This may contribute to the enrichment of theory building in SCM literatures (Carter & Easton, 2011) as well as other recycling scope literatures.

1.6. Research Significance

The contributions of this study should primarily be of interest to scholars in reverse logistics and waste management, as well as to practising managers, particularly in HRWM. A study on the symbiosis effect between HRWSs and HRB represents a piece of explorative research in the field of RL. Practicality from the perspective of the research is important in the field of solid waste management (Barr, 2005) in order to assist policymakers to come up with a doable policy (Smith, 2008), funded from taxpayers' money (UK householders pay property tax which covers HRWS). Barr et al., argued that in public administration (including managing MSW), the importance aspect is the convergence of policy into operative actions, whereby, in this case, the municipalities can recapture all the recyclates in effective forms from the householders (2013).

Carter and Easton argued that most work on sustainable issues in supply chain management has been predominantly standalone (2011), which means that the reverse logistics literature, especially on recycling, is profoundly generic to many schools of thought (Shrum et al., 1995; Carter & Ellram, 1998). However, current research is trending to adopt many theories in the work of sustainable supply chain management (Carter & Easton, 2011), whereas previously the literature on recycling often addressed either operative or behavioural issues in isolation (Shrum et al., 1995).

This study applies an interdisciplinary approach to address operative and behavioural issues in a single study which contributes a new perspective to the recycling literature.

Furthermore, this study contributes to the aforementioned literature by considering the interaction between HRWSs and HRB (which this study has termed 'symbiosis effect') as one aspect of broader changes in household recycling performance. From this perspective, the effective HRWS is not the entirety of one focal factor, but comprises many factors, both situational and/or personal. In waste management literature, the discussions are commonly based around the operative side of the HRWM (Woodard et al., 2005). However, some discussions have focused on the behavioural aspects of waste management (Barr, 2013). Despite the focal point of such discussions in waste management literature, the interaction between the HRWS and HRB remains under-studied, and is the subject of this thesis.

From a practical point of view, this study is relevant and timely for the municipalities (HRWM), which are currently under pressure from EU waste legislation, austerity and public scrutiny on the way HRWS is managed and addressed. Traditionally, the municipalities have been concerned with recycling targets and diversion of waste from landfill (CIWM, 2013). However, the volume of consumption is at incremental rate, the UK population has increased annually and recycling rates are approaching a point of saturation (CIWM, 2013). Therefore, a perceptible change is required in managing reverse logistics in HRWM by looking at the interaction between HRWS and HRB to enable better management of backward flow and retain a sustainable outcome from the process.

1.7 The structure of the thesis

The thesis is divided into six chapters, and the following is a brief outline of the contents. Chapter 1 provides an overview of the background to the thesis.

The introduction of the study, as well as the aim, objectives and research questions are reported in Chapter 1. Chapter 2 elaborates the research background and outlines the trend of HRB research to date, with particular reference to the usage of an interdisciplinary approach in understanding the mechanistic (operative) and behavioural aspects of this

study. The first part of the chapter covers the key concepts of sustainability from the reverse logistics literature.

The 'mechanistic' bodies of knowledge analysed are derived from the areas of logistics, waste management, geography and industrial ecology. The 'behavioural' bodies of knowledge are derived from marketing, behavioural and environmental psychological studies, all of which are taken into account. The reviews are based on semi-systematic literature reviews emphasized on key word combinations in the boundary of high impact journals and online databases (Web of Science, Emerald, Elsevier, Wiley, etc.). The interdisciplinary approach in exploring the literature provided the interdisciplinary framework required for answering the research questions, as well as the basis for developing a suitable research design.

Chapter 3 clarifies the epistemological, ontological and methodological assumptions of the research process. Here, the methodology and research design are defined based upon the preceding empirical and theoretical framework. Accordingly, the chosen mixed methodology approach is justified as being compatible with answering the research questions, using an interdisciplinary approach which encompasses both mechanistic and behavioural aspects of the research. The implementation of a sequential mixed method design, where both quantitative and qualitative methods are equally important, is meticulously discussed. The methods applied are described along with precautionary steps for the unit of analysis as well as the sampling strategy and research parameters. The strengths and limitations of each approach are discussed in detail, and validity and reliability issues are also addressed.

Chapter 4 consists of two parts, the first part being the analysis of qualitative Stage 1. Here discussions are focused on the usage of the qualitative approach to present the first set of findings. In addition, this chapter outlines the demographic profiles of participants from the semi-structured interviews. The qualitative findings are presented based upon the thematic analysis, whereby the same type of analysis is extended to ethnography to expose the 'causal' association between situational and personal factors that constitute the emergence

of the pre-condition phase. In addition, the quantitative survey instrument is developed using the first stage of qualitative analysis, and, similarly, the development of the subsequent stages (Stages 2 and 3) are derived from the first stage initial analysis findings.

The second part of Chapter 4 presents the quantitative analyses. First, the descriptive statistics applied in demographic analysis, and multiple regressions applied in statistical analysis (including multivariate and logistics regression) are exercised to clarify the potential for interaction between individual predictors (accessibility and availability, awareness, convenience and personal and demographic items). Power analysis, as well as reliability and validity testing, are also outlined and described here.

Chapter 5 also has two parts; the first part is the discussion on Stage 3 of the triangulation phase, and the second part is the overall discussion of the findings. The triangulation phase addresses the verification of the findings resulting from a pre-condition phase occurring in Phases 1 and 2, which comprehensively explains the major factors on both situational and personal aspects that surfaced in this study. The major significant factors were selected as themes for the focus group and semi-structured interview discussion guide in the final (Stage 3) research inquiry. Here, the demographic analysis is discussed and the organization of analyses for the focus group and interviews is described.

The final stage of the analysis verifies the findings disclosed in the earlier stage, in order to maintain the rigour and transferability of overall analysis within a sequential explanatory research design (SED). The qualitative data are discussed and new themes are outlined, with a reflection on the final stage to conclude the first part of this chapter. The second part of Chapter 5 focuses on the interplay of qualitative and quantitative findings. The discussions begin with reflections and arguments from each stage that focus on the actual findings and verification of the findings in Stage 3. The discussion includes the theoretical relation and cross-examination of *a-priori* empirical findings with the actual findings from SED. In addition, this part presents the reliability and validity consideration given to this study. Finally, the conclusion addresses the summary and denouement of the overall discussion of SED.

The final chapter includes critical reflections on several key elements which are highlighted in this study. The contributions to the body of knowledge, along with the limitations of this study, in conjunction with the future implications of the entire research are also outlined and illustrated in this chapter. Further proposals and strategies for inclusion of both situational and personal factors in the 'symbiosis effect' perspective are herewith suggested. This chapter also provides a comprehensive discussion on the main research findings. In addition to answering the research questions and evaluating the process, some speculative comments and considerations have been put forward, with suggestions implications for future research.

CHAPTER TWO: THE DEVELOPMENT OF A CONCEPTUAL FRAMEWORK

2.1 Introduction

This chapter begins with multiple definitions and perceptions of the sustainable household recycling waste system within different bodies of knowledge. These bodies of knowledge are grouped into two distinct characteristics of the literature reviewed (mechanistic and behavioural). First, mechanistic literature comprises primarily literature that focuses on operational and systemic knowledge and phenomena within sustainable household recycling waste systems; for example, major work stemming from supply chain management, logistics, waste management, human geography and industrial ecology. Second, behavioural literature focuses on the attitudinal and personal factors of sustainable household recycling waste systems; for example, major work deriving from marketing, environmental behavioural and human geography. The purpose of the reviews was to seek multiple definitions and interpretations of household recycling waste systems and find the 'common ground' between different bodies of knowledge (mechanistic and behavioural). Hence, the convergence of the reviews from these respective bodies of knowledge adequately shaped the idea of a 'symbiosis effect' between the mechanistic and behavioural aspects of sustainable household recycling waste systems.

2.2 Supply Chain Management: Forward vs Reverse logistics

In supply chain management (SCM), forward logistics is a basic conventional supply chain movement from the supplier over to the manufacturer, and the retailer to the consumer (Grant et al., 2013). However, backward logistics is in opposition to the conventional supply chain flow; rather, it is a complex non-traditional flow. Backward logistics is commonly known as 'reverse logistics'.

2.3 Reverse logistics

Logistics is about managing the movement of products or services, whether flowing backwards or forwards in the supply chain context (Stock, 1997). Figure 2.1 illustrates the concepts of forward and reverse logistics. Forward logistics is “the process of planning, implementing and controlling, and storage of goods, services and related information in the most efficient and effective way, from the point of origin to the point of consumption to meet consumers requirements” (Council of Logistics Management (CLM), 1999).

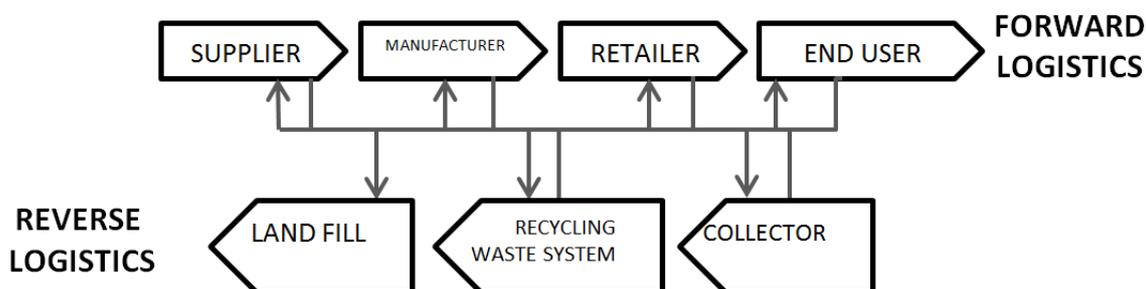


FIGURE 2.1: Forward and reverse logistics (Dyckhoff et al., 2013)

The notion of forward logistics (Fig. 2.1) is dependent on the product or services being received or consumed at the point of consumption within the supply chain (SC). However, the logistics flow within SC does not merely represent a linear process, but rather a complex two-way or multi-level process (Sarkis & Hervani, 2010). On the other hand, reverse logistics (RL) (Fig. 2.1) mainly comprises all the processes regarding products and information that are essential to recapture used, returnable, damaged, end-of-life packaging materials, production scraps and other waste, and deliver this waste back to the point where it can be reused, re-manufactured, recycled or disposed of properly (Dyckhoff et al., 2013; Stock, 1998). Kroon and Vrijens (1995) further included the activities of waste movement or diversion, physical distribution and materials management in their definition of Reverse Logistics:

“the role of logistics in product returns, source reduction, reuse of materials, materials substitution, waste disposal, recycling, refurbishing, repair and re-manufacturing” (p.20)

According to Dyckhoff et al. (2013), Stock (1998) and other eminent works on the scope of reverse and forward logistics, the waste recaptured essentially refers to the waste processing within the forward logistics (pre-consumer waste: material waste, production waste, etc.) and waste from the consumption of the product by the end-users within the reverse logistics (post-consumer waste: returned items, packaging waste, end-of-usage, etc.). In this thesis, the discussion on waste focuses on the waste from the consumption of the product by the end-users (in the following the general term 'household' or 'householder' will be used). A more elaborate definition of RL is offered by *The European Working Group on Reverse Logistics*, REVLOG, focusing on the processes involved in backward flows:

“The process of planning, implementing and controlling backward flows of raw materials, in process inventory, packaging and finished goods, from a manufacturing, distribution or use point, to a point of recovery or point of proper disposal” (De Brito & Dekker, 2004).

The latter definition is more detailed on pre and post-consumer waste, as well as the role of the consumer in backward movement. The end point of waste retrieval is the household, or at any point in forward logistics (Dyckhoff et al., 2013). Therefore, the HRWS position in RL is at the point of consumption from householders back to the main channel, as well as waste diversion from landfill and energy recovery options if feasible (Baeyens et al., 2010). To many however, reverse logistics is a green logistics concept (Rogers & Tibben-Limbke, 2001) in the fundamental sense that RL should be the opposite to the flow of conventional forward logistics. Therefore, according to the Council of Logistics Management's definition of logistics, reverse logistics is defined as:

“The process of planning, implementing, and controlling the efficient, cost effective flow of raw materials, in-process inventory, finished goods, and related information from the point of consumption to the point of origin for the purpose of recapturing or creating value or proper disposal” (Rogers & Tibben-Lembke 1999:2)

Sporadically, RL and green logistics are used synonymously prior to similar sustainable inclinations within the SCM (Hazen et al., 2011; Guide Jr et al., 2003). The discussion on RL and green logistics is further elaborated in the next section. In 1987, the concept of sustainability was defined in the Brundtland report, and was later adopted by the United Nations World Commission on Environment and Development (WCED):

“Sustainability means being able to satisfy current needs without compromising the possibility for future generations to satisfy their own needs”

(Brundtland, 1987: 8-9).

Sustainability has become an important concept for Twenty-first century organizations (Abbasi & Nilsson, 2012), and in response to this, many organizations have had to endure pressure from multiple stakeholders to be able to manage and sustain their economic activities (Grant et al., 2013; Lozano, 2015). Some of these organizations have decided to employ strategic supply chain management which emphasizes reverse logistics (RL) within their organizations to pursue such sustainability (Grant et al., 2013; Carter & Easton, 2011).

In recent years, the reason for RL to emerge with a position in the value chain is a consequence of the growing number of environmental regulations (Large et al., 2013) in many parts of the world. Initially, these regulations were enforced for manufacturers or producers on the disposition of certain products (WEEE) and certain packaging waste examples (Mayers et al., 2013; Bailey, 2003). The enforcement was subsequently extended to householders, especially in separating WEEE from their waste channel and disposing items to designated drop-in facilities (Mayers et al., 2013). These directives were not restricted to householders alone, but also to both companies and municipalities, to be committed in enforcing the regulations (Barba-Gutiérrez et al., 2008).

In accordance with EU waste directives (*Directive 2008/98/EC*), the purpose of waste legislation is to reduce the implications of waste generation and management on community well-being and the environment.

The strategic planning of HRWM is in order to reduce waste generation and improve recycling channels, in alignment with the waste hierarchy. Hence, in HRWSs, environmental directives are not just for WEEE, but also include other common recyclates which should be diverted from landfill back into the main channel to fulfil recycling targets required by EU member countries (as suggested in OECD, 2008). From a supply chain point of view, sustainability mainly focuses on triple bottom lines which include 3 key strategic issues: economy, environment and social impact (Sarkis et al., 2010; Elkington, 1998). The 3 strategic key issues are compatible with the 3Rs (reduce, reuse, and recycle) that manage backward flows in the supply chain management (SCM) (Peitz & Shin, 2013; Christopher, 2011). The management of backward flow using a simple 3Rs hierarchy of product disposition has similar characteristics of a reverse logistics (RL) system within the SCM (Stock & Mulki, 2009; DfT, 2004).

Empirically, RL has made many contributions to the social and economic sustainable impact by focusing on closed-loop economy to divert waste from landfills (Christopher, 2011; Breen, 2006; Beullens, 2004; Jahre, 1995). RL has been considered as a green logistics approach in supply chain management which focuses on saving raw material and energy (McKinnon et al., 2012; McLeod et al., 2008) within forward logistics, and within the backward movement, reduction in the usage of landfill capacity, and efficient recovery of recyclates (Murphy & Poist, 2003). Recycling in particular, has played a major role in various types of product disposition (end-of-life, unwanted, obsolete, irreparable, etc.) within *Household Recycling Waste Systems (HRWS)*. The terms 'green' and 'reverse' logistics are interchangeable in much logistics literature (McKinnon et al., 2012; Hazen et al., 2011). Both green and reverse logistics constitute the nature of sustainability; and the way to achieve such sustainability through RL is by recycling (McLeod et al., 2008). However, 'green logistics' alone does not reflect the backward flow within HRWSs (Fig.2.1). This is because this concept has a wider scope in SCM, as described below:

“Green logistics consists of all activities related to the eco-efficient management of the forward and reverse flows of products and information between the point of origin and the point of consumption

whose purpose is to meet or exceed customer demand”). (Thiell et al., 2011:335)

Green logistics primarily focuses on the reduction of the environmental impact and energy footprint from material handling, waste management, packaging and transport (McKinnon et al., 2012; Hazen et al., 2011). Therefore, in the perspective of HRWSs, green logistics can basically be explained as the awareness of municipalities on the environmental impact of the backward flow (RL) within HRWSs (Thiell et al., 2011). The essence of reverse logistics lies in reclaiming the value of returnables and recyclates, and is parallel to green logistics practices in SCM (Hazen et al., 2011). Furthermore, RL is considered as fundamental to a ‘sustainable approach’ by implementing an effective recycling system within HRWS (McLeod et al., 2008; Jahre, 1995).

2.4 An Effective Reverse Logistics System

It is crucial to have full understanding on the RL position within the system so that an effective recycling system within HRWS can be truly implemented (Rogers & Tibben-Lembke, 2001). Similar to waste management, RL also focuses on sources of reduction and substitution, including re-using and recycling (Cherrett et al., 2010). Thus, it is imperative for reverse logistics providers and municipalities to divert waste from landfills back to its reusable forms, using understood methods for effective ways of handling the backward flows (Quariguasi Frota Neto & Van Wassenhove, 2013; Starostka-Patyk & Grabara, 2010).

Retrospectively, RL reached the pinnacle of attention at the beginning of the 1990s, when much of the research focused on business (Rogers et al., 1999), strategic application at a macro level, such as planning for take-back policy, and a reverse logistics framework for returnable items (Carter & Ellram, 1998); and at a micro level, based on operational efficiencies, such as a new system for returnable items and IT application in tracking and tracing end-of-life items (Jingbo, 2011; Rubio et al., 2008).

Thus, the field comprised predominantly empirical studies on operational, technological and other SC issues, instead of the integration of multiple fields (Chicksand et al., 2012; Stock, 1997; Mentzer & Kahn, 1995).

The integration of multiple fields placed RL in the broader ambience presented by cognate disciplines, i.e. consumer behaviour, geography and waste management (Genchev et al., 2011; Carter, 2011; Rubio et al., 2008).

As explained earlier, RL research had mainly converged on End-Of-Life (EOL) products, production planning, inventory management and SCM issues that are very mechanistic (operational and technological). By contrast, the behavioural side of logistics, which is more involved with interactions and human behaviour, were excluded (Rubio et al., 2008; Carter & Ellram, 1998). Human behaviour and interaction is an important element in the backward flow, where the node point of origin has already changed from manufacturer to end-users. However, as already mentioned, the behavioural part was excluded from many empirical studies reviewed by Carter and Ellram (1998), as well as Rubio and colleagues (2008). Jahre (1995), on the other hand, proposed the inclusivity of behavioural aspects for future research. Hence, Carter and Ellram suggested that, to fully understand RL effectiveness, a specific study should be analytically undertaken in an interdisciplinary way that would be beneficial to the entire view of the RL framework (Autry et al., 2008).

This study aims to incorporate various theories from different fields in order to holistically explain the interaction between mechanistic and behavioural aspects of the logistics body of works. There is hence a need to grasp the four main drivers (Legislative; Value Recovery; CSR; Incentive) that direct and indirectly influence the efficiency of backward flows (Carter & Easton, 2011; De Brito & Dekker, 2004; Škapa, 2004; Rogers et al., 1999), so that the role of RL can be fully understood.

2.5 The Four Main Drivers in an Effective Reverse Logistics Process

Legislative

Environmental regulations (Koos, 2011; EUCommission, 2011; Holden, 2011) require (in the case of EU members) countries to reform their waste policies by reducing waste generation and diverting the flow of waste away from landfills. For instance, European Union members are compelled to achieve or accomplish the average recycling directives rate (EU27) issued by the EU environmental directives (DEFRA, 2011b; OECD, 2008).

UK recycling dated from 2011-2014 (min. 40% in 2010 and max. 44.9% in 2014) was approximately 45%, as targeted in the directive (DEFRA, 2015). Although municipalities are obliged to achieve the recycling average rate assigned to them, to go beyond the average level is still static (CIWM, 2013; Guardian, 2007). Even so many of the European Union members were more indulged in accomplishing the target instead of strategically planning for a sustainable approach suited to both their householders and their municipalities (de Man & Friege, 2016).

Value Recovery

Reverse logistics activities such as recycling may provide direct gains to companies through reduction in the use of virgin materials, and recapturing value by product recovery. This would allow a reduction on disposal costs primarily in pre-consumer waste. Incorporating RL in supply chains allows the reduction of waste from backward flows by closed loop SC, which increases profitability and competitiveness (De Brito & Dekker, 2004; Guide Jr et al., 2003). The critical role of post-consumer waste is essentially as a supply of recyclates back to the manufacturer, in order to add value and compensate the use of virgin materials.

Corporate Social Responsibility (CSR)

Customers expect companies and government agencies to improve their sustainability level through assessing environmental and social demands. Companies and government agencies hence respond to these requirements through the application of corporate social responsibility (CSR) (Kordestani & Salehi-Sangari, 2015). CSR has become a strategic driver to retain customer loyalty (Öberseder et al., 2013). Companies use RL to apply green supply chain management, a method of applying CSR (Zhu et al., 2013; Murphy & Poist, 2003) which attracts customers' interest in the product segmentation.

In return, companies gain recognition for using RL strategically as a part of corporate social responsibility strategy, for example, using RL as a CSR strategy, a returnable old item in exchange for discounted price for new purchases (Öberseder et al., 2013; Skarmas & Leonidou, 2013; Lozano, 2015). Acknowledging RL in CSR strategic planning confers many advantages on companies, although this has to be streamlined with the financial

capabilities, technology advancement and public engagement (Kisbu-Sakarya et al., 2013; Lozano, 2015).

Incentives

In retrospect, legislation is the foundation of sustainable reverse logistics, but equally important is the contribution of value-added factors if the reverse logistics movement is to be effective and efficient from the end-users' point of view. In addition, the incorporation of CSR by respective companies and agencies could be seen as aggressively mobilizing RL as a key strategy in creating green supply chain management. The most critical factor is the development of effective incentives to encourage positive HRB. Incentive provision has been a positive driver to increase the movement of recyclates back to the original flows in the supply chain (Eppel et al., 2013). As an example, the work of Fulford and colleagues found that the UK government offers positive support with incentives to increase recycling performance among households (2010). The first trial was in 2001, when the Greater London Authority found positive outcomes when reward schemes were introduced (Fulford et al., 2010). Incentives can be beneficial to both the end-users of backward flows (householders) and the businesses dealing with returnables, recyclates and waste recovery operatives (Škapa & Klapalová, 2012).

Incentives can enhance the recycling rates between householders and supply chain stakeholders (Keramitsoglou & Tsagarakis, 2013; Lacetera & Zirulia, 2012). The provision of incentives can be in a form of financial instruments (environmental taxes, subsidies, rubbish pricing, carbon allowances (Škapa & Klapalová, 2012; De Brito & Dekker, 2004) and services included (frequent scheduling, better accessibility and availability, together with convenience (Abbot et al., 2011). However, such incentives have to be well-defined and responsive to public needs (Shaw & Maynard, 2008).

The well-defined rewards schemes are consistent with Fulford and colleagues' findings on other elements that should be embedded in the schemes, such as the facilitation of HRWS, householders' attributes (personal factors) and voluntary action (2010). Thus, this implies that a greater understanding of consumer engagement is needed to spur on household recycling behaviour (HRB).

2.6 Consumer Engagement and an Introduction to Symbiosis Effect

Elkington mentioned pursuing sustainability through triple bottom line performance, and that there is a need to shift the paradigm from revolution to symbiosis (1998). As he stated,

“To achieve outstanding triple bottom line performance, new types of economic, social, and environmental partnership are needed. Long-standing enemies must shift from mutual subversion to new forms of symbiosis. The resulting partnerships will help each partner perform traditional tasks more efficiently, while providing a platform from which to reach towards goals that none of the partners could hope to achieve on their own” (Elkington, 1998:1)

Therefore, from the perspective of end-users within the reverse logistics system in HRWM, a symbiotic element of engagement with other channel actors is required, which in this instance are the municipalities. Product recovery process strategy (as in Fig. 2.2) illustrates the incorporation of end-user engagement in the management of backward movement. Even though much literature supports the significant role played by consumers (Kim et al., 2014), in general, it mainly focuses on a generic model that conforms to organizational strategic relations instead of actual events or circumstances (Abbasi & Nilsson, 2012; Carter & Easton, 2011).

Where the actual circumstances can be motivated a complicated strategy and requires a thorough method (Bai & Sarkis, 2013; Chiarini, 2013). This is because the reverse logistics framework presupposes the importance of end-user roles in managing the backward movement (Rogers & Tibben-Lembke, 2001).

This implies that the channel actors in reverse logistics are interdependent (Cherrett et al., 2010), which can be perceived as having a ‘symbiotic’ relationship (Ehrenreich, 2002).

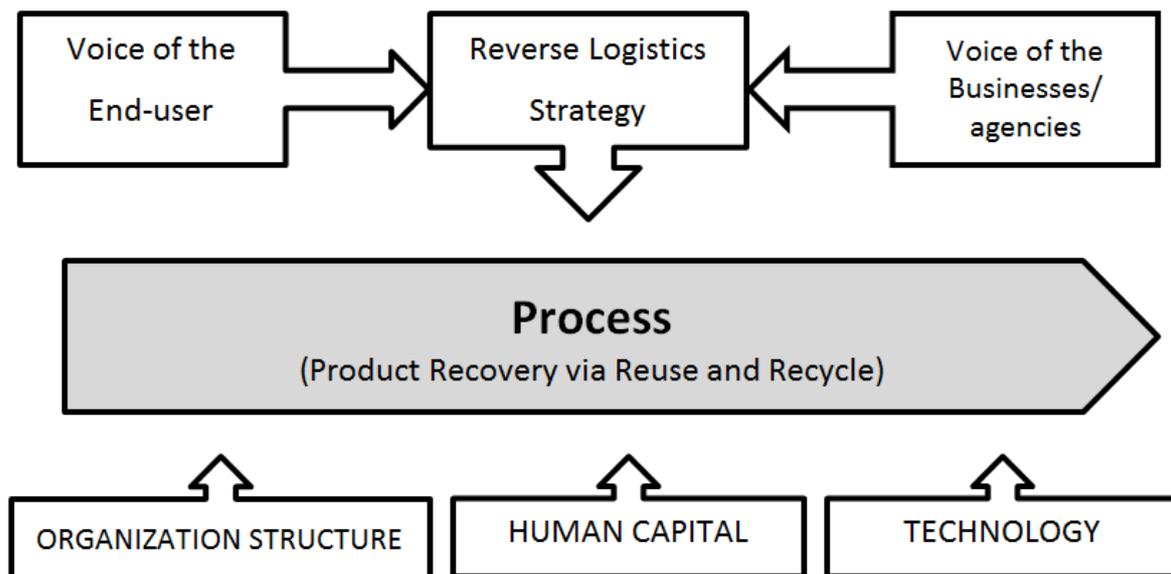


FIGURE 2.2: Consumer Engagement in Product Recovery Process in typical Company
Adopted from PwC (2008) Report

RL in logistics literature (mainly subject to operational studies) is predominantly a strong element in contributing towards sustainable development (Chiarini, 2013). In previous sections, RL scope was mentioned pertaining to backward movement, and sustainable approaches such as 4Rs (Reduce; Reuse; Recycle; Recover), closed loop SC, cradle-to-cradle, resource recovery (Kumar & Putnam, 2008) and renewable energy have significantly elevated RL to the level of importance (Sahamie et al., 2013; Chiarini, 2013). However, the critical role of the end-users is sometimes ignored (Sharma et al., 2010).

Therefore, to secure the effectiveness of end-users' participation in RL, and to maintain its level of effectiveness, there should be increments in both end-user engagement and corporate social responsibility (CSR) in SCM (Daugherty et al., 2001).

It is suggested that end-users play a major role in RL, and make a significant contribution to creating an efficient backward movement in the logistics pipeline (Genchev et al., 2011). This makes it appealing for companies to integrate end-user interaction (feedback and engagement) in their product recovery strategies (PricewaterhouseCoopers, 2008).

The notion of symbiotic relationships between companies or agencies (HRWS) with end-users (householders) reflects the interdependencies of both entities, which require a holistic approach. The holistic approach allows elements such as personal factors (behavioural aspects from end-users) and situational factors (operational aspects from agencies) to interact and influence the RL capabilities in handling sustainable issues (Madaan et al., 2007; Lau & Wang, 2009). As a consequence, future studies have to fully investigate these factors to grasp the RL framework more effectively (De Brito & Dekker, 2004; Škapa, 2004).

So far, the logistics literature has been able to identify four major factors which significantly influence the RL design processes to become more effective and efficient (Brito et al., 2004; Škapa, 2004; Carter & Easton, 2011). In referring to Figure 2.3, the first influential factor that contributes to the strategic decisions of a company or agency associated with RL investment in its facilities and technology is the economic factor, for instance landfill taxes, garbage fees and pollution taxes. Economic factors are not restricted to corporate entities however. Public bodies such as local authorities or municipalities are also affected by economic factors. This factor is also influenced by the re-processing demand of industries for recyclates.

Other influential factors that need to be taken into account are the legislative and political elements such as take-back policy, restriction on landfill capacity and carbon emission policy, which could affect RL strategy and scope in firms or municipalities. Reverse logistics effectiveness and efficiency is dependent on innovation and continuous improvement (Beullens, 2004).

Therefore supply chain management (SCM) optimization factors such as closed-loop SC, cradle-to-cradle, ecological product design and green logistics have promoted efficiencies and effectiveness in backward flows (Rubio et al., 2008; Carter & Ellram, 1998).

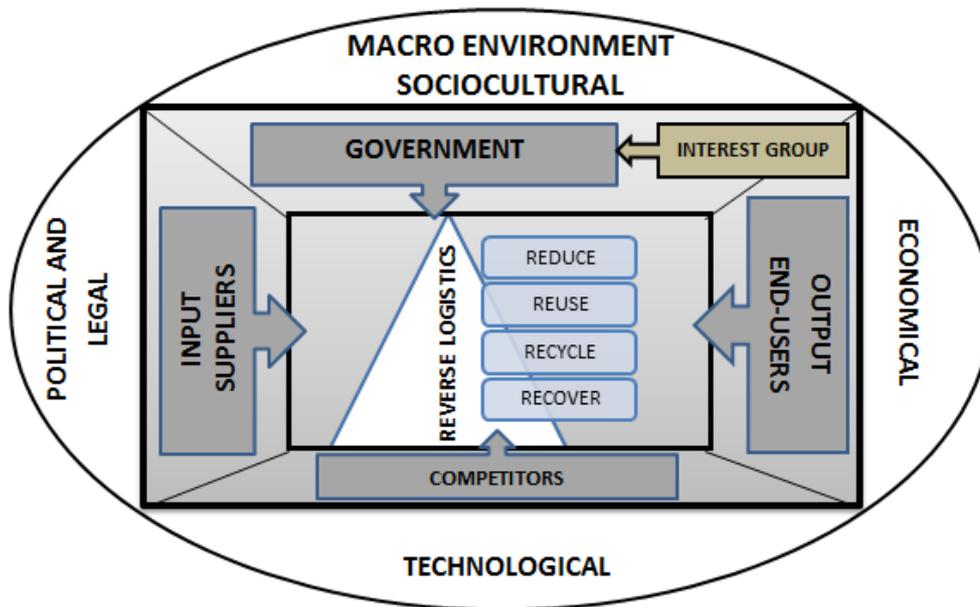


FIGURE 2.3: A Model of the Environmental Forces affecting Reverse Logistics Activities adapted from Achrol et al. (1983) and Carter & Ellram (1998).

The model illustrated in Figure 2.3 implies a complex and multifaceted environment, and in order to understand the complexity of reverse logistics in household recycling waste management (HRWM), a cross-discipline (interdisciplinary) between logistics and other fields (waste management and consumer behaviour) is fully required for a study (Carter & Ellram, 1998). This interdisciplinary approach needs an ‘initiation’ using the waste framework directive that was originally galvanized from the 1974 Control of Pollution Act (COPA) (Hawkins & Shaw, 2004) framework, which is similar to the waste hierarchy model in Figure 2.4. This particular model highlights the hierarchy of household recycling waste management (HRWM) which promoted the so-called 4Rs: Reduce, Reuse, Recycle and Recovery (Hawkins & Shaw, 2004), as well as the *Recovery Option Pyramid* (ROP) conceptualized by De Brito and Dekker (2004) and Škapa (2004) for the RL framework. The next section will be a discussion on the 4R’s that reflects both product recovery and HRWM.

2.6.1 Reduce

In supply chain management, reducing primarily focuses on the reduction of virgin material usage in the production or manufacturing processes.

However, in certain cases within the green supply chain management, especially with regards to *product design*, all 4R's (McKinnon et al., 2012, Guide Jr. et al., 2003) may be abundantly addressed. In this process, the reduction of virgin material (reduce) is permitted, allowing the parts in the production to be reused, 'greening' (McKinnon et al., 2012; Murphy & Poist, 2003) the production processes along the way, and encouraging consumers or households to reuse and extend the lives of their products. For example, some companies offer free services within a warranty period for refurbishment or repairs.

On the other hand, from the HRWM perspective, reducing means a reduction of overall household waste, whereby householders are encouraged to reduce their daily consumption of unwanted goods by sustainable consumption (Jagel et al., 2012; Chipp & Naidoo, 2015). According to the latter, sustainable consumption means a householder is aware of the impact of his/her purchases on the environment. Therefore, they buy what is necessary and refrain from buying what is not. In addition, sustainable consumption also promotes the longevity of product usage. This leads to the next point of recovery option: Reuse

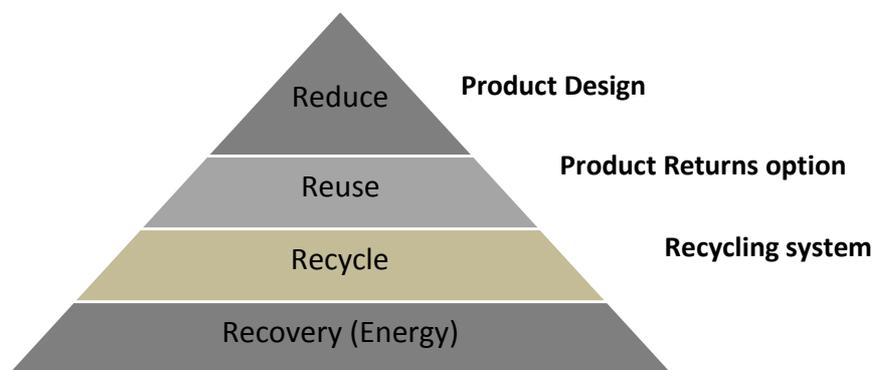


FIGURE 2.4: Recovery Options Pyramid (ROP) for Household Recycling Waste Illustration by the Author based on De Brito & Dekker (2004) and Škapa (2004).

2.6.2 Reuse

In supply chain management, specifically in green supply chain strategy, reuse refers to a closed loop supply chain. A closed loop supply chain addresses profitable recovery of value from product or by-product, returnable items, exchange items, functional components, materials and packaging that are reused in the supply chain (Gurtu et al., 2015).

Furthermore, reuse addresses product returns or take-backs relating to end-of-life products or defectives goods to be returned to the retailers or manufacturers (Stock & Mulki, 2009; Fleischmann et al., 1997), such as Waste Electrical and Electronic Equipment (WEEE) (Thierry et al., 1995). On the other hand, reuse in HRWM applies to householder initiatives in reusing and prolonging the life of items they purchased for an extended period of time. However, when the item is no longer needed and it has value to recapture, the role of the municipality is to recycle the item to the reverse logistics channel.

2.6.3 Recycling: the Reverse Logistics and Household Recycling Waste Management (HRWM)

It is clear that the movement of recovery options (Fig. 2.4) is interconnected effectively between the chosen options (De Brito & Dekker, 2004; Škapa, 2004). When the option is recycling, the four main drivers mentioned earlier (legislative, value creation, CSR and incentive) are equally important, as they directly and indirectly affect the backward movement. Therefore, to interpret the recycling system, we have to recognize that RL is not just a physical backward movement, but it also requires many aspects that go beyond mechanistic approach, and are interrelated with the macro (political and socio-economical) and micro-environment (stakeholder engagement) (Škapa, 2004; Rogers et al., 1999).

Besides, it is clear that recycling is in alignment with the green logistics (McKinnon et al., 2012), as it closes the loop in the supply chain, and with correct applicable technology, it may provide a more sustainable approach in HRWSs.

Meanwhile, the recycling option is the recycling system used by municipalities in recovering the material back from products that are not suitable for input directly back into production in their current form (e.g. recyclates such as plastic, aluminium, paper, rubber, etc.)

The last option for recovering value, or energy recovery, is normally carried out by municipalities or assigned operators (Hibbert et al., 2005; Ferrara & Missios, 2005; Gultinan & Nwokoye, 1975). Solid waste literature focused on HRWS has discovered empirical evidence which suggests that practising waste prevention, reusing materials, recycling and making environmental disposal decisions allows firms to benefit from cost reductions and

gain efficiency in reverse logistics channels of distribution (UNEP, 2012; Ryu, 2010). For example, when the EU directives were introduced, many local authorities came up with various recycling schemes, some of which were more effective than previously (Woodard et al., 2005). The findings from this study showed an incremental change in local recycling performance and positive involvement from the community. These practices would encourage cost savings and therefore provide immense assistance to the municipalities in lower disposal levels and treatments costs, enabling cost recovery on selling the recyclates (Williams, 2011; Fulford et al., 2010).

The RL factors (Cherret et al., 2010; Jahre 1995; Kopicki et al., 1993) within HRWM include transportation (scheduling and routing of waste vehicles using modelling method), procurement (provisions for recycling: co-mingled/separated collections using cost benefit analysis), services and facilities (charging vs. non charging for collection using cost benefit analysis). Other factors are also involved, such as innovation and technology advances, for instance hybrid vehicles (low carbon emission vehicles), and real-time modelling, which encourages efficiency in routing and scheduling. Furthermore, strategic alliances have also been found to encourage co-sharing and mutual benefit (Fulford et al., 2010), by partnering with neighbouring municipalities, private recycling waste operators, energy suppliers and big retailers. This strategic alliance depicts a synergistic or symbiotic relation between stakeholders within a municipality or an establishment under local authority management.

2.7 Recycling is a reverse logistics of household recycling waste systems

This study is particularly concerned with one aspect of reverse logistics, namely recycling. Recycling has been analysed thoroughly as a reverse logistics concept (Dowlatshahi, 2010; Autry et al., 2008; De Brito, 2004; Škapa, 2004; Carter & Ellram, 1998), which has encouraged the development of many theoretical frameworks.

Recycling can be defined as *“A method of recovering waste as resources that includes the collection, and often involving the treatment, of waste products for use as a replacement of*

all or part of the raw material in a manufacturing process” (European Environment Agency, 2013, in Garechana et al., 2014).

Recycling is basically a reverse logistics option for retrieving product returns and waste to the forward channel by ‘reuse, recycle and reduce’ in managing the returnables, recyclates and waste (Stock, 1998; Thierry et al., 1995; Pohlen & Farris, 1992; Kopicki et al., 1993; Guiltinan & Nwokoye, 1975). Guiltinan and Nwokoye’s research discovered that recycling plays a major role in RL processes, with three key areas (legislation, operation capabilities and marketing) having significant influence on the performance of HRWM.

This also coincides with Carter and Ellram (1998), who addressed the effectiveness of RL framework based on those key areas. However, the latter authors were more concerned with RL framework at the pre and post-consumer waste stage, compared with Guiltinan and Nwokoye who were more concerned with post-consumer waste. Recycling is an important RL option, as it is accountable for collection, and processes consumable waste back to forward logistics to reduce the usage of virgin materials in mainstream production (Garechana et al., 2014). Take an example of De Brito’s framework (2004) where the RL framework establishment includes recycling with its critical factors (actors, drivers, product, process) and expands the dimension of Carter and Ellram’s framework to a more practical approach in handling backward movement primarily in HRWM (in the following the HRWM only focuses on post-consumer waste).

Therefore, the establishment of efficient recycling systems within HRWM may reduce the need for waste disposal and diversion of waste streams from the landfills (Deutz & Frostick, 2009). RL is the management of all recovery options (de Brito & Dekker, 2004) which may or may not apply to HRWM (Rogers & Tibben-Lembke, 2001), and is also mentioned in the work of De Brito (2004) and Fleischmann et al. (1997). Moreover, recovery options in supply chains and waste streams have many similarities to residential settings (Huscroft, 2010). For example, pre-consumer waste in the SC or logistics stream will be diverted back to production or distributed to a secondary market for further usage within the supply chain.

Similarly, post-consumer waste is also diverted back to production or recycled back for the secondary market. Hence, in the end, both pre and post-consumer waste is eventually settled in a secondary market to be recycled into a newer form (Cherrett et al., 2010).

In a nutshell, this study refers to HRWM as the supervised handling of waste material from generation at source, through the recovery processes, up to disposal (OECD, 2008). In the UK, this definition refers to *Local Authority Collected Municipal Waste (LACMW)*, and defines whether the waste collected by municipalities originated from household or business waste, which is collected by the local authority, both carrying a similar aspect and composition, as required by the Landfill Directive (DEFRA, 2011a).

2.8 Household Recycling Waste System (HRWS): United Kingdom

The UK waste and secondary materials market is governed by and, in many respects, created by regulation. However, government has committed to reduce the burden of regulation, and to free up innovative businesses to create new values and jobs. As announced in the UK Budget 2011, the UK Government, especially the Department for Environment Food and Rural Affairs (DEFRA), is conducting a public thematic review of legislation, which will consider the impact on growth of waste legislation as part of the exercise (DEFRA, 2012). UK waste legislation mainly derives from EU waste directives, and commonly relies on waste hierarchy (as discussed in previous sections) to better understand a sustainable method of waste disposal. However, to adopt a sustainable method of waste disposal is very complex, and requires consideration of both the system and the behavioural aspects of the waste movement (Crociata et al., 2015).

Many key environments (directly or indirectly) influence the development of households' systematic recycling waste channels (Koos, 2011). English local authorities' HRWM uses a two-tier approach: Waste collection authorities (WCAs) manage the day-to-day collections of household waste, and at agreed locations, usually called transfer stations, waste disposal authorities (WDAs) take over the control of the waste and see to its disposal. However, some urban areas of England (including Hull) are governed by Unitary Authorities, which

take responsibility for the collection and disposal of the waste generated within their boundaries.

This study is focused on current waste management strategic planning in the English unitary authorities of Hull and the East Riding of Yorkshire. In accordance with the Waste Review 2011 (DEFRA, 2011c), local authorities need to plan a sustainable use of material and continuous improvement in HRWS facilitation, together with addressing environmental benefits and supporting local economic growth. Waste management is defined by the revised Waste Framework Directive (DEFRA, 2011a) as: the collection, transport, recovery and disposal of waste, including the supervision of such operations and the after-care of disposal sites, and including actions taken as a dealer or broker. Each recycling scheme operates in its local context and takes into account situational, demographic, political and cultural factors (Timlett & Williams, 2008).

The major influences on the UK HRWM are summarised in Figure 2.5. These key influences will regulate the local authorities' decisions on effective HRWM. The unit within the local authorities which takes care of waste collection and disposal is given a budget, and collection/recycling targets. An economic instrument was introduced to the UK in 1996 (POST-PN-212, 2004) to increase Landfill Tax and thereby improve local recycling rates, subsequently putting pressure on municipalities to divert potential recycling materials from landfills.

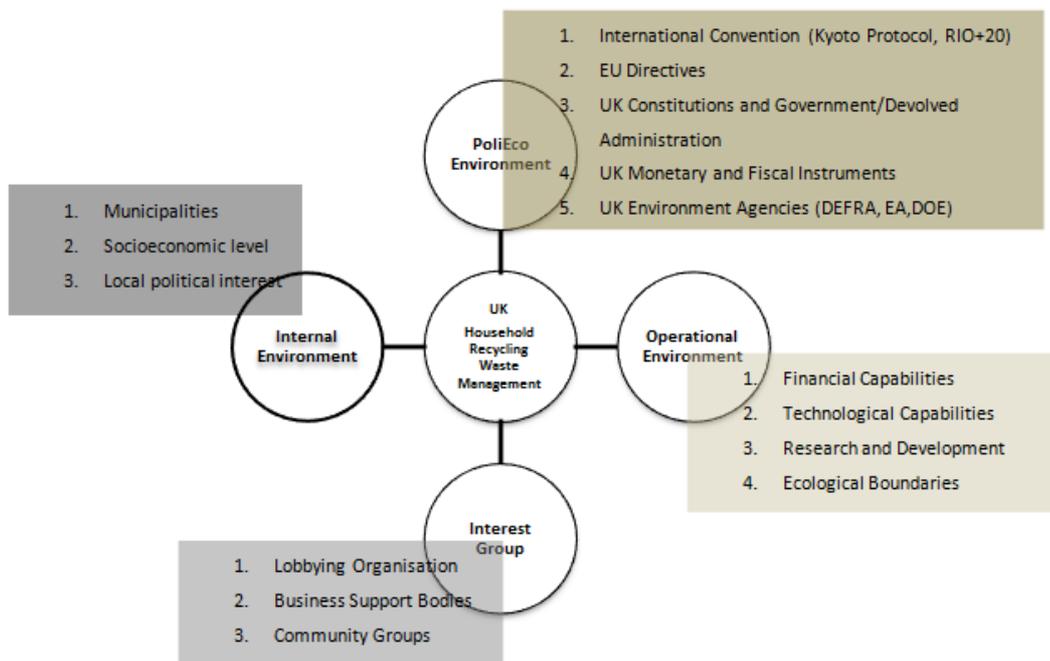


FIGURE 2.5: Self-produced by Author based on Zott, Amit & Massa (2010): The 4 Key Environments affecting UK Household Recycling Waste Management

In addition, households commonly pay a council tax to the local authority and the tax is used to cover a lot of services including schools, police, street lighting and waste/recycling collection (Abbott et al., 2011). There is no special tax for waste, although calculation of tax based on weight/volume of waste has been practiced by other countries (US, Germany and Norway) (Kipperberg, 2007). At the moment tax levied due to waste not being recycled is not common, but there are some local authorities currently testing such systems (DEFRA, 2012). However, local governments in the UK are reluctant to charge for waste collection. Funding for recycling and residual waste collection comes from the council tax, a tax on property, and a central government grant, which funds all local government services.

The component of council tax related to waste collection bears no relation to the quantity of waste produced, so households perceive the marginal cost of all units of waste disposed after the first as zero (Callan & Thomas, 2006). Thus, there is no monetary incentive for households to minimize waste production or to increase their recycling rate.

Fiscal measures introduced to improve recycling performance have been directed towards local authorities, rather than households (Abbott et al., 2011).

Legislation was passed in the years 1996 and 2005 to introduce a scheme for landfill allowances, which are tradeable in England (360environmental, 2012). The common methods of waste management currently employed in the UK are landfilling, recycling, composting and capturing energy from waste plants. Landfill is the least sustainable operation in waste management, which, at its most basic level, involved placing a waste in a hole in the ground and covering it with soil. Today, the engineering of a modern landfill is a complex process, typically involving lining and capping individual 'cells' into which waste is compacted and covered to prevent the escape of polluting liquid or gases (wrfound, 2012). Systems are installed to capture and remove the gases and liquids produced by the contaminated rubbish.

Before the inception of stringent waste legislations in 2003, and as a member of the European Union in 2002, English recycling practice was in its relative infancy. For example only 7% of household waste was recycled in England in 1997/8. Since that time, the rate of recycling of household waste has risen rapidly to 36.3% in 2007/08, and to over 40% according to the most recent figures (DEFRA, 2012). In total, 47.9 million tonnes of commercial and industrial waste was generated in England in 2009, compared with 67.9 million tonnes in 2002-3 (DEFRA, 2012). Over the past few years, there has been significant progress with waste and resource management in England. Recycling and composting of household waste has increased to 43%, and waste going to landfill has almost halved since 2000 (DEFRA, 2012).

The improvements have been driven by a combination of regulatory, policy and financial measures, such as recycling targets, landfill tax, and targeted financial support. The UK National Planning Policy seeks to enable local authorities to put planning strategies in place through their local plans, which shape the type of waste facilities in their areas and where these should go.

The facilitation of these measures improves the adoption of the 4Rs. Hence, the application of Waste Review 2011 to expedite waste management policies and review the applicability of current waste policies in addressing socio-economic needs, as well as to realize the larger aim of becoming a zero-waste state in the future (DEFRA, 2011). The current data on waste generation for the two districts in comparison with the national average are detailed below.

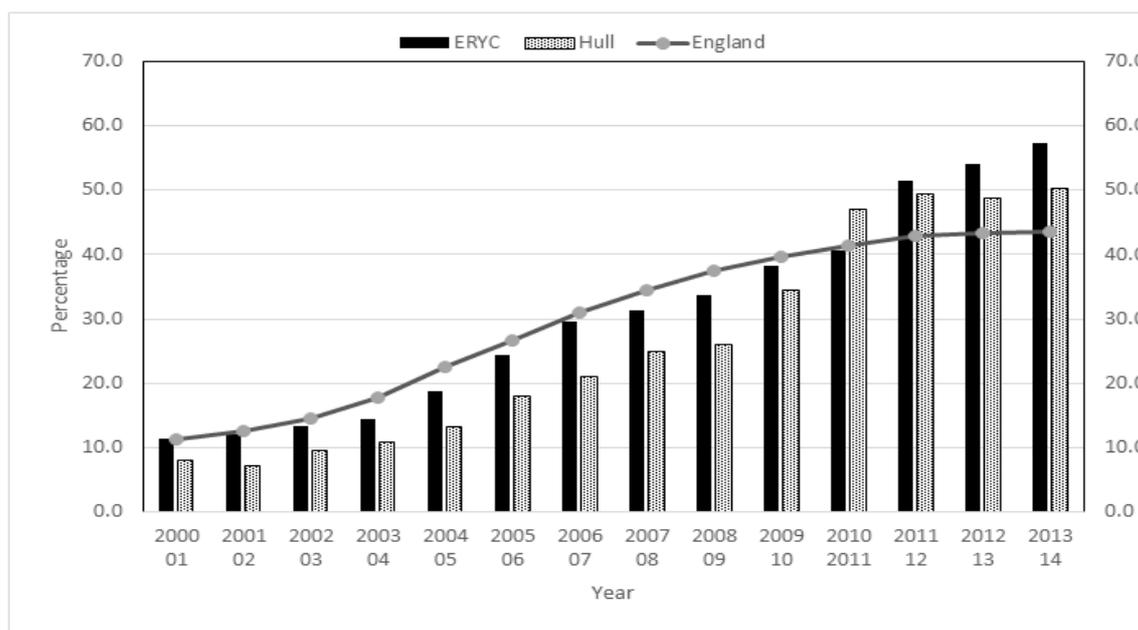


FIGURE 2.5: Percentage of Household Waste Recycled or Composted for the Two Local Authorities and an Average for England (sourced from statistics reported to the UK Department of the environment, farming and rural affairs by local authorities.)

As mentioned earlier, waste management policy addresses both households and municipalities. The effectiveness of addressing waste policy is driven by two crucial key players: the householders and municipalities (Barr et al., 2013). Furthermore, these key players are each other's strengths and weaknesses, as a concomitant in one spatial setting and also in symbiotic relationship (Ehrenreich, 2002). Thus, their interaction is critical in the implementation of HRWS and development of sustainable living (Moh & Abd Manaf, 2014; Abbott et al., 2011). To ensure the integration work in HRWS runs effectively, some determinants derived from Starostka-Patyk and Grabara (2010) are shown to have a direct effect on household recycling performance (Fig. 2.6)

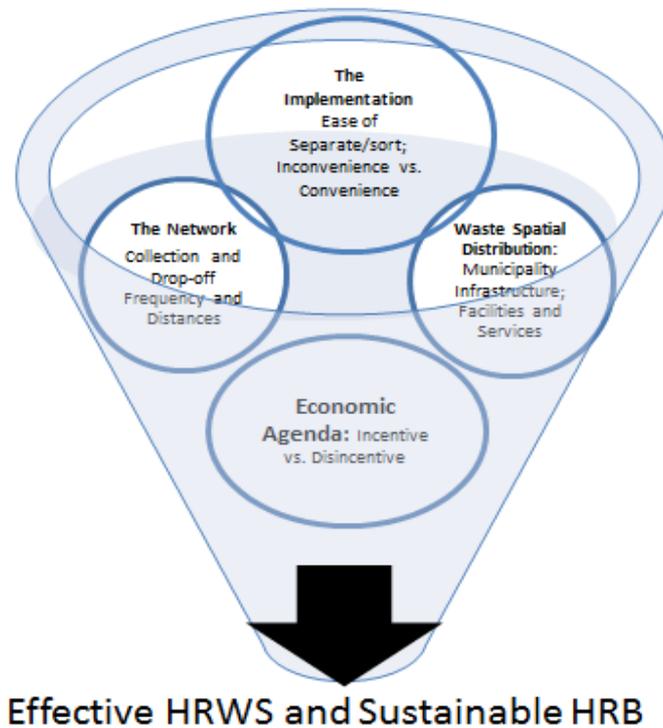


FIGURE 2.6: The determinants for Effective Waste Recycling System derived from Starostka-Patyk & Grabara (2010)

The determinants suggested by Starostka-Patyk and Grabara (2010) in tackling post-consumer waste (Fig. 2.6) requires an effective RL framework, using multiple determinants (Carter & Ellram, 1998). This reveals multiple determinants signifying RL characteristics of uncertainty, complexity, variability and extensiveness; whereby having to develop an ideal system is likely to be crucial (Zhu et al., 2013; Lau & Wang, 2009). A better understanding of each determinant may reduce some of the complexity in developing a sustainable reverse logistics process, especially for the Household Recycling Waste System (HRWS).

2.9 The determinants for effective Household Waste Recycling Systems: Situational and Personal Factors

This section details the two major determinants that impact the recycling behaviour of households.

The first discussion concerns the situational factors that cover Starostka-Patyk and Grabara’s (2010) determinants that promote an efficient reverse logistics system in handling waste stream from the end-users. The second section covers the personal factors and discusses the major theories and models that encapsulate personal factors.

2.9.1 Situational Factors

In the UK, municipalities are responsible for waste management, as collection and disposal authorities, and also have responsibility for meeting recycling targets. Referring to the diagram below, the flow of reverse logistics in HRWS (Fig. 2.6) leads from the households and back to recovery options.

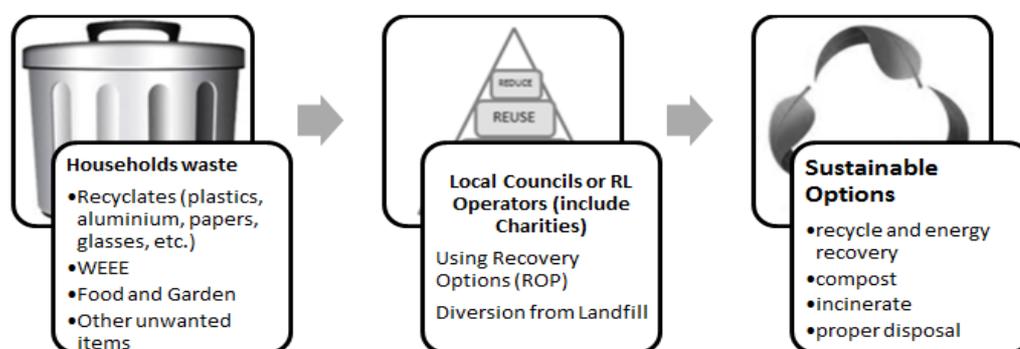


FIGURE 2.6: Illustration by the Author based on ROP and 4Rs

In the UK, HRWS comprises many situational factors (in the following, the general term ‘situational factors’ will be used) that might contribute to productive recycling participation. Table 2.1 shows the different aspects of recycling systems and their influence on HRB, derived from previous literature (refer [Appendix A](#)). These factors are discussed in the following sections.

Aspects of Situational Factors	Situational Factor
Facility <ol style="list-style-type: none"> 1. Collection/Delivery Operator 2. Household Waste and Recycling Centres (HWRC) includes drop-off centres 3. Customer Services Centre 	Accessibility and Availability
Kerbside Scheme Options <ol style="list-style-type: none"> 1. Kerbside-Sort 2. Co-mingled 	Difficulty and Convenience Frequency

3. Collection Frequency 4. Bins (Type, Numbers and Size) 5. Distances	
Marketing and Education 1. Advertising 2. Information 3. Public Engagement 4. Education	Frequency and Coverage User friendliness
Incentives 1. Monetary Rewards 2. Non-monetary Rewards 3. Penalty Fee	Incentive or Disincentive

Table 2.1: The situational factors based on content analysis and themes

i. Accessibility and Availability

In logistics theory, accessibility and availability of services and facilities are crucial situational factors for seamless product movement from the point of origin up to the point of consumption (McLeod et al., 2008; Muñuzuri et al., 2005). This also applies to reverse logistics, especially in HRWS. The facilitation of HRWS from local authorities in the UK varies between localities, from separated waste collection to the single kerbside system (WRAP, 2010). The main reason behind the variation in recycling schemes is cost allocation for HRWS, as every locality is different, and statutory recycling targets are weight-based. Therefore, some municipalities shift the focus onto heavier waste streams (e.g. glass, metal, etc.) at the expense of lighter plastics.

Other reasons behind the variation in recycling schemes are logistics challenges due to the level of remoteness of residential homes in rural areas, or the close-space proximity between flats or apartment blocks in urban areas (Abbot et al., 2013). Lastly, there is a lack of standard practices to act as points of reference. This means the type of recycling schemes where municipalities are able to collect recyclates from households using a kerbside scheme, which could either be 100% dry co-mingled (household to mix recyclates all in a single bin) or 0% dry co-mingled (household to separate recyclates into different bins).

Another option is for a food and/or garden waste bin (East Riding of Yorkshire Council, 2012; Hull City Council, 2012; DEFRA, 2011b).

Householders require convenience in the recycling provisions, in order to follow them effectively, such as drop-in centres, bringing their recycling out to the kerbside, or attending awareness programmes run by customer services centres (Williams and Cole, 2013). The responsiveness of the municipalities and availability of scheme provisions (providing bin bags, additional bins, pick-up services and collection times) (Abbott et al., 2011) also has an influence on HRB. As an example, Grazhdani found that educating the public on recycling through awareness programmes offered by the municipalities has increased the recycling rate in the district of Prespa Park, Albania (2016). Furthermore, collection can take place on a weekly or bi-weekly basis, and householders have to be aware that certain recyclates (large items, WEEE, hazardous waste, etc.) may need to be delivered at *Household Waste and Recycling Centres* (HWRC) or at drop-off centres (Woodard et al., 2004).

The effectiveness, accessibility and availability of HRWS services and facilities varies across geographical areas (Williams & Cole, 2013; Abbott et al., 2011; Woodard et al., 2005). Abbot et al. (2011) found that households in a heavily populated area (Southern England) in a panel data study, tended to recycle more depending on collection frequency, in comparison to sparsely populated areas (Non-English regions) (Woodard et al., 2001). In addition, household size (with or without garden, and flats or non-flats) contributed to the variation of composting level (Abbott et al., 2011; Woodard et al., 2004; Barr et al., 2003; Lyas et al., 2005).

In the Horsham and Sussex district (South-East England), new or improved HRWSs, such as the introduction of a co-mingled scheme or kerb-sorting recyclates, were found to have increased participation rates (Woodard et al., 2001; Woodard et al., 2006; Woodard et al., 2004). The design of HRW systems in the UK is not homogenous; thus, a single design may not be successful compared to other, different types of recycling schemes (Abbott et al., 2011; Guardian, 2007; Friends of the Earth, 2002).

ii. Difficulty, Convenience and Frequency

Difficulty and convenience were found to be the most significant factors in determining participation levels in most recycling research.

Difficulty and convenience refers to the level of hardship when conducting household recycling (Davis et al., 2006; Barr et al., 2003; Tonglet et al., 2004; Tucker et al., 2000). Household-friendly schemes, such as co-mingled waste is preferable to pre-sorting by recyclates type, and more frequent collections of recycling bins encourages households to recycle more (Lyas et al., 2005; Woodard et al., 2004; Woodard et al., 2001; Tucker et al., 2000).

iii. Coverage and User-friendliness

Coverage and user-friendliness within the marketing and education domains are other situational factors that have been discovered by many recycling studies to affect HRB (Bhate, 2005; Barr et al., 2003). This aspect of situational factors focuses on information dissemination to educate the public on recycling, and engagement programmes that encourage householders to participate and give feedback on the HRWS (Barr et al., 2013; Latif et al., 2013; Thomas et al., 2013).

Household participation has an influence on overall quality, whereas the quantity of returnable and recyclates is based on acknowledgment of their role in the HRWS (DEFRA, 2013). Therefore, having the right marketing communication and education could lead to higher HRB (Hadjimanolis, 2013; Kinzig et al., 2013; Rath, 2013).

iv. Marketing, Policy and Household Recycling Waste System

Telling the public about the advantages of recycling and recycling routines is considered a marketing strategy with positive implications on recycling performance (do Valle et al., 2004). Marketing is an important tool in communicating and engaging the public to adopt sustainable behaviour, such as pro-environmental, recycling and conservationist habits. Engagement and promotions on the benefits of recycling has an incremental effect on

recycling performance, because the engagement factors create 'stimulation', affecting householders' attitudes towards recycling (Lakhan, 2016).

This is where household recycling behaviour (HBR) has an implication on the HRWS. Through social marketing, householders become aware of their responsibility to the environment, and adopt more appropriate sustainable behaviour, such as recycling and conservationist practices (Moore, 2016). The householders (the end-users) will benefit from a well-managed reverse logistics process, with greater facilitation, and should have a perception of heightened customer services (Autry et al., 2008). The backward processes should, in turn, become more formalized and convenient for them to execute, for instance processing return items, separating and sorting recyclates and exchanging old items for newer ones (Carter & Ellram, 1998).

From the supplier perspective, a successful reverse logistics programme offers a firm the ability to build a closer relationship with the end-users by providing additional opportunities to serve and satisfy them (Autry et al., 2008). Thus, marketing creates awareness of the backward movement, as well as promoting end-user participation in sustainability needs, so that they can go beyond green consumption or environmental purchasing. It can also educate them on managing their waste sustainably (Spaargaren, 2013; Gustavsson & Elander, 2013; Barr et al., 2013).

Marketing alone is insufficient to tackle the sustainability issues within HRWS. However, with sufficient policy, the public could be effectively informed on acknowledging their role in regional sustainable aspiration (Steiner et al., 2014). For example, the adoption of EU waste directives has been a key instrument in improving the UK's current recycling performance from 11% to approximately 45% (DEFRA, 2011). Many local authorities have invested in customized waste frameworks that align with EU waste directives. Some of the frameworks were successful, and some required improvement (Harder & Woodard, 2005). The key findings relating to non-conforming waste frameworks are the diversity of socio-economic background and the spatial distances between residential properties (Abbot et al., 2012).

Whilst policy instruments can be a solution for motivating householders to recycle (Finnveden et al., 2013), they are not an absolute solution for changing social norms and improving HRB entirely (Kinzig et al., 2013). Policy instrument does, however, play an important role in mitigating sustainable waste strategic planning (and improving recycling rates). However, using a top-down approach by letting municipalities deal with the issues without the right support could lead to inefficient HRWSs (Hadjimanolis, 2013; Holden, 2011; POST-PN-212, 2004).

To have better policy implications, political visibility is required to promote sustainability through education (Dimitrova, 2014; Godemann et al., 2014; Thøgersen & Grunert-Beckmann, 1997). It is important to inform the population about the environmental consequences of their consumption patterns and their share of responsibility in achieving sustainability (Sen, 2013; Jagel, 2012). If environmental policies are not progressive and supportive, this could lead to inefficiencies (Strange & Bayley, 2008). On the other hand, when a policy is decentralized, implementation may lead to sporadic outcomes, which could be a misleading factor in actual performance (Gui et al., 2013; Keramitsoglou & Tsagarakis, 2013; Kinzig et al., 2013). A strategic policy needs to portray sustainable development in a broader scope at the national, as well as regional level (de Man & Friege, 2016; Ashenmiller, 2009).

Effective policy and marketing have the capacity to boost sustainable consumption, together with ensuring follow-through of the dissemination (Carballo-Penela & Castromán-Diz, 2015; Dyck, 2015). This is especially the case when it comes to marketing, since it has been focusing entirely on understanding the environmentally-conscious consumer, and devising appropriate strategies to target such consumers (Grimmer & Bingham, 2013; Rath, 2013). For example, public engagement from the community and environmental groups, and promoting environmental awareness, such as door-to-door meeting, social networking and community environmental programmes, can also intensify recycling rates (Keramitsoglou & Tsagarakis, 2013; Halvorsen, 2008; Bekin et al., 2007; Bhate, 2005).

This should be accompanied by community engagement, appropriate participatory processes and experiential education (Godemann et al., 2014; Kollmuss & Agyeman, 2002), in conjunction with coherent legislation and policy that should facilitate community recycling and promote energy-efficient ways of disposing of waste (do Paço et al., 2013; Friends of the Earth, 2002).

Some literature has argued that sustainable strategy does not involve any marketing aspects, but needs to be part of the corporate strategy (Kim et al., 2014; Lozano, 2015) within an organization (public or private). It has also been argued that organizational decision-making must incorporate environmental issues, including ideas on resource conservation and environmental sustainability (Alvén & Huhtilainen, 2013). Incorporating consumers' and managerial concerns on the natural and physical environment not only contributes to superior business performance for competitive advantage, but can also enhance corporate reputation (Ahmed et al., 2014).

Marketing and education are perceived as engagement tools in the development of a critical relationship which is needed to effectively implement HRWSs (Maddox et al., 2011; Jesson, 2009; Bekin et al., 2007; Woodard et al., 2006). Thus, if marketing and education are not practised effectively, householders will not recycle as much as was hoped (CIWM, 2013; WRAP, 2010; DEFRA, 2012), householders generally tending to be oblivious to their HRB (Koos, 2011; Birtwistle & Moore, 2007).

Birtwistle suggested that consumers from households with a high consumption awareness level projected a pro-environmental behaviour, which implies a better HRB (2007; Koos, 2011; Gronhoj & Thogersen, 2009; Biswas et al., 2000). Therefore, municipalities have to strategically implement relatable marketing communication that applies to the heterogeneity of their population (Breen, 2006; Bhate, 2005). Heterogeneity among households contributes to complexity in developing an ideal HRWS (Zhu et al., 2013).

For example, two areas under the management of Sunderland Municipality (East Herrington and Roker, North East England) were found to have achieved a totally different recycling rate, even though both areas practised the same recycling schemes (weekly collection). The one having low interaction with their households (Roker) yielded a lower HRB rate. On the other hand, the households from East Herrington were very much aware of all the recycling initiatives done by their municipality, due to effective marketing communication and closer engagement, which resulted in a higher HRB rate (Bhate, 2005).

Inefficiency in a recycling system typically occurs due to lack of understanding about the pivotal point of recapturing unwanted waste from the reverse logistics perspective (where the householders have become the 'the point of origin' (Roger & Tibben-Lembke, 2001). Therefore, the recycling system should be addressing public needs, rather than imposing a system that is doomed to failure (Barr et al., 2013; Shrum et al., 1995). The inability of a government to comprehend the real issues affecting public HRWS from the bottom-up made it critical to conduct holistic measures for sustainable waste management, in order to have parity with EU key players in waste management (CIWM, 2013).

The utilization of effective marketing communication (as suggested by Shrum et al., 1994) and education which stresses environmental awareness generates a positive impact on HRB rate (marketing elements were found to be important in improving sustainable behaviour, such as recycling in Tucker & Speirs, 2003; Barr, 2003; Tonglet et al., 2004; Bhate, 2005; Birtwistle & Moore, 2007; Bekin et al., 2007). In this expanded role, marketing becomes the key player in building the critical relationships needed to effectively implement RL, thereby promoting sustainability (Bai & Sarkis, 2013). Indeed, effective marketing (Shrum et al., 1994) could be the missing link encapsulating the existence of *symbiosis effect* between households and HRWSs. The role of marketing is not just to promote sustainable consumption, but also to address sustainable ways of disposing of waste and increasing recycling activities among households (Abbott et al., 2011; Keramitsoglou & Tsagarakis, 2013; Wright et al., 2011).

Therefore the usage of applicable marketing communication tools (advertising, public engagement, labelling, etc. (Kalamas et al., 2014) in conveying the right way to dispose of waste and motivating households to become more engaged in recycling activities is considered critical in HRWS (Buelow et al., 2010).

v. Incentive or Disincentive

As explained earlier, incentives are one of the drivers that create an effective RL, and further investigation in HRWS has proven that incentives also have a positive influence on HRB (Keramitsoglou & Tsagarakis, 2013; OECD, 2008). DEFRA (2008) has allowed pilot municipalities to use incentives as a tool to promote HRB. The act of rewarding good HRB (points collection, vouchers, etc.) allows positive reinforcement to be generated; on the other hand, negative reinforcement (bins not collected, compounding, etc.) can change it to unhealthy HRB (Hantula & Wells, 2014). Abbot et al. (2011) mentioned that incentives are not only restricted to monetary rewards, but facilities or services provided by municipalities can also be used to incentive or promote HRB. In the UK, where property (municipality) tax normally includes recycling services, the idea of imposing monetary incentives for HRB has been under discussion (DEFRA, 2008; Guardian, 2007).

Harder and Woodard further examined monetary instruments using a trial voucher system to promote HRB in six chosen districts in the UK, and the results clearly showed HRB as being positively higher when incentives are injected as a positive reinforcement (2007). Hence, this study suggested further assessment on different types of incentives, and involvement from retailers in incentive contributions, together with incentive promotion campaigns (Harder & Woodard, 2007). Another form of positive reinforcement is to increase HRB by applying policy instruments which are found to be an effective tool in improving HRB, such as a mandatory recycling policy imposed in some European countries (Norway, Denmark and Germany). These countries use positive reinforcement (economic incentives), as well as negative reinforcement (punishment for non-compliance) to improve their national recycling initiatives (Dahlén & Lagerkvist, 2010; Kipperberg, 2007).

It is clear that situational factors have a major implication on households recycling behaviour, from logistical to marketing aspects of HRWS within the realm of RL (Foxall & Yani-de-Soriano, 2005; Schultz et al., 1995).

2.9.1 Household Recycling Behaviour (HRB)

In HRWS, household behaviour is influenced by situational and personal factors. The projection (elicitation/manifestation) of the recycling behaviour is derived mainly within members of the household's personal state of mind (do Paço et al., 2013; Thøgersen, 2006).

There are many factors that contribute to HRB. Among them are:

- a. Reverse logistics (types of disposals, accessibility, method of disposals, level of difficulty, level of separation or sorting) (Cherret et al., 2010);
- b. Marketing (awareness, information, advertising, household engagement) (Biswas et al., 2000; Shrum et al., 1994);
- c. Social Norms/Values (perceived pressure, such as neighbouring householders are avid recyclers, community intervention, local interest groups, public pressure) (Biel & Thøgersen, 20);
- d. Individual [Demographic Background (age, education, income, location), Knowledge (product, package, environmental impact, product life cycle, recycling method) and Self Efficacy] (Swami et al., 2011; Shrum et al., 1994);
- e. Policy Instruments (directives and economic incentives or benefits) (Stewart, 2011).

In conclusion, the situational factors are related to reverse logistics system, and the facilitation of the situational factors impact on household recycling behaviour (HRB). On the contrary, social norms and individuals are designated as *personal factors* (in the following the general term 'personal factors' will be used) and are considered as another influencing factor affecting HRB. This study uses personal factors as a representation of HRB.

2.9.2 Personal Factors

The most complex factors affecting HRB are the personal factors, which are divided into two aspects (attitudinal and personal capabilities).

Attitudinal factors, which are derived from the *Theory of Planned Behaviour* (TPB) (Ajzen, 1991) and *Norm Theory* (Stern et al., 1999) are referred to as perceptions, predisposition, belief, norms, religion and culture. TPB is an extension of the *Theory of Reasoned Action* (TRA), developed by Ajzen and Fishbein in 1980. This theory suggests that people generally behave reasonably and they are indeed aware of the consequence of their actions. Alternatively, personal capabilities such as knowledge, social status and experiences that define individuals' socio-economic backgrounds (Stern et al., 1999; Ajzen, 1991) have also been suggested to have an effect on change of behaviour.

Twenty years ago, recycling research predominantly focused on the behavioural change within HRWS (as reviewed by Shrum et al, 1994) rather than focusing on multiple factors in understanding HRB (Werder & Depoe, 2006). To add the complexity of HRB, one needs to distinguish between environmental behaviour and non-environmental behaviour in HRB projection (Martin & Bateman, 2014; Kalamas et al., 2014). For example, Stern mentioned that environmental inclined behaviour extended beyond recycling behaviour (2000) which encompasses compassion on public well-being, conservationism and perceptively being good to nature and one's surroundings (Thorgesen, 2006). However, there is, sporadically, inconsistency within the empirical studies, with implied significant differences between pro-environmental and non-environmental behaviours (De Nisco & Warnaby, 2014; Bhate, 2005).

Some studies have suggested that pro-environmental behaviour has the tendency to project pro-HRB in comparison with non-environmental behaviour. For example, in Thorgesen, recyclers with higher pro-environmental behaviour are positively involved in recycling activities at home compared to those with limited environmental behaviour (1994). By contrast, Bhate's study found pro-environmental behaviour to be insignificant with regards to pro-HRB (2005), due to limited engagement from the municipality. Furthermore, a number of studies have suggested that pro and non-environmental behaviour derives from many aspects in personal and situational interaction (Vicente & Reis, 2008; Bhate, 2005).

For example, Vicente and Reis found that many factors interacted, especially from a personal and situational standpoint, to change HRB (2008), and Bhate implied the same, which suggests that interaction is the key to understanding recycling behaviour in the residential setting (2005).

In Brixworth, which is located in the Daventry district of Northamptonshire, attitudinal factors such as attitudes towards recycling (the act of improving the environmental impact from waste generation) have been revealed as significant factors in HRB (Tonglet et al., 2004). Whenever HRWS situational factors are aligned with Stern's proposition in an environmental attitude assembly, it has to interact with certain stimulus (situational factor) conducive to stimulate HRB to manifest itself (2000). For example, when there was direct involvement from municipalities (the municipality went to a local community group to actively discuss better recycling waste management), and dynamic public engagement in recycling initiatives, a higher participation rate was observed (Bhate, 2005). Besides attitudinal factors, household perceptions (predisposition or pre-conceived condition) (Ajzen, 2014; Ajzen, 1991) on situational factors such as recycling schemes (bin type, scheduling, easy to understand flyers) and convenience also influence HRB (Tucker & Speirs, 2003; Tonglet et al., 2004; Barr et al., 2013).

In addition, many findings have suggested that households' predisposition to environmental actions (such as the tendency to acknowledge that their waste generation has implications on the environment) indicates a strong intention to participate in recycling (Saphores et al., 2012; Bezzina & Dimech, 2011; Timlett & Williams, 2008; Thorgesen, 1994). Furthermore, TRA and TPB suggest that when household behaviour changes (attitudinal and personal capabilities) (East, 1993), the attitude change broadcasts a meaningful behavioural justification (by separating and sorting their waste for recycling purposes). This suggests that the reasoning behind individuals' decisions causes either positive or negative actions. For example, as soon as the environmental behaviour (households decide to start recycle) is manifested in a household, driven by certain factors (accessibility), the result will in fact boost HRB (Thorgesen, 1994).

Both of Ajzen's theories have explanation with regards to HRB, and support Guagnano et al.'s (1995) hypothesis "*that individuals construct attitudes towards emerging objects by referencing values and beliefs about the consequences of behaviour for their values*". In other words, households behave accordingly, as intended by their predisposition or beliefs when they perceive the benefits of doing so. Another aspect of personal factors identified by Stern (2000) is personal capabilities, referred to as 'task knowledge' in the TPB. These theories suggest that households have the ability to follow the basic and simple chores (Thøgersen, 1994) of recycling (sort and separate), and that they should at least understand basic materials (Barr et al., 2003; Tonglet et al., 2004) that can be recycled (paper, glass, plastics or aluminium).

To encapsulate personal capabilities comprehensively, Stern included education, past experience, and financial and social status of households (2000). These additional personal capability factors are essentially households' demographic background. In meta-analyses (research output from 1990-2010) on HRB, Miafodzyeva and Brandt (2013) found that determinants of demographic background, such as age, income and education had significant impact in some studies, but were quite insignificant in others. This was similar to other demographic elements, such as type of locality, socio-economic background and property types (Table 2.2).

The meta-analyses by Miafodzyeva and Brandt (2013) and Grazhdani (2016) encapsulates the inconsistency of various socio-demographic elements in predicting HRB, suggesting that there are many factors that should be considered when predicting change of population behaviour towards recycling and reduction of waste generation. These include facilitation of the right policy, improving social factors (engagement and awareness) and managing effectively the economic factors (which include the right resources for implementing HRWS). The key demographic characteristics in recycling waste management may be considered irrelevant if situational and behavioural factors are investigated separately, rather than from a symbiosis perspective.

	Demographic Element	Significant	Not Significant
1	Age and income	(Woodard et al., 2004) Not conclusive in some behavioural studies on recycling (Werder & Depoe, 2006; Shrum et al., 1994)	(Bhate, 2005; Miafodzyeva & Brandt, 2013)
2	Education	Not conclusive in most HRB studies (Autry et al., 2008; Guide Jr et al., 2003;).	
3	Locality *	(Steiner et al., 2014; Finnveden et al., 2013; Kinzig et al., 2013; Sen, 2013; Strange & Bayley, 2008; OECD2014; Grimmer & Bingham, 2013)	This factor is found either directly or indirectly effecting HRB level.
4	Socio-economic Background**	(Godemann et al., 2014; do Paço et al., 2013; Alvéen & Huhtilainen, 2013; Breen, 2006; Zhu et al., 2013)	This factor is found either directly or indirectly affecting HRB level.
5	Nationalities/ Ethnic Background	(Bhate, 2005; Shrum et al., 1995; CIWM, 2013)	This factor defined households' predisposition to recycling.

Note : * Locality includes type of property and type of residential area

** Socio-economic background includes deprived or non-deprived areas

Table 2.2: Demographic Element influences on HRB level based on systematic review.

Householders are the pivotal point of source separation in improving recycle volumes in HRWM. Thus, from a behavioural perspective, there is a requirement for behavioural change in improving the environment, which is sustainable HRB (Stern, 2000). HRB can only change under the influence of dual factors symbiotically: personal and situational factors. It is suggested that personal factors are driven by precursive elements (Culiberg, 2014) which derive from the emergence of situational factors (Tucker & Speirs, 2003). Thus, to say that a person recycles due to his/her own personal factors cannot be entirely supported, since some behavioural theories suggest that personal factors have to interact with other factors in order for HRB to become manifest/apparent (Ajzen, 2014; Swami et al., 2011; Schultz et al., 1995).

The situational and personal factors described in previous sections derive from fragmented and isolated discussion in relevant literature. Situational factors are discussed according to operational elements (improving kerbside sort-separate; better bins; improving scheduling) (Harder et al., 2008; Harder & Woodard, 2007) and technological aspects (improving routing systems; lifecycle assessment; better waste collection vehicles) (Cherret et al., 2010), which are related to the design of recycling systems, although the understanding of behavioural roles in recycling systems has been unclear. Similarly, personal factors have been discussed explicitly in relevant literature (cross-disciplined fields) with abandonment of the interaction between situational and personal factors.

Therefore, holistic investigations of the situational and personal factors, which acknowledge the interaction and explore the interdependencies between these two factors, are quite nebulous to date. The behavioural role plays a significant part in household recycling waste systems, and householders are concomitant with municipalities in determining the effectiveness or sustainability of the RL movement in HRWS. The behavioural literature has ascertained that HRB can be affected by both personal and situational factors (Biel & Thøgersen, 2007; Stern, 2000; Stern et al., 1999; Guagnano et al., 1995). Consequently, a coherent explanation of the interaction suggests that a symbiosis effect needs to exist between the two factors (situational and personal).

2.10 Research Gap

To date there are few studies that approach situational and personal factors in interaction empirically. The work which focuses on HRWS (Williams & Cole, 2013; Wagner, 2013; Mao et al., 2013; Dahlén & Lagerkvist, 2010; Harder et al., 2008; Isely & Lowen, 2007; Harder & Woodard, 2007; Woodard et al., 2006; Woodard et al., 2005; Bench et al., 2005; Woodard et al., 2004; Woodard et al., 2001; Jahre, 1995) attempts to determine an effective design of recycling systems (situational factors), notwithstanding the effects of personal factors in the progression of HRB.

According to the norm-activation theory (Park & Ha, 2014; Biel & Thøgersen, 2007), such interaction, if mutually beneficial, as this study proposes, may be viewed as *symbiosis effect*, whereas Ehrenreich (2002) refers to it as a symbiotic relationship in an organizational setting. This mutual benefit arises when the householders are aware of and acknowledge the expectations of the municipality, whereby they are required to recycle as much as they can to help the reverse logistics flow effectively, assuming the municipality has provided an accessible and convenient HRWS. Even though some householders are willing to be at the forefront of the HRWS, the number is limited. For example, in some cases, householders had recycled before the system was even introduced, by going to drop-in or collection centres set by NGOs (Kipperberg, 2007).

In contrast to the norm-activation theory (Biel & Thøgersen, 2007), empirical studies focused on HRB (Keramitsoglou & Tsagarakis, 2013; Saphores et al., 2012; Bezzina & Dimech, 2011; Brekke et al., 2010; Jesson, 2009; Timlett & Williams, 2008; Shaw & Maynard, 2008) concentrated solely on behavioural attributes (personal factors) in HRB progression, limiting discussions on situational factors, since they have similar influences to personal factors. For example, discussions by Keramitsoglou and Tsagarakis (2013) and other authors implied that householders needed cues from the municipality to stimulate their need to recycle (Saphores et al., 2012; Bezzina & Dimech, 2011; Brekke et al., 2010; Jesson, 2009; Timlett & Williams, 2008; Shaw & Maynard, 2008). These cues were explained as an object (recycling provision, marketing communication, awareness, etc.) that motivate HRB projection (Keramitsoglou & Tsagarakis, 2013; Werder & Depoe, 2006; Stern, 2000).

In reality, perception (a personal factor) of recycling systems depends on the provision of HRWS (a situational factor) (Latif et al., 2013), just as HRWS depends on HRB (Schultz et al., 1995). It is suggested that personal and situational factors interact with one another, and this interaction is considered a causal relation whereby one influences the other (Stern et al., 1999).

In fact, situational factors (HRWS) may interact with personal factors (attitudinal and personal capabilities) and subsequently influence HRB (Lacetera & Zirulia, 2012; Brekke et al., 2010; Halvorsen, 2008; Biel & Thøgersen, 2007; Tucker et al., 2000).

So far, the closest empirical study to scrutinize these two factors holistically was conducted by Bhate (2005), who found that municipalities with higher interaction (marketing and recycling engagement meetings) went side by side with households that had achieved higher HRB, regardless of whether the households possessed high or low *environmental* behaviour. In a similar study, environmental behaviour was referred to as the individual's attention and action towards environmental impact on the locality or residential setting (Barr et al., 2003). Hence, when pre-supposed interactions with the municipality are limited, HRB tends to diminish, even though some households personified a high *environmental* behaviour. Bhate's (2005) study signified that the interactions between householders and municipalities required a new perspective in the research setting, to further examine which factors contribute to a higher level of HRB and influence a consumer-driven recycling system.

The limitation of Bhate's work and other similar studies was that the adaptation or abstraction of conceptual models and frameworks were restricted to one particular model. For example, Bhate used a *Behavioural Perspective Model* (Foxall, 1999a) to examine the relative roles played by consumer behavioural settings, particularly in investigating the engagement of a municipality with two different residential settings. When a study adapts to a singular model, this study is restricted to the boundary of the model, and therefore it is challenging to substantiate new findings or phenomena loosely based on that particular model (Wallis, 2014; Sniehotta, 2009).

In HRWM, end-users also play a contributing role in supplying the recyclates in the backward stream (Roger & Tibben-Lembke, 2001; Fleischmann et al., 1997). Indeed, reverse logistics is "a reactive processwhich is usually initiated by the end users..." (Roger & Tibben-Lembke, 2002).

Hence, it is crucial for municipalities and RL operators to acknowledge the need for participation from consumers in assuring the quality and the quantity of returnables and recyclates (Brito et al., 2004; Dowlatshahi, 2000).

Jahre (1995) tried to come up with a better understanding of the role of RL by examining the marketing integration in household recycling. The work of this author can be considered as pioneering in allowing RL theory to cross over into household recycling waste systems. However, more empirical evidence is needed to support the role of RL, together with marketing function, to manoeuvre the course of recyclates from HRWS. Murphy and Poist (2003) also suggested that the interaction between consumers and RL (the personal and situational factors) has a positive impact on the environment.

The lack of an appropriate model to examine both situational and personal factors holistically has encouraged new research to develop a more cohesive model by abduction of theories (Stock, 1997) and theoretical frameworks (Park & Ha, 2014) that may lead to an insightful investigation, as well as robustness in the chosen research approaches (Carter & Ellram, 1998; Mangan et al., 2004). The next section is a discussion of the differences between industrial symbiosis and symbiosis effect conceptualization.

2.10.1 Industrial Symbiosis versus the ‘Symbiosis Effect’

In the previous section, a discussion on strategic alliances was assumed to be similar in explaining ‘integration’ (Garechana et al., 2014) between key actors within a system or process (here focusing on reverse logistics system i.e. HRWS). The notion of integration is a familiar concept within the industrial ecology domain (Lifset & Graedel, 2002; Garner & Keoleian, 1995). Industrial ecology promotes integration or strategic alliances between co-actors, addressing the reduction of human impact on the environment by the adoption of lessons from nature. These include life cycle approaches, design for the environment, dematerialisation and studies of material or energy flows. One approach to industrial ecology is ‘industrial symbiosis’, which promotes optimization of resource use (reducing the consumption of raw materials and production of waste), energy and capital (human and monetary).

This optimization of resources (Jacobsen, 2006) is consolidated from the waste of all co-actors (industries, public agencies and householders, sometimes in one geographical setting) for recovery options (recyclates and energy). Then, the recyclates and energy is recycled and recovered back to the co-actors as input to others for the mutual benefit of all (Deutz, 2014; Chertow, 2000).

Although there are clearly overlaps between RL and industrial ecology, the focus here is on the symbiosis concept as applied to municipalities and their residents. Referring to the Oxford Dictionary (2013), *symbiosis* is an interaction between two different entities in close physical association, typically to the advantage of both. The key element from this definition of symbiosis is the element of interaction between two different entities. In the context of this study the symbiosis partners are not two companies, with or without a mediator, but a public sector body and the multiple households, to whom it has a service obligation. The desired outcome, restoration of materials to productive use, is the same. However, the symbiosis concept has not been previously extended to the household level. It is the contention of this study to highlight that the relation between the municipalities with the households is similar to symbiosis partners in industrial symbiosis (as defined by Jacobsen, 2006). The municipalities depend on the households as much as the households depend on the municipalities. This mutual interdependency is considered a 'symbiotic' relation between the two key actors in HRWS.

This affords an opportunity to focus on the pivotal relationship, in a way that is often overlooked by industrial symbiosis literature. Although there are exceptions (Hewes & Lyons, 2008), industrial symbiosis tends to be more interested in the materials than the people, or the broader context in which the partners are operating (Zhu & Ruth, 2014). This study is not examining the relationship between local authorities and materials reprocessing companies, or the relationship between reprocessors and manufacturers, both of which are important (for future studies) to actually achieving a return of recyclates to production (Fig. 2.7). However, the first step (collection of those materials from householders) is a fundamental pre-condition to the operation of the later steps.

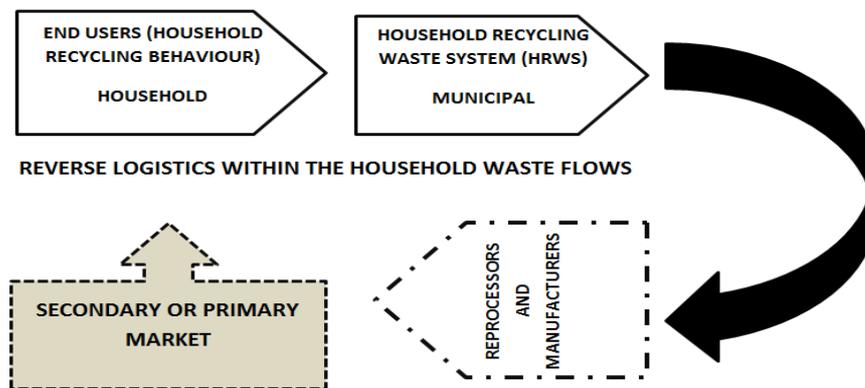


FIGURE 2.7: Illustration of HRWM by the Author based on RL

Hence, effective deployment of RL within HRWM is essential to achieve effective resource recovery. Studying this involves closely examining the functions of the two key players (householders and municipalities) (Jahre, 1995). The role of householders is considered the major driver in the recovery option (Fig. 2.7), although some authors overlook its importance within the RL framework. For example, De Brito and Dekker (2004) focused more on the returnable items rather than the source separation. Householders can be motivated by many forms of incentive, which can both be monetary and non-monetary, in order to increase the volume in recovery options (Abbott et al., 2011; Brito et al., 2004).

The first step of recovering recyclates from householders is a fundamental pre-condition to the operation of return of used materials to production, whereby the RL framework (Fig. 2.7) in HRWM could be effective, if the municipalities understand the type of incentive to apply. At the same time, the householders are fully aware of the incentive, so acknowledge and perform their role in increasing the recovery option, taking appropriate action to ensure that the right recovery option has been implemented.

In coexistence, the householders and municipalities are benefiting the roles and functions of each other in HRWM. Many behavioural and operational studies tend to overlook the mutual benefit between these key actors (Botetzagias et al., 2015). However, it is right to state that householders contribute to the replenishment of recyclates, and that

municipality's benefit from recycle sales. The benefit that the householders gain is greater awareness of the potential reduction in landfill use, and the opportunity of recovering some of their final waste for renewable energy, which is of mutual benefit (Lai et al., 2009).

2.11 Relevant framework and models

The relevant frameworks and models that juxtapose the symbiosis effect perspective to grasp a holistic view between situational and personal factors is described in this section.

2.11.1 Reverse Logistic Framework (Fig. 2.8)

Carter and Ellram's (1998) framework is an abstraction of the literature reviews and proposition for future research that focuses on backward movement. The key points derived from the reviews are: (1) the RL study suggested is interdisciplinary in nature; (2) the key actors or drivers have been determined for the investigation; (3) the framework is for use as guidance in developing conceptual or theoretical frameworks for future research (Fig. 2.8).

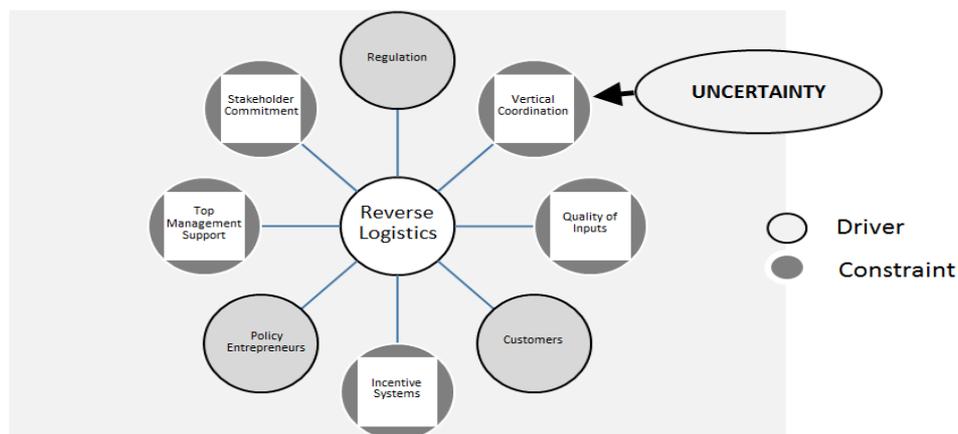


FIGURE 2.8: The Drivers and Constraints of Reverse Logistics adopted from Carter & Ellram (1998)

The framework suggests that the constraints could be drivers, if the policy entrepreneur (waste/recycling managers or logistics managers) understands the drivers' roles within the backward movement, and that these drivers or antecedents are not in a linear relationship with reverse logistics. However, in a network formation (Ebers & Maurer, 2014; Hoppe et

al., 2014), each driver can or may interact with one another to influence the backward movement (Cherrett et al., 2010; Huscroft, 2010).

For example, a policy entrepreneur will face financial constraints in coming up with monetary incentives to promote recycling. However, he or she could partner with local establishments (stakeholder commitments) to distribute vouchers for achievement in recycling performance to the localities (Harder & Woodard, 2007). Thus, a close relationship between drivers would create mutual dependency (Christopher, 2011) that has the possibility to improve the overall progress in backward movement. This framework is essential to interpret the holistic picture of reverse logistics, applying multiple fields of understanding in waste recycling management, in which behavioural and operative dispositions are constituted.

Moreover, Carter and Ellram's (1998) framework has established the 'pavement' for conceptual development. However, it is necessary for this study to apply other theories or models, as it has to be robust to be applicable and useful for future research. Next, the theory that has been considered in understanding behavioural aspects of HRWS is the Theory of Planned Behaviour (TPB after Ajzen, 1991).

2.11.2 Theory of Planned Behaviour (Fig. 2.9)

In a recent article, Ajzen (2014) defended the reasons why TPB is still useful and applicable in approaching a behavioural study, as opposed to Sniehotta (2009), who stated that the current theory was limited in supporting the reasoning for behavioural change. However, Ajzen made a clear proposition that, while a theory has to be robust, it can also be flexible to allow additional constructs or extensions, in order for new theories or frameworks to evolve.

This is in parallel with previous theories that surpassed decades of evolution in their own empirical works, such as motivational theory from a simple Hierarchy of Needs by Maslow (Maslow & Herzberg, 1954), which contributed to many advanced motivational theories (Armstrong & Taylor, 2014). The theory of 4Ps (product, price, promotion and place) by

Kotler was the basis of marketing principles (Zineldin & Philipson, 2007), and contributed to many focal dimensions in marketing research (Kotler, 2011;). Porter’s value chain concept (2008) was a catalyst for the importance of logistics and supply chain management (Holweg & Helo, 2014) in strategic management fields, as well as giving relevancy to theory evolution in fragmented business settings (van Weele & van Raaij, 2014). These theories or concepts are still relevant to date, and, while simplistic in nature, have been accessible to enable the evolution of many innovative theoretical or conceptual positions, as well as being useful for future research.

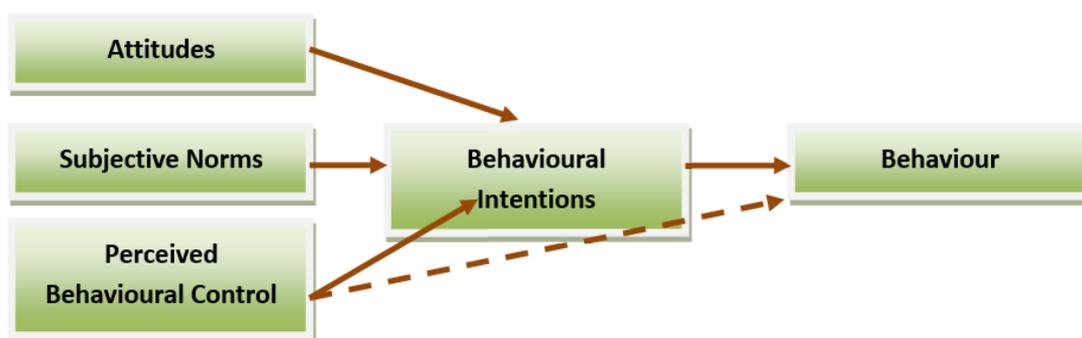


FIGURE 2.9: Theory of Planned Behaviour (Ajzen, 2014; Ajzen, 1991)

This study has applied Ajzen’s TPB to strengthen its interdisciplinary approach, and the conceptual framework is considered robust with the behavioural aspects (personal factors). Nevertheless, in this context, Ajzen’s work does not fully explain the behavioural activation processes (why has behaviour changed?). Thus, it was essential to include another theory in order to explain behavioural change, using a norm-activation model (Biel & Thøgersen, 2007).

2.11.3 Norm-Activation model (Fig. 2.10)

Norm-activation model is based on the social dilemma (Dawes, 1980) such as environmental problems, high crime rates, teenage pregnancy etc. For example, environmental problems are regarded as a social dilemma whereby individuals have a tendency to react or to deviate from the normalization process (Biel & Thørgesen 2007). The model explicitly outlines how

an individual's norms are manipulated by situational and personal factors, which is partially discussed in other behavioural studies. The model is applicable for the conceptual framework of this study, as it explains the importance of the two factors (situational and personal) affecting behavioural change.

In this model, the situational factor is divided into five aspects (communication, benefit and cost, framing, behaviour of others and salience of needs) that affect normalization of individual behaviour in a social dilemma (Thøgersen, 2008). These five aspects juxtapose an individual to commit and/or look for social justice and reciprocity, as well as justifying the environmental responsibility. The personal factor in this model addresses the internalized values of an individual. The two factors (situational and personal) coincide, as salience of need and actions (situational) and internalized values (personal) interact to justify individual environmental responsibility.

The interaction between situational and personal factors only focuses on salience of need and actions, but, unfortunately, not on the individual setting (residential area and living arrangement (Wiidegren, 1998), and it is unclear how the internalized values of an individual could go further (attitudinal, knowledge, experience and beliefs (Grønhøj & Thøgersen, 2012)). The next section is a discussion on how Foxhall's (1999a) behavioural perspective model is suited to explain the individual setting, which corresponds to situational factors that influence individual behavioural change, and explains the personal factors that address individual learning history (experiences).

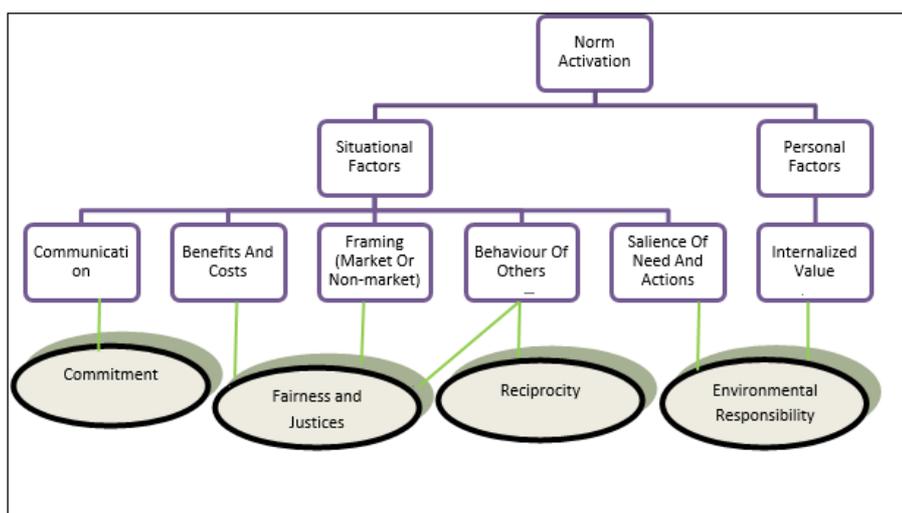


FIGURE 2.10: Norm-Activation Model (Biel & Thøgersen, 2007)

2.12.4 Behavioural Perspective Model (Fig. 2.11)

The contextual setting (situational factor) of an individual has equal or greater reinforcement in predicting decision-making choices than influence from individual personal factors (Foxall & Greenley, 2000; Foxall, 1992). The underpinning of the multiple reinforcements in Foxall's (1999a) contextual setting propose the Behavioural Perspective Model for consumer research, which overlooks the situational determination of consumer consumption patterns. This model addresses the situational setting (residential area, supermarket, cinema, hospitals, public areas, etc.) that has most impact on individual choices of consumption and actions. The two main situational aspects are the current individual behavioural setting and the individual's learning history. Thus, the interaction of these two factors determines the behavioural change, based on certain reinforcements (monetary or non-monetary instruments, policy and procedures) and stimuli (marketing communication (Foxall & Yani-de-Soriano, 2005).

The relevance of the model in the conceptual framework of this research is to address situational factors as the main trigger for behavioural change, and which have to interact with the individual's learning history (personal factors), whereby the reinforcements and stimuli are mechanisms for the predicted behaviour to conform.

However, the model does not clearly state the position of personal factors in explaining behavioural change, which in this study embraces two major factors (situational and personal) (Barr et al., 2013).

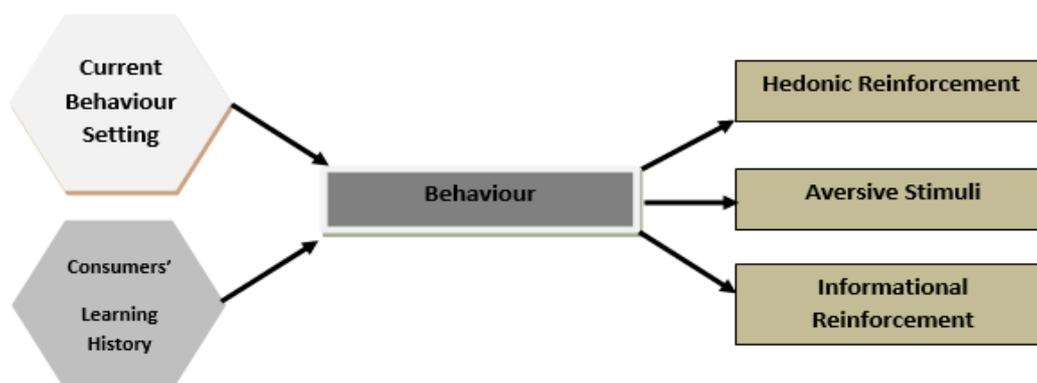


FIGURE 2.11: Behavioural Perspective Model (Foxall, 1999a)

It is clear that multiple theories are needed to comprehend a fragmented area such as reverse logistics and household recycling behaviour. And an interdisciplinary approach is accessible to combine multiple theories from different bodies of knowledge (Wallis, 2014) in a single study in order to answer the research questions. The multiple theories and models contribute to the development of one holistic conceptual framework. Furthermore, the application of multiple theories and models is relatively uncommon and is fragmented across empirical studies and literatures (Sahamie et al., 2013; Zacharia et al., 2014; Jiménez-Parra et al., 2014; van der Linden, 2014).

In addition, there is no clear framework to understand the symbiosis effect between RL and consumers, or in this case, between householders (HRB) and municipalities. There are many RL theories and models that focus on improving efficiency and effectiveness via technological innovation, operational improvement and TQM (Rubio et al., 2008; Dowlatshahi, 2000; Rogers et al., 1999), as well as empirical studies on recycling behaviour (Culiberg, 2014; Park & Ha, 2014; Thomas et al., 2013; Hadjimanolis, 2013).

Hence, this study tries to encapsulate relevant models and theories, and to develop a more concise and robust framework. In conjunction with Rungtusanatham et al. (2011), Carter and Easton (2011) suggested that more theories and theoretical frameworks are needed to understand the various assumptions in the logistics field, and, particular to this study, the interactions between situational and behavioural factors.

2.12 The Development of Research Objectives and Questions

To understand the symbiosis effect between HRB and municipalities, households' attitudes and perceptions on different recycling systems (situational factors) need to be examined. In terms of the recycling waste system, we need to determine how the different factors (accessibility and availability, incentives, or marketing) may affect personal factors and, subsequently, HRB. Lastly, there is a need to explain the level of interaction between marketing, education (the efforts of municipalities to promote recycling initiatives among households) and HRB.

The concept of interaction may justify the mutual interdependencies between householders and municipalities which suggest a symbiotic relationship (Fennell & Weaver, 2005; Ehrenreich, 2002). This interdependency leads to a 'cause and effect' scenario, where the municipalities have to provide efficient and effective ways of recycling, and in return, the householders have to exhibit better recycling behaviour. The degree of effectiveness of a recycling system may be affected by the degree of householder engagement in recycling activities. The interaction or *symbiosis effect* between HRWS and households may be the key to achieve a clearer understanding of the 'cause and effect' scenario.

Woodard et al. (2001; 2004) mentioned face-to-face engagement with households, explaining the new or improved HRWS (co-mingled for certain dry recyclates). In this study, awareness had been given prior to the studies undertaken (stimulus). Consequently, the expected HRB, or increase in recycling participation was realized. This shows that Woodard et al.'s (2004) fieldwork was based around the new schemes and aimed to examine the households' acceptance of these schemes.

The initial HRB increment was due to the close engagement between the householders and municipalities with regards to the new schemes, as well as providing a clear instruction manual for recycling activities. Besides engagement having an impact on HRB, convenience (how to separate/sort the waste easily, which in this case refers to a situational factor) is also found to influence householders' decisions, and significantly impacts their HRB (Keramitsoglou & Tsagarakis, 2013).

Both situational factors (engagement and convenience) are considered as precursive factors to manifest effective HRB (Keramitsoglou & Tsagarakis, 2013; Wagner, 2013). Thus, many previous studies have identified situational factors as the main determinants of HRB; nonetheless, it is unclear exactly how they affect HRB. More research is required to investigate these 'effects'. Stern (2000) and Biel and Thorgesen (2007) have explained that personal and situational factors interact to affect behavioural change, for example sustainable HRB.

The facilitation before and after HRWM that influences recycling performance has shown behavioural changes in HRB, but the exact reasoning behind the facilitation is unclear (Keramitsoglou & Tsagarakis, 2013; Saphores et al., 2012; Bezzina & Dimech, 2011; Brekke et al., 2010; Jesson, 2009); it has been suggested that the changes, due to both personal and situational factors, came to effect through cohesion (Barr, 2013). The cohesion of both factors imply the symbiosis effect (represented as an interaction between them) is crucial not to ignore, which may affect HRB (Timlett & Williams, 2008; Shaw & Maynard, 2008; Tudor et al., 2007; Woollam et al., 2006; Davis et al., 2006; Ferrara Missios, 2005; Lyas et al., 2005).

The theory of symbiosis effect was not conceptualized in previous research, and only Ehrenreich (2002) conceptualized the assumption of the interdependencies of concomitant behaviour in a setting that refers to symbiotic relation between organizational members.

However, a similar study does not address the interaction between organizational members, but moves more towards exploring the organizational members behaving

symbiotically. The theories from Ajzen, Stern, Thorgesen, Foxall (TPB, Environmental Behaviour, Norm-activation model and BPM) have been exhaustively used in literature to understand HRB or environmental behaviour in the municipal setting.

The theories mentioned and discussed are important in expanding the interaction factor (symbiosis effect) which pushes the boundary of mono-factor or multiple determinants that determine behavioural change, suggesting that it is the interaction between multiple determinants that changes behaviour, not vice versa. Previous studies used one of the above mentioned theories (Davis et al., 2006; Bhate, 2005; Barr et al., 2013; Tonglet et al., 2004; Thogersen, 1994), and explained behavioural aspect with situational aspect as an antecedent where the empirical findings were varied and in isolation. It needs to acknowledge all recycling determinants and investigate the notion of *symbiosis effect* between consumers and RL which has to exist to achieve total sustainability.

In addition, many studies have confirmed that recycling rates depend as much on HRWS provided by municipalities as on HRB (Wagner, 2013; Barr et al., 2013). Thus, UK municipalities have been trying to promote recycling in their area by making it easier via kerbside schemes, incentives, multiple bins and local awareness programmes (Barr et al., 2013; Abbott et al., 2011, 2013). Failing to influence the householders (HRB) somehow lured the municipalities into making ineffective decisions, so that they ended up choosing ineffective HRWS, ultimately jeopardizing their recycling performance (Keramitsoglou & Tsagarakis, 2013).

The key to gaining a sustainable flow of household recycling is to have control/ influence on HRB from the point of consumption until the point of disposal, hence creating a 'closed recycling loop' in order for recyclates to go back to forward flow again. Stern (2000) and Carter and Ellram (1998) therefore suggested interdisciplinary research to unravel the interaction effect.

To address the above gap, this study aims to find out whether such symbiosis between recycling systems and household recycling does exist. To answer this question, there is a need to cross-examine the interaction between situational factors and personal factors. This study proposes that the existence of symbiosis effect influences the transformation of sustainable recycling behaviour of households in HRWSs. Based on the above rationale, this study aims to explore and explain the suggested symbiosis effect between HRWS and HRB.

2.13 Summary

In conclusion, discussion has been offered on the applicability of interdisciplinary approach in understanding multifaceted fields with two major themes: household recycling behaviour (personal) and household recycling waste systems (situational). It is clear that both situational and personal factors have a major impact on residential recycling performance. The limited research investigation on their interaction has eluded the reality of household recycling behaviour. Applying multiple insights from many disciplines has influenced the current research approach to use mixed methodology, which may shed some light on, and offer clearer understanding of the two major factors: situational and personal.

CHAPTER THREE: Research Methodology and Design

3.1 Introduction

This chapter discusses how the mixed methodology in this study is applied, and how it and the chosen paradigms could support data collection phases and analyses, and develop the theoretical framework. The chapter emphasizes the frame of the methodology and research design, and shows how the chosen design is used to answer the fundamental research questions. The research questions are quintessential to guide the flow of the chosen research frame, as it is one of the characteristics of the mixed methodology approach, and explicit explanation on the reasoning behind this choice is provided.

To realize the objectives of this study, a mixed methodology approach was applied (Ågerfalk, 2013; Golicic & Davis, 2012). The study aims to use multiple theories and theoretical frameworks to build a new conceptual model that is relevant to interdisciplinary studies (Zscheischler et al., 2014). The rationality of this study in using a multi attributes model (Fig. 3.1), as suggested by Laudan (1984) in Anderson (1986), was the need for a theoretical model (Fig. 2.0), first to understand HRB from a clearer perspective (Park & Ha, 2014), and second, to address the multiple attributes by harmonizing the 'facts' and aims, which, in turn, suggested more applicable methods to answer and realize the research questions and objectives.

The facts show that there is limited understanding of the situational and personal factors involved in interaction, and only a fragmented approach to understanding recycling behaviour. By using an uncommon approach, such as an interdisciplinary review of multiple discipline literature, it is necessary to understand the multifaceted views holistically in order to contribute to the knowledge and understanding of social dilemma (environmental issues) (Wallis, 2014).

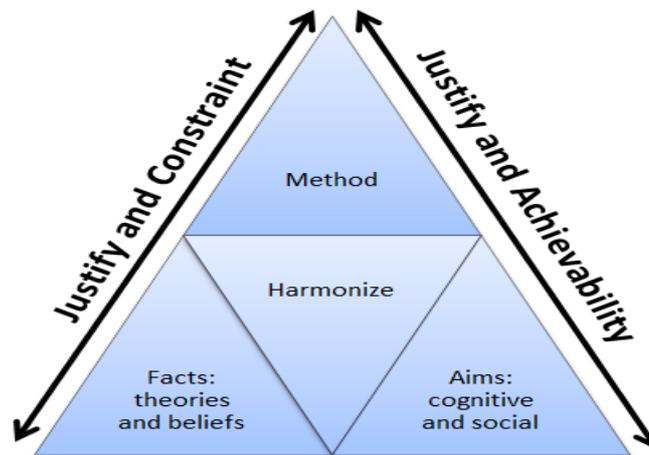


FIGURE 3.1: Adapted from Anderson (1986)

3.2 An Overview of Mixed methodology

Past literature has shown that recycling studies were approached either quantitatively or qualitatively (Rubio et al., 2008), although a limited number of similar studies have employed both approaches together (Castro et al., 2014), Barr et al. (2013) proposing an integrated approach using mixed methodology to explain household recycling behaviour. Nonetheless, the studies explicitly pinpointed the personal factors of householders' attitudes towards recycling and disregarded the possibility of interaction between personal and situational factors. Hence, Barr's study found the present situational factor to be a strong predictor in improving householders' recycling attitudes (2013). The various methodological options in social research show particular strengths and weaknesses in explaining the research assumptions (Creswell, 2008; Newman & Ridenour, 1998, Teddlie & Tashakkori, 2009; Anderson, 1986).

Therefore, to combine positivist and interpretivist world views requires an accessible approach, such as the mixed methodology popularized by Teddlie and Tashakkori (2009); Castro et al. (2014); Povee and Roberts (2014); Mertens (2014); Venkatesh et al. (2013); Ågerfalk (2013); Mertens and Hesse-Biber 2013). This study agrees with the suitability of the mixed methodology approach for addressing the research questions, as it can either be used quantitatively, if the subject matter requires an objective explanation of

the worldviews, or qualitatively, in order to understand the meaning and nuances of the worldviews (Teddlie & Tashakkori, 2009; Johnson & Onwuegbuzie, 2007; Johnson et al., 2007; Creswell, 2008).

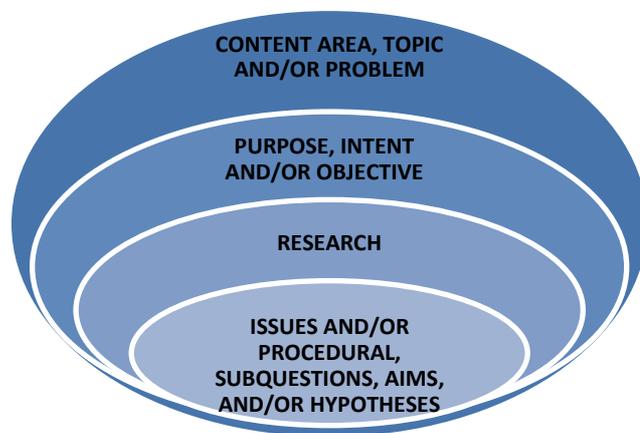


FIGURE 3.2: Research Questions as the centrality of research mixed methodology design adapted from Creswell (2008) and Newman & Ridenour (1998)

3.3 Methodology and Research Approach

This study is not defending paradigm dichotomy or even centrism (pragmatism), to embrace the 'goodness' of both worldviews in coherence with the research assumptions. The research objectives and questions are the doctrine of the overall study that addresses the interplay of two dimensions (behavioural and operational) from the body of knowledge. The development of the research objectives with relevant research questions became the centrality of this research design (Fig. 3.3), and application of mixed method was suitable due to the balance of both quantitative and qualitative paradigms or worldviews (Venkatesh et al., 2013; Ågerfalk, 2013; Mertens & Hesse-Biber, 2013; Golicic & Davis, 2012; Spens & Kovacs, 2012; Cameron & Molina-Azorin, 2011; Onwuegbuzie et al., 2010; Teddlie & Tashakkori, 2009; Creswell, 2008; Clark et al., 2008; Trochim et al., 2008; Johnson & Christensen, 2007; Johnson et al., 2007; Hanson et al., 2005).

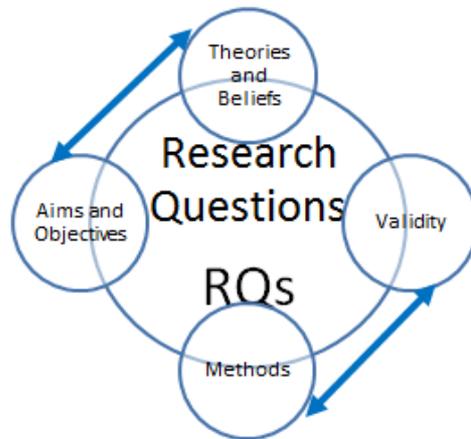


FIGURE 3.3: Research Questions as the centrality of Research Design adapted from Maxwell & Loomis (2003)

It is abundantly clear that in achieving holistic explanation of the interplay of two domains (behavioural and operational) from the body of knowledge, a mixed methodology is considered accessible in capturing the objective and subjective of the worldviews of reality. The motivation of this study is the need to explain that a *symbiosis effect* does exist (Fig. 3.5) between the provider (municipalities) from the operational domain of the body of knowledge and the end-users (households) from the behavioural domain of the body of knowledge, in order to attain sustainability within the scope of household recycling waste management.

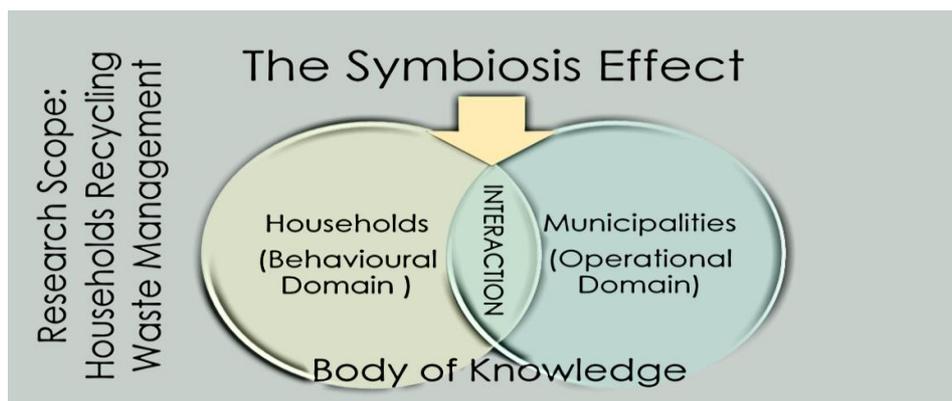


FIGURE 3.5: The understanding of the symbiosis effect existence from two focal domains from respective body of knowledge within the scope of households recycling waste management.

Mixed methodology is appropriate in applying both statistical data and subjective interpretations, using qualitative (interviews, focus group, observational, ethnography) and quantitative methods of inquiry (survey, lab-experiment, simulation). Juxtaposing both subjectivity and objectivity in worldviews is a suitable approach for this study, as it develops a solid research design (Fig. 3.4).

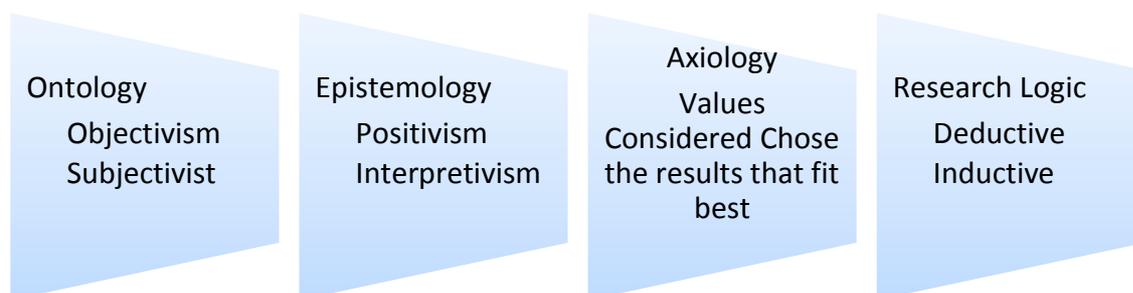


FIGURE 3.4: Research Assumptions according to Mixed methodology (Teddlie & Tashakkori, 2009)

3.4 Research Design

Firstly, this section offers a brief reflection on the aims and motivation of the study, as well as the research objectives, with the relevant research questions described in Chapter 1. Next, discussion focuses on the application of mixed methodology approach using *Sequential Explanatory Design (SED)*, which applies sequential phases or stages from different research approaches as the main determinant of the chosen method of inquiry, for example, in this study beginning with qualitative approach, followed by quantitative approach and finally, triangulating by qualitative approach.

3.4.1 Research Objectives and Questions

The overall design of this study is centralized around the objectives and research questions (Table 3.1).

Research Questions (RQ)	Objective(s)	Qualitative Approach	Quantitative Approach
1. What is the reasoning behind HRB between different municipalities	<ul style="list-style-type: none"> To reveal how household recycling behaviour affects the 	Interviews and Focus group	Survey

2. What are the different factors associated with HRWS that may affect HRB, and how do they affect HRB?	provision of HRWS by the municipalities		●
3. What are the interactions (symbiosis effects) and the conditions that support the symbiosis between HRWS and HRB?	● To reveal and explain the pre-condition phase between HRWS and HRB	Interviews and Focus group	Survey

Table 3.1: The Research Question addresses the relevant objectives with applicable research approach.

In addition, using mixed methodology contributes to logistics literature, in which most research is dominated by positivist doctrine in comparison with interpretivist and mixed methodology approach. Nevertheless, the movement towards applying both doctrines is encouraged to understand the paradigm through multiple worldviews of reality by exploring other methodologies in empirical work (Golicic & Davis, 2012; Spens & Kovacs, 2012; Mangan et al., 2004). This study regards reality as both a contextual field of information, and a realm of symbolic discourse, where epistemology is explained in order to understand the patterns of symbolic discourse, along with examining its processes. Nevertheless, any philosophical underpinning in social sciences tries to address plausible affirmations on human beings (or specific groups of human beings) within their natural settings (Biesta & Burbles, 2003). Hence, a mixed methodology approach was considered the best to address the above mentioned research questions. Using this approach would not imperil the philosophical stance, but was determined by the research questions, to guide the direction of data collection and analysis in the research design. The usage of both quantitative and qualitative approaches in the SED enhanced the rigours and authenticity of this study. SED determines how data is collected and the creation of the type of analysis it will produce by mixing both qualitative and quantitative data in a single study. Thus, it enables the researcher to adopt the research questions as the centrality of the SED, rather than approaching the study from a worldview stance.

3.5 An Overview: Sequential Explanatory Design (SED)

Sequential Explanatory Design (SED) is a mixed model design derived from mixed methodology, which combines qualitative and quantitative approaches in different phases of the research process (Teddlie & Tashakkori, 2009; Creswell, 2008). SED is formally defined as sequential studies that involve multiple phases and equally address, in sequence, either qualitative or quantitative method at the initial stage (Creswell, 2008; Clark et al., 2008) (Fig. 3.6).

The SED application for the research design is appropriate in accomplishing the research aims and objectives by cross-examining two sources of data (interviews and questionnaires), to produce a holistic understanding between two variables (households and municipalities) with respect to the critical factors (situational and personal). It also increases the comprehensiveness of the overall findings by showing how qualitative data provide explanations for statistical data. This increases the methodological rigour, since findings from the qualitative and quantitative phases are accessible and can be examined for consistency and transferability. Hence, using mixed methods can greatly enhance the explanation of *symbiosis effect* between HWRS and HRB. Initially, consolidation of the *a-priori* themes and cross-examination during semi-structured interviews continued with the development of quantitative inquiry to seek generalization of the themes, finally using a focus group to further confirm the notion of symbiosis effect.

As Dunn et al. (1994) stated, “*Logistics is confounded with an abundance of concepts that are not easily operationalized for scientific analysis*”. As in the scope of HRWM, the interaction between situational and personal factors is considered inherent, or a latent variable that is an unobserved entity, presumed to underlie observed variables. Hence, this study shows more interest in the relation between latent variables than the relation between observed variables (recycling rate), as it seeks to investigate the phenomena and their relations (the proposition of the existence of symbiosis effect between HRWS and HRB).

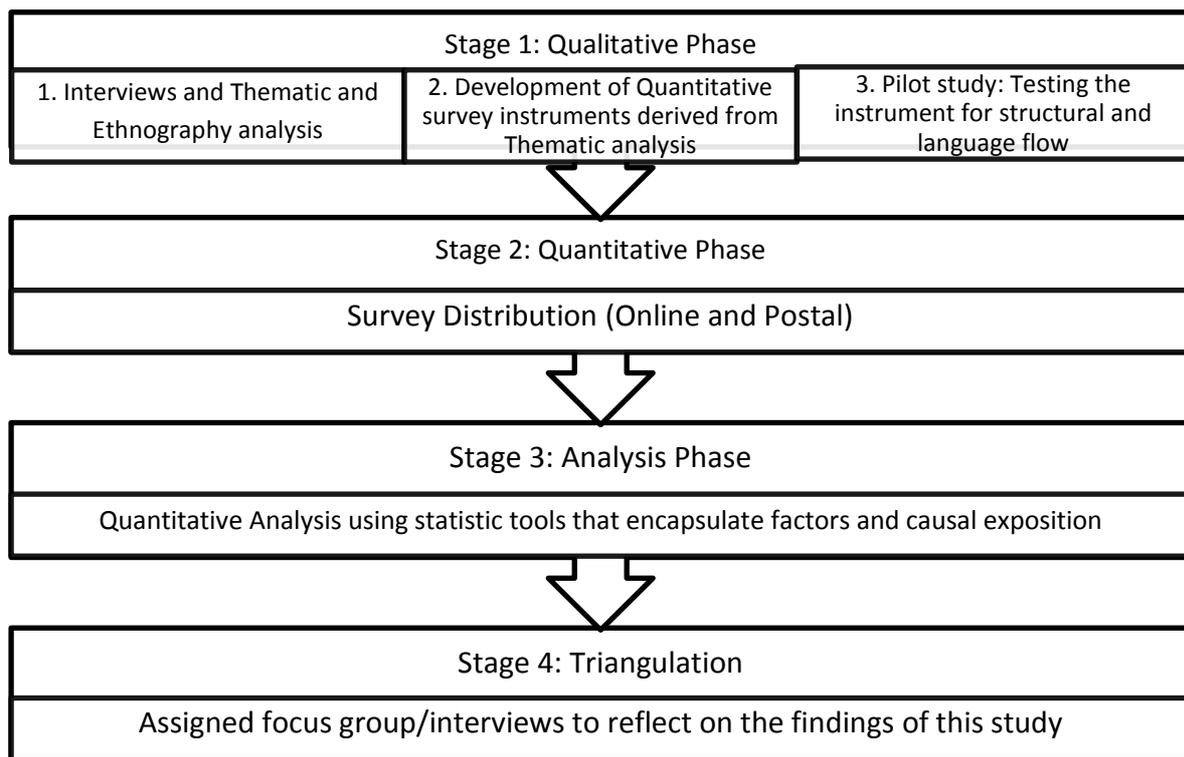


FIGURE 3.6: Research design based on SED (Creswell, 2008; Clark et al., 2008; Teddlie & Tashakkori, 2009)

Before the discussion on the stages of SED, the research population and sampling strategy need to be determined. The next sections offer discussion on the sampling strategy chosen for this mixed methodology design, prior to the stages undertaken in the SED.

3.6 Population & sampling

The sampling is taken from mixed methodology techniques that favoured convenience sampling, as opposed to other sampling techniques. Convenience sampling is a non-probabilistic sampling technique that is useful for both qualitative and quantitative approaches (Creswell, 2008; Teddlie & Tashakkori, 2009). Thus, it is premeditated in nature, and was the reason behind the selection of the East Riding of Yorkshire Municipality and Hull City Municipality for non-probability sampling design. The justification for the chosen samples is further explained below.

3.6.1 Target population

The population chosen for this study consisted of households in the East Riding of Yorkshire Municipality and the City of Hull Municipality. The reasons for choosing these two localities were:

- i. Both municipalities use the same sustainable waste management strategy (Target 45+). Target 45+ is a Joint Sustainable Waste Management Strategy developed in partnership by Hull City Council and the East Riding of Yorkshire Council. The target of 45% recycling and composting is the basis for the strategic Target 45+. Both municipalities are unitary authorities; hence the strategic Target 45+ is a common goal for these municipalities to achieve over a 15 year period (2006-2020), with separate facilitation of their strategic HRWM. (Further details of Target 45+ can be found in Appendix I).
- ii. Both municipalities have unique demographic backgrounds compared with other English municipalities. Although neighbouring municipalities, the East Riding of Yorkshire is geographically diverse (a mixture of rural, suburban and urban) in comparison to the City of Hull (mostly urban and suburban).
- iii. Both municipalities had previously contributed to low percentages in recycling performance (DEFRA, 2011d), but showed impressive improvement in recycling targets in recent years, both having achieved more than 50% above EU27 average (Burton, 2013).

Municipality	2009-2010 (%)	2013-2014 (%)
East Riding of Yorkshire Council	38.22	57.2
Hull City Council	34.45	50.2

Table 3.3: Recycling Performance for East Riding of Yorkshire and City of Hull (DEFRA, 2011d; SITA, 2015)

Note: the data were derived from Wastedataflow, and based on dry and composted recycling, excluding other organic waste within the respective financial year.

- iv. It was a feasible choice as a population parameter that allowed the researcher to access the fieldwork with low research capacity constraints.

3.6.2 Sampling size & strategy

East Riding of Yorkshire Municipality is the largest unitary municipality in the UK, comprised of 325,000 residents (East Riding of Yorkshire Council, 2012), whereas Hull City Municipality itself has approximately 263,900 residents (Hull City Council, 2012). The total population of both areas is 588,900 inhabitants, and is hence in accordance with Sekaran & Bougie's (2010) 'rules of thumb': a sampling size of 95% confidence level, which applies to the total population of a minimum of 384 sample size as the baseline. Out of 588,900 residents, the target of 384 respondents was considered feasible for generalization of the given population. The sampling strategy applied was purposive, and based on quota sampling, meaning that questionnaires were equally distributed to both respective populations, and that the qualitative sampling was homogenous in recruiting the participants. According to Sekaran and Bougie (2010), when a study focuses on the phenomenon of worldviews in a particular sample, generalization for the larger population is unnecessary. Hence, this study mainly seeks explanations for behavioural change in recycling waste management from the respective areas of the East Riding of Yorkshire Municipality and the City of Hull Municipality, with regards to *symbiosis effect*. Thus, the research outcomes are a representation of the population parameter from those two municipalities. The sampling strategy in this study is purposive within the parameter of the researcher's place of study. Therefore university students were considered reliable as homogenous sample candidates (Iacobucci et al., 2001).

3.6.3 Population Geographic and Demographic Profiles

The description of the geographic profile of each municipality for the research parameter is distinctive. According to the Office of National Statistics (ONS), the City of Hull area is urbanized with higher density and heavily populated. Therefore, the residential area is secluded within a 50–100 mile radius (Humber Data Observatory, 2014; East Riding Data Observatory, 2014; ONS, 2013). Most of the residential area is terraced without gardens, although nearer the border, towards the East of Riding area is more suburbanized. The residential area here is more dispersed, the properties being mostly detached with gardens,

or small pieces of land (Fig. 3.7) (East Riding Data Observatory, 2014; Humber Data Observatory, 2014).

On the other hand, the East Riding of Yorkshire area is mostly suburbanized, with low density population. In addition, the residential properties in this area are mostly distant from one another, with gardens or small pieces of land. The higher density area is concentrated towards the border of the City of Hull or other bordering municipalities (Fig. 3.7) (East Riding Data Observatory, 2014; Humber Data Observatory, 2014).

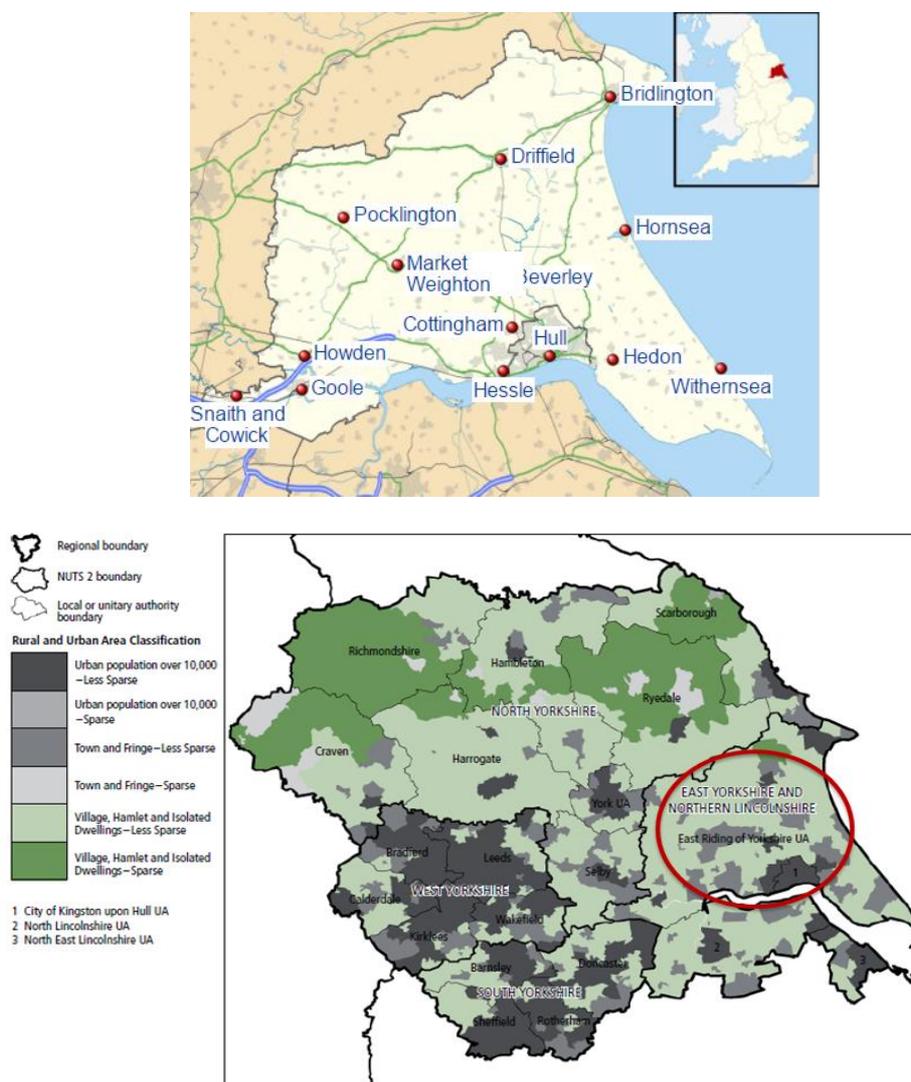
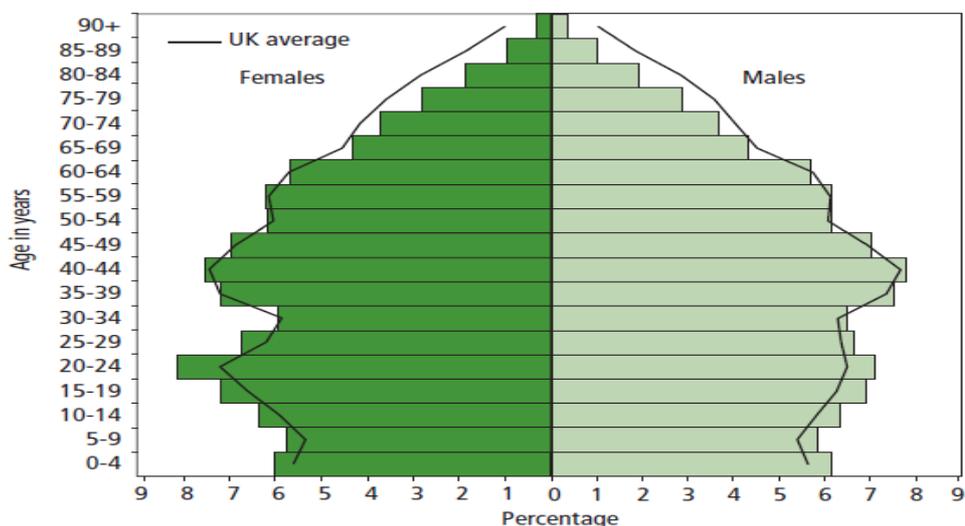


FIGURE 3.7: The geographical profiles based on ONS (2013)

The population of both municipalities demographically mirrors the UK average for the region of Humber and Yorkshire (Fig. 3.8) (ONS, 2013). The age group is fairly equally divided for this region (Fig. 3.8).



Source: Office for National Statistics

FIGURE 3.8: The demographic profile based ONS (2013).

In previous literature, the demographic background is essential to predict HRB (Miafodzyeva & Brandt, 2013). Demographic elements such as age, income, locality, deprivation indices and geographic disparity were often considered in the analyses. However, Miafodzyeva and Brandt (2013) found inconsistency in various socio-demographic elements for predicting HRB. Moreover Grazhdani (2016) suggested that many factors should be considered when predicting changes in population behaviour towards recycling and the reduction of waste generation, including facilitation of the right policy, improving social factors (engagement and awareness) and managing the economic factors effectively (e.g. devoting the right resources to implement HRWS). Hence, this study has not included income and deprivation indices as part of the measurements, but only includes age group and type of property. The argument for the particular omission of deprivation indices and income level is consistent with Bertram-Hummer and Baliki's (2015) suggestions about the importance of visible wealth in an individual's assessment of their own relative economic situation, as opposed to relying on income-based deprivation measures.

In addition, a report from the Greater London Authority (GLA, 2011) argued that many factors affect recycling rates and agreed that in some areas, deprivation levels and household density influence recycling levels. However, these factors are not overarching attributes, as some areas had achieved a higher recycling rate, even though the deprivation level was high, and vice-versa for some low deprivation level areas (2011). The same report stated that most of the high deprivation and low deprivation areas with lower recycling performance had the same problem, which was the facilitation of the HRWS (engagement, availability and accessibility).

3.7 Stage by stage in SED

In the mixed methodology approach, data collection is accessible since it has many options to choose from. This contributes to rigour in choosing the right method in accordance with the right research questions (Venkatesh et al., 2013; Ågerfalk, 2013; Mertens & Hesse-Biber, 2013). The previous section has discussed the research's background parameter which is based on ONS (2013), and also on the geographical distinction between the East Riding of Yorkshire and the City of Hull municipality. There has been an expectation of some heterogeneous outcomes from the research design. The next section consists of discussion on the chosen method and approach, including the type of investigation, chosen research instrument and sites for each stage in the SED.

The chosen investigation is empirically based on quantitative and qualitative approach. As for quantitative approach, the investigation will examine certain sets of quantitative properties that investigate phenomena and relationships.

It is an explorative investigation, the purpose of which is to reveal the symbiosis element effect between HRWS and HRB. Furthermore, this study explains the existence of one or more factors causing the *symbiosis effect* to take place. For the qualitative approach, there were two investigations, focused on households and the respective municipalities. The first investigation arranged for one-to-one semi-structured interviews to examine a-priori themes with emergent themes from the session, the final investigation being in the form of a focus group to triangulate Stages 1 and 2.

3.7.1 Stage 1: Qualitative Phase I (Type of Investigation-Research Site-Data Collection)

The first stage began with a qualitative approach addressing the research question. The data collected were consolidation of the themes using semi-structured interviews, and based on the phenomenological interviewing approach (Roulston, 2010). The phenomenological interviewing approach basically involved respondents with recycling experience and the application of probes derived from *a-priori* themes. The interviews were designed to be structured or semi-structured, this method of inquiry allowing attitudes, beliefs and anecdotal data from respondents to be compiled intensively (Longhurst, 2003).

This particular stage was important as it defined the following stage, of the quantitative phase. The research questions that guided this stage are as follows (Table 3.2):

RQ1. What is the reasoning behind HRB between different municipalities?
RQ2. What are the different factors associated with HRWS that may affect HRB, and how do they affect HRB?
RQ3. What are the interaction and symbiosis effects and what are the conditions that support the symbiosis between HRWS and HRB?

Table 3.2: Research Question addressed in Stage 1: Qualitative Phase 1

In Stage 1, a qualitative inquiry was chosen to reveal and explain the above questions (Table 3.2), and the investigation used a semi-structured interview based on phenomenological method (Roulston, 2010). The university was utilized as the selected research site, since it was accessible to potential volunteers for this study. This study was advertised to students via a student portal and social media of relevant departments.

Students were considered as suitable candidates for the research framework can to ‘mirror’ the actual population (Peterson & Merunka, 2014; Povee & Roberts, 2014). The study used a semi-structured interview technique, which is considered a common type of qualitative inquiry (Rubin & Rubin, 2012; Qu & Dumay, 2011). The number of respondents for qualitative approach is not as restricted in the same way as quantitative approach (Roulston, 2010). Therefore the call for participants was based on the willingness of respondents to participate, and the study managed to recruit 14 respondents (two municipal officers and 12 householders) within first month of fieldwork.

There were 14 interview sessions: 1) two separate interviews with the municipalities, and 2) twelve interviews with the residents of the East Riding of Yorkshire (ERY) and the City of Hull (Hull) (ERY: 7 respondents and Hull: 5 respondents). During the sessions, the interviews were audio-recorded. However, the study was also assisted by memo taking to prepare a conceptual synthesis from raw data for those abstractions that explained the research phenomena in a natural state. The audio recording was transcribed, with the help of the memo-taking used in the thematic analysis, to investigate the development of quantitative survey instruments. Ethnography analysis was used to further analyse the raw data juxtaposing the research questions. Ethnography analysis is one way to analyse qualitative findings (Roulston, 2010), and even though this study is not an ethnography study, but it was applicable to address the research questions (Creswell, 2008). Furthermore, all identifying details within the qualitative phase were removed to maintain anonymity.

The interviews were arranged to allow personal contact with the respondents that could elicit richer and more detailed responses, thus giving an excellent opportunity for the interviewer to clarify, probe and explore questions in real-time (Roulston, 2010). An interview may be viewed as a process whereby “all meaning is constructed in the interaction, with no access to the inner world except through language”, and the essence of the structured interview is seen as a social context where the respondents produce a situated account whereby the researcher is the social inquirer of that particular situated account (Qu & Dumay, 2011; Alvesson, 2003).

Each semi-structured conducted interview took approximately 45 minutes to an hour. The interview sessions were arranged according to the volunteer’s chosen time-slots, and the place chosen for the interview was at their convenience. During each discourse, the research ethical protocol was briefly outlined and some demographic information had to be completed before or after the session ended. Upon arrival at the interview session, each respondent was given an information sheet with a brief demographic survey. The

respondent was then asked to provide his or her verbal consent to participate in the interview, as well as the pilot study for the questionnaire design.

The sessions were then audio-recorded, notes were taken and transcribed by the author, and all identifying details were removed to maintain anonymity. A total of 14 respondents participated in this study, two of whom were municipality officers – one from the East Riding of Yorkshire and the other from the City of Hull municipality. The remaining 12 respondents were demographically diverse, and lived or used to live in the East Riding of Yorkshire and the City of Hull. Appendix B includes the email that was sent out to the volunteers before giving their consent to participate in the interview session, as well as the interview protocol used during the sessions.

These interviews were essential in forming the following stage (2) of the quantitative phase. The application of phenomenology method during the interview sessions was adapted from Roulston (2010), and allowed the participant to reflect or anticipate his or her own experience within the scope of the study. The goal of this inquiry was to review the a-priori themes derived from previous studies, and whether they fell within the scope of household recycling waste management (HRWM) compared with themes that emerged during the sessions. The inquiry was derived from a review of the literature to form particular themes that could transform into an interview guide (Table 3.4). The questions imposed with targeted themes were not restricted to the interview guide, as some of the themes were expected to emerge during the discourses.

RESEARCH QUESTION with interview guide	Theme (s) and area (s) Investigated
Interview Guide with the Municipality	
<p>RQ2: What are the different factors associated with HRWS that may affect HRB, and how do they affect HRB</p> <ul style="list-style-type: none"> ● Why the changes were made considered an important move? ● Who were the most significant contributors to ensure these changes? ● Why were they significant? 	<ul style="list-style-type: none"> ● Sustainability ● Household recycling – frequency, bin, scheme, etc. ● Recycling rate ● CO2 Emissions
Interview Guide with the Households	

<p>RQ1: What is the reasoning behind HRB between different municipalities</p> <p>1. When I say “Recycling”, what are the first things that come to mind (probe on municipality roles)</p> <ul style="list-style-type: none"> ● How do you feel when you are sorting and separating your rubbish for recycling? ● Is it convenient for you to do this on a daily basis? ● What will make it easier? 	● Sustainability
	● Knowledge of issues
	● Awareness of consequences (personal)
	● Personal recycling attitudes and norms
	● Motivating factors
	● Intentions to act
	● Knowledge of recycling
	● Satisfaction with service provided
	● Scheme preferences
	● Recycling participation
<p>RQ3: What is the interaction (symbiosis effects) and what are the conditions that support the symbiosis between HRWS and HRB? Show the picture and probe on these changes toward themselves and the environment</p> <p>1. I’d like to ask you... Before the 3 wheelie bins were introduced in 2009 and looking at your current address, could you recall the time when you felt the need to change how the municipality managed your waste?</p> <p>2. Do you feel this is a convenient way of recycling? If yes, why, and if no, give your reasons why not.</p> <p>3. Show/talk about the pamphlet. Do you find it important to be able to recycle?</p> <p>4. When I say “Sustainability”, what does this term mean to you, your neighbourhood and the environment? What is it about the environment that you value?</p> <p>5. Do you think that you are recycling adequately and is the pamphlet given by the municipalities every year clear and easy to understand?</p>	● Sustainability
	● Collection/Delivery Operator
	● Household Waste and Recycling Centres (HWRC)
	● Customer Services Centre
	● Kerbside-Sort
	● Co-mingled
	● Collection Frequency
	● Bins
	● Distances
	● Advertising
	● Information
	● Public Engagement
	● Education
	● Monetary Rewards
	● Non-monetary Rewards
	● Penalty Fee
	● Knowledge of issues
	● Awareness of consequences (personal)
	● Personal recycling attitudes and norms
	● Motivating factors
	● Intentions to act
	● Knowledge of strategies and action skills
● Satisfaction with service provided	
● Scheme preferences	
● Recycling participation	
● Situational factors affect	

	personal factors
	● Advertising
	● Information
	● Public Engagement
	● Education
	● Other new factors

Table 3.4: The Interview Guide for Stage 1 (Qualitative Phase)

With the development of the interview questions based on a review of the literature, the following is the overview of the interview sessions undertaken for this study to address the relevant research questions (Fig. 3.8).

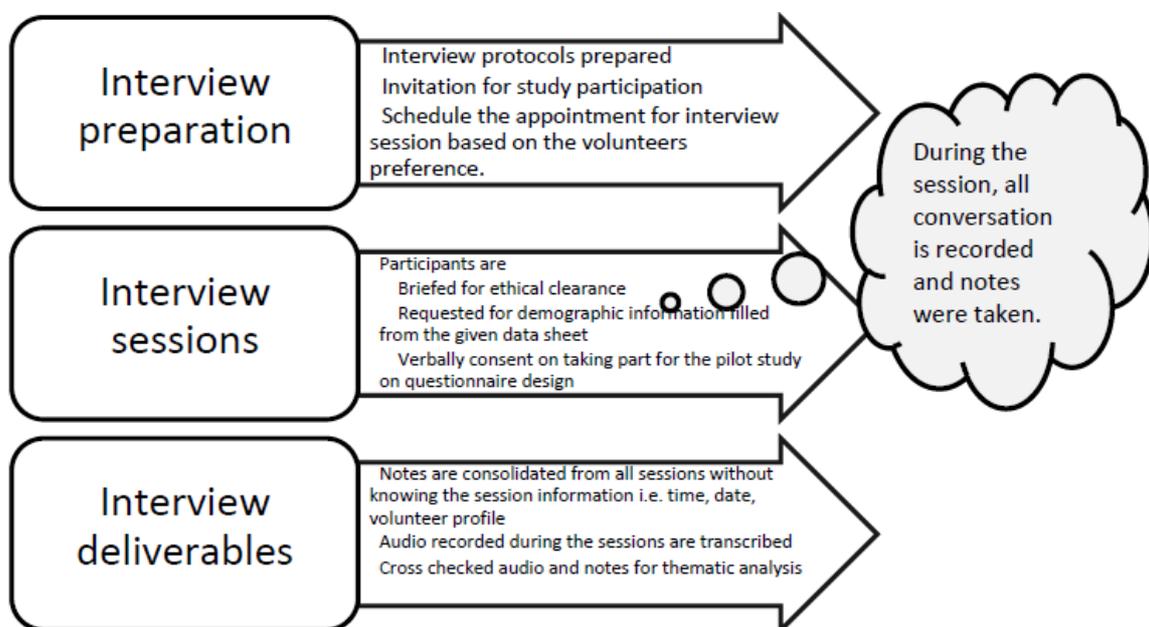


FIGURE 3.8: The Interview process for qualitative inquiry for Stage 1

The qualitative data from these semi-structured interviews was collected until 'saturation', or no new information or themes were produced (Mason, 2010; Francis et al., 2010), and the findings were consolidated from all sessions for thematic analysis (Braun & Clarke, 2006). The thematic analysis is to group all the findings under major themes, and, for this particular study, the findings were grouped under two major themes with respect to situational or personal factors. This study also applied ethnography analysis to explore the proposition of symbiosis effect (RQ3) between HRWS and HRB.

Ethnography analysis is an analysis of the semantic relationship between the subject and the subject matter (Spradley, 1979).

This method of analysis could explain the discussion between the householders and researcher in semantic (interpretative) explanation or description, so as to show the conceptualization of the symbiosis effect perspective. The analysis applied in Stage 1 contributed to developing and shaping Stage 2 of the SED.

3.7.2 Stage 2: Quantitative Phase (Type of Investigation-Research Site-Data Collection)

The next data collection following SED applied the quantitative approach; this specific quantitative phase being derived from the first stage of the SED. The development of the instruments and methods refer to the combination of the thematic analyses from the first phase of qualitative findings and *a-priori* research. Previously, a thematic analysis was defined as a method for identifying, analysing and reporting patterns (themes) within data (Roulston, 2010). Roulston (2010) also suggested that the data could exist from qualitative or/and quantitative findings (Braun & Clarke, 2006; Aronson, 1994). The flexibility of thematic analysis allows the researcher to be robust in the analysis of “...discovering themes and concepts embedded throughout your interviews” (Rubin & Rubin, 1995:226) (Braun & Clarke, 2006).

The legitimacy of using this analysis allowed the researcher to develop a ‘custom made’ quantitative instrument using the 5-likert scale questionnaire. A questionnaire represents a formalised method of communication (Zikmund & Babin, 2010) derived from research questions and thematic analyses, and hence designed with minimal ambiguity to reduce the number of items with a non-response rate.

The questionnaire was informed by two types of survey design (Mail Survey and Internet Survey). The two types of quantitative instruments are complimentary with one another (Dillman et al., 2009). Both types of survey had geographic flexibility to cover the research parameters and allow respondents to answer at their own convenience, without being influenced by the presence of the researcher (Chidlow et al., 2014; Dillman et al., 2009).

The goal of the chosen survey instrument was to have a well-balanced questionnaire or method of inquiry that emphasizes psychometric credibility (Switzer et al., 1999). Psychometric credibility covers the contextual issues in research parameters and aligns with the research questions assembled in the study. The major factors involved in selecting the instruments were: contextual and psychometric issues (Table. 3.6)

Contextual issues	Aspects	Research Goal
Population Characteristic	Age Gender Marital Status Number in Household Working Status Type of Area Type of Property	To seek differences between groups
Cultural Context	Ethnicity Residential Status	To seek differences between groups
Historical Context	Knowledge Experiences	To seek differences between groups
Research Goals	Content of measurement Comparisons to normative groups	To seek significant relationship between groups To seek significant factors between groups To seek differences between factors within the group
Administration	Postal Survey Online Survey	To seek what is applicable to a certain population frame (internet users vs. non internet users) Feasibility option based on financial capacity and geographical accessibility

Table 3.5: Key Contextual Measurement within the quantitative phase based on Switzer et al. (1999)

The key contextual measurement (Table 3.5) involves reliability and validity of instruments. The questionnaires formed should be a reliable instrument that will only detect correct scores. Hence, the development of the questionnaire was based on two central considerations (Switzer et al., 1999): 1. Do items evidently belong to a scale that examines a single construct? 2. Do scales measuring a single construct develop consistency across multiple measurements?

The validity of this questionnaire was ensured by the extant measurement of this distinct instrument as it was knowingly measured (Anastasi, 1985).

It should be noted that validity is context specific, whereby validating a measure must be seen as “...a process of accumulating evidence that supports the meaningfulness of the measure instead of a discrete endpoint at that validity is proven” (Switzer et al., 1999: 5) (Stewart & Ware, 1992). Therefore, this study allows two-fold validation, which could not only be context specific (within the quantitative analysis), but also as an interrogation between the qualitative phases (inter-measurement validation within the research design) (Teddlie & Tashakkori, 2009).

To ensure that the questionnaire built in the quantitative phase was entirely reliable and certified for this stage in the SED, it had to be adapted from previous instruments. These instruments were from previous empirical studies that had undergone a reliability and validity process. Therefore, it was crucial at this stage to develop an effective instrument in the SED, which comprised previously tested instruments (Timlett & Williams, 2008; Woodard et al., 2005; Barr et al., 2003; Rogers et al., 1999) that had been adapted for this study to cater for quantitative inquiry. The questionnaires comprised four sections to investigate the research questions for this study (Table. 3.7).

Research Question (s) RQ	Section	Instruments	Items
RQ1: What is the reasoning of HRB between different municipalities?	Personal	Adapted from Timlett and Williams (2008); Barr et al. (2003)	11 items
RQ2: What are the different factors associated with household recycling systems that may affect HRB?	Situational	Adapted from Rogers et al. (1999); Woodard et al. (2005)	16 items
RQ3: What are the interaction and symbiosis effects and the conditions that support the symbiosis between household recycling systems and household recycling behaviour?	Interaction	Adapted from Woodard et al. (2006); Barr et al. (2003)	28 items
RQ2: What are the different factors associated with household recycling systems that may affect HRB?	Population Profile(s)	Developed based on Office of National Office (ONS) (2013)	10 items

Table 3.6: Quantitative Instruments based on *priori* research

The questions were designed according to the 5-Likert scale. The types of questions used were as follows:

i. Numerical rating

This type of question design used the Likert scale 1-5 for the respondent to choose, and each item (statement) was assigned as a separate variable in quantitative analysis.

Consider the following set of statements related to your views on recycling and the environment. Please circle the number under the initials that applies.						
SA = STRONGLY AGREE						
A = AGREE						
N = NEUTRAL						
D = DISAGREE						
SD = STRONGLY DISAGREE						
NO	QUESTIONS	SA	A	N	D	SD
3	I check product labels for disposal information when I go shopping.	5	4	3	2	1

ii. Check lists

This type of question design enabled the respondents to choose as many options as needed to portray their views, and each statement was addressed as a separate variable in the quantitative analysis.

I recycle because	(Tick <input checked="" type="checkbox"/> all that apply)
To comply with regulations	
To improve the environment	
To represent a good image	
To serve an environmentally conscious society	
Financial gains from the sale of recyclable products	
Do not know	
Others: _____	

iii. Multiple choice

Separation and Sorting the waste is usually done by	a. Myself
	b. Other members of the household

	c. The whole household

The final question design in the survey item was a multiple option whereby the respondents had to select one option from the required questions.

The selected option was considered as one variable per item in the quantitative analysis. Some of the items found in the quantitative phase of the questionnaire included non-committal responses (e.g. don't know, other; not sure), the respondents were able to avoid choosing an appropriate option to express their view (De Vaus, 2008). However, this non-committal item was used at a minimal level and as a last alternative for selection of options within the questionnaire.

Over-use of non-committal responses could lead to an 'easy way out option' for the respondents to complete the survey (Francis et al., 2010).

For this quantitative research inquiry, 1000 postal surveys were equally distributed to both areas (500: East Riding of Yorkshire; 500: City of Hull). An online survey under the discretion of selected companies established within the population parameter (KC Communications, East Yorkshire Motor Services and Jackson's Bakery) was published for the municipalities' affiliated community network and public community online news network (this is Hull and East Riding) including the online survey via University social media. The choice of affiliated community networks from among private and public organizations was based on both being prominent, active organizations and iconic players in ERY and Hull urban development.

Mail and internet surveys have the advantage of retaining respondent anonymity, by offering the convenience of time and place at the respondent's disposal, without the researcher being present (Dillman et al., 2009). The mail and internet surveys had similar questions designed to consolidate the results in one form. The questionnaire is a *respondent-completed survey* which demands a non-response bias from the researcher. This non-response bias is fully discussed in the quantitative analysis in Chapter 4. Furthermore, the questionnaire was piloted by selected individuals, including respondents from the first stage of the qualitative phase, to assess any uncertainty that occurred in the response rate (questions are highly ambiguous), question applicability and question performance (not a suitable item), before the actual study took place (Ticehurst & Veal, 2000).

The pilot study applied in this stage was to explore the consistency of the themes discussed in the first stage, and mentioned the usage of certain language (ambiguity, applicability and suitability) for inclusion in the questionnaire. In the pilot study, there were 50 selected individuals (38 postgraduate students and 12 volunteer households from Stage 1 were interviewed). The pilot study used only the online version, rather than paper; however, the paper-based version was available for respondents upon request.

Reliability Statistics	
Cronbach's Alpha	N of Items
0.887	53

Table 3.7: The reliability test for the pilot study

The pilot study showed reliability between the feasible items (Table 3.7) within the questionnaire, which could be used in the actual study at this stage. The alpha of 0.89 was considered acceptable (Hair et al., 2009; Venkalahti, 2000) and consistent with the previous empirical study's unit measurement. In addition to the reliability test for the survey instrument, all the remarks and comments made by the respondents, particularly the 12 households, were addressed and amended before distribution of the mail survey and transmission of the online survey. The process of the questionnaire development for this Stage 2 of SED in the quantitative phase was as follows (Fig.3.9):

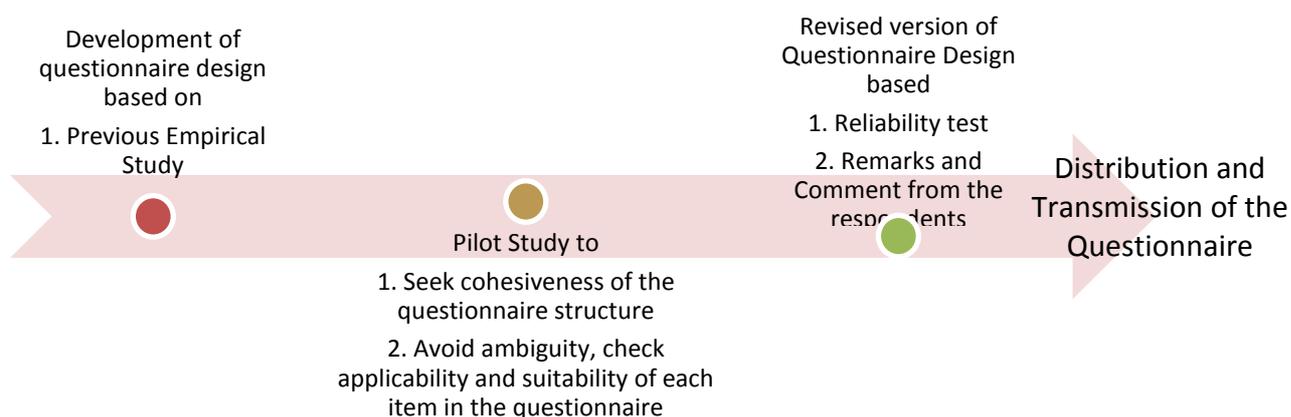


FIGURE 3.9: The process of questionnaire development based on Stage 1 and *a-priori* empirical study

As the quantitative phase commenced, it took approximately nine months for the overall data to be collected from the target sample of the population, which targeted 95% of confident level of 384 sample sizes, as suggested in Sekaran and Bougie (2010). The sample questionnaire for the online and mail surveys (Appendix C) included the covering letter inviting participation. After the quantitative analyses were conducted, the next stage was the qualitative Phase II, where both qualitative and quantitative findings from the prior stages were fully addressed. This stage only commenced when both Stages 1 and 2 had been thoroughly analysed, based on the relevant research questions. The outcome from both stages was transformed to the discussion protocol in the focus group, as described in the next section.

3.7.3 Stage 3: Qualitative Phase II (Type of Investigation-Research Site-Data Collection)

The final stage was the data collection phase of the qualitative inquiry, using a focus group. The focus group is a data collection design in the qualitative approach which enables respondents to interact with one another and form an abstraction for the researcher to synthesise (Kitzinger, 1995). This inquiry can be accessible to those individuals who are reluctant to undergo a one-to-one interview, and encourage 'behavioural' discussion without frequent probes by the researcher or moderator (Longhurst, 2003; Kitzinger, 1995).

The focus group is an excellent approach to assemble an in-depth reflection from a group of individuals in real time. This focus group was essential to triangulate the previous stages and contribute to the holistic views in the overall research questions that were separated in previous stages. Triangulation is a technique to cross-examine the qualitative and quantitative findings (Guest et al., 2006; Punch, 2013; Jick, 1979) and is also considered a validation tool to address the reliability of the whole SED (Creswell, 2008). In the final stage of the qualitative phase, the goal was to ensure that the overall research questions had been addressed. Any new information was considered as a further requirement, for future research. This stage also used confirmatory and explanatory triangulation, where the findings of the prior stages were shared with the focus group in order to seek validation of the findings, and consider any disagreement in the findings as a limitation of the research

inquiry chosen for that respective stage. Furthermore, the triangulation method was based on micro-interlocutor analysis. Micro-interlocutor analysis is an analysis suggested by Onwuegbuzie et al. (2010) to ensure consensus views from multiple members of a focus group.

This reflected the overall study outcome. The focus group and data from interviews at this stage were combined, as the discussion and interview guide used during the sessions were standardized. The findings from this stage were analysed by constant comparison technique, popularized by Glaser and Strauss (2009). Comparison technique is the usage of multiple inquiries within an analysis. It allows across-group saturation in verification of previous stage outcomes. These multiple inquiries are quite similar to emergent-systematic focus group design (Onwuegbuzie et al., 2010), wherein the systematic term refers to the focus groups that are used for verification purposes. Hence, the purpose of micro-interlocutor analysis is to seek verification throughout the discussions, either in focus groups or interviews, whereby the multiple views of members are achieved with a high level of homogeneity among the population (Charmaz, 2014; Mason, 2010) and consensus of the overall members' views (Onwuegbuzie et al., 2010).

The number of participants considered conducive to a focus group is suggested as four to eight individuals (Kitzinger, 1995), the research setting in this case being the university, as it was the most convenient place for volunteers to participate. The volunteers were selected based upon the overall sampling of the study population, the sample being a reflection of the population of the East Riding of Yorkshire and City of Hull. The invitation for participation was emailed through university social platforms, including social media and an online newsletter (Appendix D). The focus group was initially planned to include two representatives from the municipality, but due to a conflict of scheduling from the municipality, the session only addressed the group of householders. Hence, a separate interview with the municipalities from the East Riding of Yorkshire and the City of Hull was held after the focus group had commenced.

Using two types of qualitative inquiries for this stage did not affect the cohesiveness of the SED, but it did promote rigour and flexibility in mitigating the methods of inquiry by a mixed methodology approach (Creswell, 2008).

The focus group volunteers were pre-selected to ensure diversity, and 13 householders agreed to take part. The qualitative inquiry was a one-off session led by the researcher to cover overall findings from Stages 1 and 2 in the SED, as well as the overall research questions. The process of qualitative inquiries for this stage was as follows (Fig. 3.10):

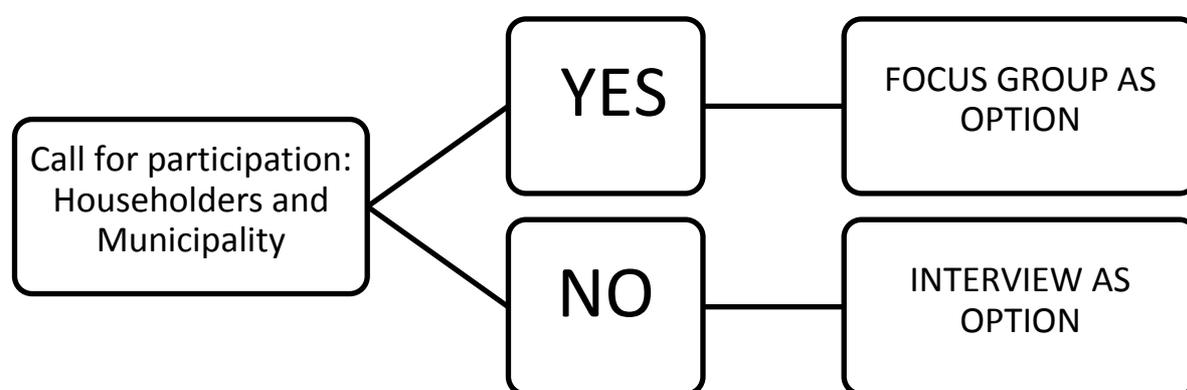


FIGURE 3.10: Stage 3 of Qualitative phase II for research inquiry option

Focus group and interview discussion guides (Appendix E) were developed to assist the sessions. The discussion guides were then reviewed by a group of supervisors and an external proof reader. A 10-item participant information form, consisting of demographic background and a respondent's consent form, was circulated during both sessions (Appendix E). The personal information form was handed out before commencing the focus group discussion, as well as the interview sessions. The site for selecting the focus group was within the vicinity of Hull University.

The recruitment process was launched by advertising through general group mail, which is assigned to both undergraduates and postgraduates, including common social media platforms which are widely accessible throughout the university. The potential respondents were then thoroughly screened to ensure diversity in the focus group. 13 householders

were identified as a desired mix for the focus group. Volunteers were offered a token of appreciation (GBP5) prior to the focus group session, in order to increase the likelihood of participation. The session was conducted in a seminar room at the Graduate School, University of Hull on the 6th of February, 2014. The discussion for the focus group was conducted in English and lasted approximately 90 minutes.

As for the interview sessions with the municipality (the two respondents were officers from waste and recycling management), one was held in the university compound, and the other administered at the municipal office. Each interview session lasted approximately 80–90 minutes, and both qualitative inquiries at this stage were tape recorded, with notes being taken and later transcribed. All respondents in both sessions (focus group and interview) were briefed concerning ethical considerations, and informed about the confidentiality of the respondent profiles, which were only disclosed as anonymous. The development of the discussion guide for the focus group and interview sessions was as follows (Fig. 3.11):

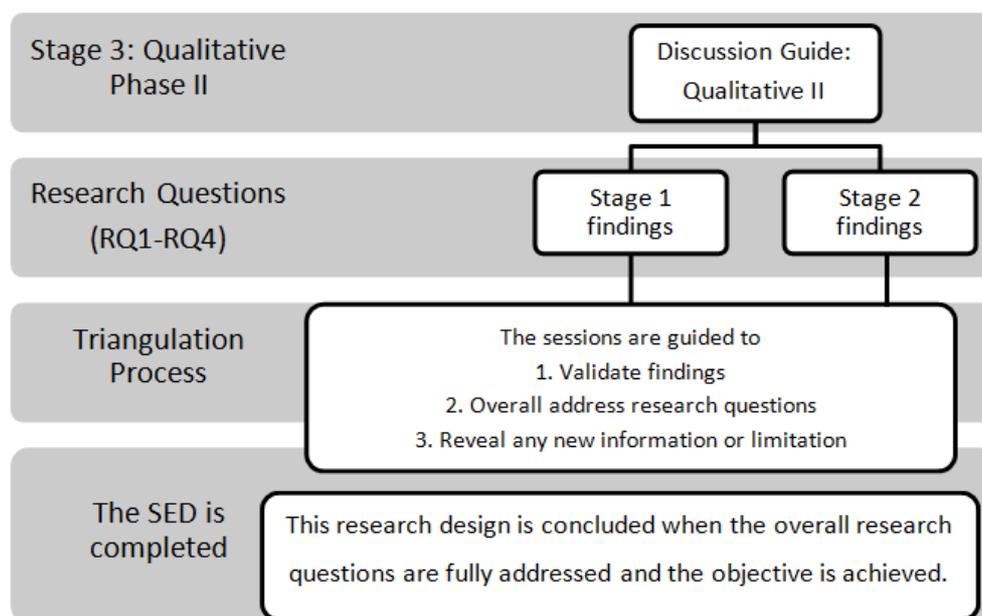


FIGURE 3.11: The development of qualitative inquiry for Stage 3 based on overall RQs

The final stage and overall SED were an affirmation of the mixed methodology approach in addressing the RQs for an interdisciplinary study. Hence, the reliability and validity issues needed to be addressed, and are described in the next section.

3.8 Reliability & Validity

A mixed methodology approach had the ability to validate the credibility of both measurements in the research design (Teddlie & Tashakkori, 2009; Creswell, 2008). The uniqueness of this approach assisted the researcher to mitigate reliability and validity issues. As mentioned in Jick, validity of a study may derived from another method of inquiry, in order to increase the validity of the study (Venkatesh et al., 2013, 1979). This section is divided into two sections, which describ each research approach in relation to reliability and validity.

3.8.1 Qualitative Approach

Reliability and validity in a qualitative study are more focused on the process and procedure which took place during the research inquiry, rather than quantifying measurements or observations (Healy & Perry, 2000). Reliability and validity are not a rule of thumb in developing good research in a qualitative study (Guest et al., 2014). Besides, the biased notion of the researcher could also be considered as normality in the research processes (Braun & Clarke, 2006). Thus, this study utilized SED mixed methodology, which applied the two stages of the qualitative phase (Phases I and II). Here, Phase I is the critical development of the foundation from the entire set of RQs, whereas the final stage of qualitative Phase II is an affirmation of the overall research outcomes.

This is the point where the collision begins with the major extreme paradigm (Polit & Beck, 2010), in which the mixed methodology between two extreme approaches is considered 'doomed to failure' (Teddlie & Tashakkori, 2009). This is not the case when the RQs are considered as a 'paradigm', addressing reliability and validity in the qualitative phase as rigour, transferability and trustworthiness (Onwuegbuzie et al., 2010), and adding the RQs as the parameter. The transferability and trustworthy elements in qualitative approach when addressing reliability and validity issues in research design constitute verification processes, such as triangulation and iteration (Onwuegbuzie et al., 2010). The qualitative Phase I was conducted using semi-structured interviews, analysing these with thematic and ethnography analysis to ensure rigour, and allowing the data to evolve naturally by triggering a conversation between two individuals on a subject matter guided by the RQs.

The natural state of retrieving the information was elusive, without forcing the respondents to make a stand or take up an opinion when participating in the discussion with the researcher on the subject matter. Thus, the rigour naturally emerged as a state of saturation was achieved and the RQs fully answered. The trustworthiness of this phase was addressed by the researcher by exposition of good research ethics, and reporting the outcome with the consent of the respondents, promising anonymity in the process of inquiry.

According to the deployment of thematic analysis (Vaismoradi et al., 2013), iteration between a-priori and current themes was crucial, as it defined the second stage of quantitative inquiry.

Reporting the 'truth' is defined in quantitative inquiry as the most substantial of empirical findings, with current frequent observations. The analyses from this phase were contemplated as rigour and trustworthiness, and transferred to the second stage. In order to ensure the transferability of this analysis, the pilot study of the quantitative phase was thoroughly examined. The pilot study showed the quality of the analysis depicting the questionnaire design when its reliability was tested ($\alpha > 0.80$).

The final stage of the qualitative phase was the triangulation findings gathered in Stages 1 and 2, using the focus group and interviews. The goal of this stage was to find confirmation on the overall findings, discover any new information for further research, and identify any limitations or barriers, acknowledging that it was guided entirely by the RQs. In the discussion, the research iterated the number of affirmations or confirmatory statements for the outcomes. This technique encapsulated rigour and trustworthiness of the subject matter. The triangulation process is considered a form of transferability and quality (rigour) of qualitative approach (Jick, 1979). As long as the discussion was in both the focus group and interviews, it would reach saturation level or similar by validly depicting the first stage.

3.8.2 Quantitative Approach

In the SED, the research inquiry adapted a form of survey design in Stage 2 of the quantitative phase, the survey applied consisting of a set of questionnaires that utilised the Likert scale 1-5. The 5-point scale was considered supplementary in this study because there is a definite relation between the scale length and reliability. To accomplish the most reliable results, as mentioned in Krosnick and Fabrigar (2010); Agresti (2014) a test of 706 studies that applied either the 5 or 7-point scale between subjects has yet to be proven to maximize reliability and validity in the chosen measurement.

This also supports the credibility of research which is dependable on the level of suitability of a chosen measurement (Switzer et al., 1999; Anastasi, 1985).

Looking at the second stage of the quantitative phase in this study, the first step was to consider the development of the questionnaire and where it was piloted, to ensure the survey was feasible to use in the actual study. The psychometric issues relating to the questionnaire scrutinized the use of internal-consistency of the scale and found the measurement $\alpha > 0.80$ as an acceptance level for internal-consistency in social research (Henson, 2001). On the contrary, validity of the chosen scale is the extent to which the measurement tool accurately measures what allegedly is to be measured (Hair et al., 2009; Punch, 2013). The purpose of validity is to ensure that the scale measuring the concept definition is one-dimensional and has appropriate levels of reliability.

Thus, a scale's validity has to be examined before conducting further analysis. Punch (2013) and Sekaran and Bougie (2010) stated that there are three types of validity: content and face validity, criterion-related validity, and construct validity.

- Content validity is related to the full representation of the content of conceptual definition. A factor is considered to have content validity if such theoretical support from the literature exists, and the items included in each sample are representatively intended to measure the domain of the concept (Newman et al., 2013). The discussion in the preceding literature reviews reflects the origin of the construct in the relevant literature. The purpose of content validity is to specify the content of a definition, and to develop indicators that samples have been collected from all areas of content in the definition. Face validity, on the other hand, subjectively assesses the correspondence between individual items and the concept through ratings in a pilot test with sub-populations.

The objective is to ensure that the selection of scale items of measurement meets the theoretical assumptions and practical understanding (Hair et al., 2009). In the current study, the measurements were mostly adapted from previous studies; hence

the prior measurements were considered validated and reliable, having been tested within the research parameter (Hair et al., 2009).

- Criterion-related validity is an indicator that a measured construct acts as expected, based on the theory comparing with another measure of the same construct which gained the researcher's confidence. Two types of criterion validity are concurrent validity and predictive validity. Concurrent validity is the criterion validity existing now, while predictive validity may exist somewhat later. Because the time horizon of this present study is cross-sectional, concurrent validity has been adopted. As seen in the literature review, numerous relationships between variables are expected. These are the expected correlations used in considering criterion-related validity.
- Construct validity focuses on to what extent a measure confirms theoretical expectations. Construct validity evaluates any measure in a given theoretical context, and therefore shows relationships with other constructs which can be predicted and interpreted within that context. In construct validity, there are two methods to assess validity, convergent and discriminant validity. Convergent validity is used to assess scales' correlation with other factors of the same construct, while discriminant validity is to identify whether the scales are different from other constructs (Hair et al., 2009). Hence, factor analysis and correlation matrix analysis were performed to assess the convergent and discriminant validity of the data.

Factor analysis is a well-established tool used to identify the construct adequacy of a measuring device (Thompson, 2004). All the data collected for the predictive variable were included in the validity analysis because these responses did not include any disagreement that required the data to be excluded. Regarding the sample size for factor analysis, Habing (2003) suggested that 100 = poor, 200 = fair, 300 = good, 500 = very good, 1000 or more = excellent. Factor analysis was carried out with data collected from 412 subjects. This is an acceptable number, according to Hair et al., (2009), and Lawley and Maxwell (1971), for conducting the factor analysis.

As the quantitative phase commenced, the process of testing the reliability and validity was addressed during the analysis. The discussion on the psychometric issues relevant to reliability and validity on the quantitative analyses is described in detail in Chapter 5. Here, some of newly improved ways to show validity in this study have been applied. For example, this study is considered as a Monte Carlo (MC) simulation (Kisbu-Sakarya et al., 2013) that uses computational technique to check variances within multiple measurement consistency and cross-validate KMO and Bartlett test of validity (further discussion appears in Chapter 5). In earlier sections, discussion took place on the sampling strategy of this study, which is a non-probability sampling technique which may contribute to somehow distort the outcome (Zumbo, 2014).

This study tries to address the probability of distortion (Type I and II error) in the quantitative analysis by using power analysis (Zumbo, 2014) as a computational method (G*Power) by Faul et al. (2009). A further discussion on the application of G*Power to address the psychometric issues in Chapter 5 and the overall aspects in relation to reliability and the validity of the overall quantitative phase is summarized in the table below (Table 3.9).

Psychometric Issues	Aspects	Measures
Reliability	Internal-consistency	Cronbach alpha
	Multiple measurement consistency	Test-retest: MC simulation
Validity	Content	Interviews and thematic analyses for quantitative survey Factor Analysis
	Criterion	MC Simulation Internal consistency
	Construct	Explication of process: Power Analysis

Table 3.8: Psychometric for reliability and validity of research instrument (Switzer et al., 1999; Creswell, 2008)

The reliability and validity of the measurement were vital in Stage 2 in the development of the survey design, and proceeded to the quantitative analysis in order to have a robust

outcome and minimize the distortion of the outcome. Hence, mixed methodology addressed this issue by embracing the qualitative approach to validate the quantitative outcome if some limitation did occur in this avenue. However, qualitative approach is not exempt from critical scrutiny of reliability and validity issues in its methods.

Reliability and validity have been addressed in this SED mixed methodology. Hence, the ethical consideration of respondents has to be recognised, since the population sample derives from human participation. The discussion on ethical issues and mitigation applied will be described in the next section.

3.9 Ethical considerations

Research methodology will not be completed if the ethical aspects of the research design are not recognised or are ignored. According to Smith (2005), research ethics is the procedure that should be pursued throughout the research process, and post-research. It has to be acutely communicated to the stakeholders, and they should understand that its implications are nothing but for the betterment of society.

Gillespie (1994) stated that ethics apparently emerge from value conflicts, and these conflicts are expressed in different manners: privacy, ambiguity, manipulation of data, openness and replication versus confidentiality, and so forth. Ethical decisions should be made based on these values, and to what degree we, as researchers, may compromise one value for the other. Researchers should observe the acumen of the whole process as a result of improvement, and not to exploit or discriminate any subject for self-fulfilment in any way. Most social science research involves collecting data either directly or indirectly from human beings. Gillespie (1994) suggested that ethical considerations should be followed as set out below.

3.9.1 Privacy

The confidentiality of participants' means that they are assured that information will not be made available identifying them to anyone who is not directly involved in the study. The strictness of the anonymity standard in a study, the higher the standard of importance to

remain anonymous throughout the entire study, the researchers themselves also being bound by these restrictions. Clearly, the principle of anonymity is a strong guarantee of privacy, although it is sometimes difficult to accomplish, especially in situations where participants have to be measured at multiple time points (e.g. pre/post study) (Gillespie, 1994; Ana Smith, 2005). The respondents in this study had the data usage briefly explained to them, and how the analyses would be based solely on their interpretations and the researcher's reflexive notes which had been circulated to them during the first phase of SED.

3.9.2 Telling the truth and reporting findings accurately

Telling exactly what you have found in a piece of research may become an ethical dilemma, the risks including falsification of data, plagiarism, abuse of confidentiality and deliberate violation of regulations.

Safeguarding confidentiality (Singer et al., 1993; Nancarrow et al., 2001) becomes extremely difficult in research on high profile issues (Islamophobia, criminality, controversial medical issues, etc.), and misconceptions by the public on these issues can be quite daunting. Fears about relinquishing confidentiality may thwart individuals from participating altogether (Mayer, 1985), and confidentiality is seen as a very sensitive issue, especially when the risk to an individual explicitly counterbalances the risk to others (Volberding & Abrams, 1985). The studies mentioned here were affecting two concomitant respondents (municipalities and households), in which the municipalities had a predetermined set of understandings towards their households' local area and vice versa.

Therefore, both sets of respondents were not interviewed at the same time, at the same venue. The questions were more neutrally structured for both parties with regards to recycling issues, and no leading questions were put that may have imposed some connotation towards each party. In some cases, relationships with others could become impaired through conducting the research, for example, in an organizational setting where

superiors, peers and subordinates have the opportunity to openly exchange their feelings and opinions, and where, as a result, great displeasure or resentment may linger.

This might lead the participants to suffer career liabilities and other kinds of economic harm (Nancarrow et al., 2001). Therefore, in developing the focus group for this study, both sets of respondents were only requested to introduce their names and inform on their length of residency in the respective municipalities, without naming their local authorities or their employment.

3.9.3 Making results understandable to various groups of stakeholders

Research may be carried out with complete objectivity, only to have the findings misrepresented. Findings may be 'adjusted' to fit expectations, and studies may conclude with only one supporting 'preferable theory' that is currently being published. McNemar (1960) noted that findings are sometimes discarded as 'bad data' when they fail to support hypotheses. Wolins (1962) reported that after requesting original data from 37 studies, it was discovered that out of 21 researchers, feedback was given that the data had either been misplaced or destroyed. Prior to this, seven published studies had been re-analysed, and three out of the seven revealed errors large enough to alter the conclusions drawn from the original data analysis (1962).

Therefore, an ethical consideration in any research is crucial. Meticulously examining systematic ethical reviews, and ensuring that respondents are lucid on their rights throughout the research, and post-research will lead to a greater impact on the integrity and culture of future research. There will be contributors who may play minor or major roles throughout the research process or journey, and acknowledging their contributions is both justifiable and desirable.

3.9.4 Psychological Harm

Documented cases of death during social research are extremely rare, but they do exist (Ana Smith, 2005). However, psychological harm is frequently reported. In a study on obedience to authority, Milgram (1964) reported that some respondents were

psychologically affected, instead of portraying normal responses towards the experiments. Therefore, this research informed participants with the research brief at an early stage, in order for respondents to have a clear conscience in participating.

3.10 Conclusion

The discussion of this chapter has encapsulated the mixed methodology approach with the relevant epistemology and ontology from multiple world-views of reality. The choice of mixed methodology design was considered accessible for an interdisciplinary study. The examination of symbiosis effect between HRWS and HRB derived from a multifaceted body of knowledge that is fragmentised by different world-views of reality. Hence, the understanding of symbiosis effect was necessary to encapsulate a holistic view by the application of SED (Qual-Quan-Qual) to address the necessary RQs. The chapter outlined in detail the steps that had been taken in all stages within the SED, and discussion on reliability and validity issues were addressed, as well as the ethical consideration applied in this study.

The following chapter, the analysis on the findings of the two stages of SED (Stage 1: qualitative analysis and Stage 2: quantitative analysis) is described precisely from the two points of view: semi-structured interview and questionnaire survey design. The final stage of qualitative Phase II analyses are combined with the discussion in Chapter 5, as it is considered a triangulation process (Jick, 1979), which is not to seek new information, but to support prior findings with the inquiry methods of focus group and semi-structured interview.

CHAPTER FOUR: ANALYSES STAGE 1 AND STAGE 2 (QUAL-QUAN)

4.1 Introduction

This chapter presents the main findings from Stage 1: Qualitative Phase I and Stage 2: Quantitative Phase 2, whereas the findings from the final Stage 3: Qualitative Phase II are combined with the discussion of the overall study. The chapter is divided into two parts, and the description from each phase focuses on the outcome of each stage within the SED with relation to the RQs, for instance Stage 1 for Qualitative Phase I of the research design. The description of qualitative findings begins by thematic analysis that compares and consolidates the *a-priori* themes. *A priori* themes derived from previous empirical studies and those derivations of themes from this study have been grouped into two major factors to illustrate the *symbiosis effect* (situational and personal). Those themes were modified until all key themes were included and reached a saturation point (no new information i was) (Creswell, 2008).

Next, the quantitative phase of the research design is the survey design, which uses a questionnaire with 5-point Likert scale as means of measurement. The analyses start with demographical analysis, followed by the reliability and validity tests of items measured, and the major discussions on inferential statistics, which cover correlations, multiple regressions (logistics, multi regression, and multivariate) and finally, the power analysis that cross-validates the application of inferential statistics within Stage 2 of the SED.

4.2 Stage One: Qualitative Analysis Phase I - Overview

The qualitative data analysis (Fig. 4.2) involved cross-analysis of themes identified from within the discourses and identification of themes, using thematic analysis as the primary method of analysis in the first phase (Braun & Clarke, 2006). Those *a-priori* themes were used in the research inquiry, that was based on phenomenological interviewing (Roulston, 2010), whereby the themes derived from *a-priori* literature were highlighted during the interviews.

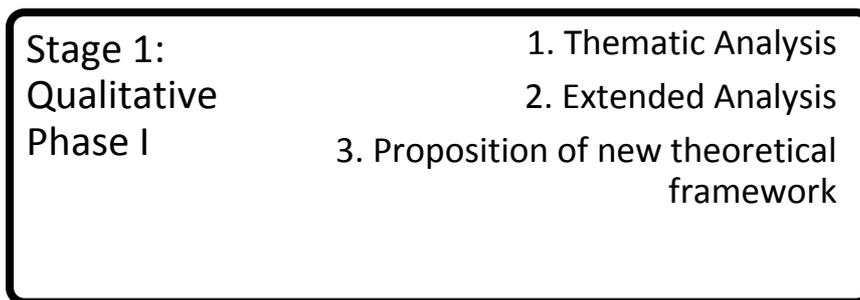


FIGURE 4.1: Stage 1: Qualitative Phase I Analysis

4.2.1 Thematic Analysis

The interviews were semi-structured and followed a phenomenological approach (Roulston, 2010) to inquire about the experiences of the respondents with their municipalities' recycling initiatives, and used probes derived from *a-priori* themes. Then, the themes that emerged during the interviews were analysed and re-organized, based on frequency, in a thematic analysis network and tabulation (Braun & Clarke, 2006; Vaismoradi et al., 2013).

As mentioned in the earlier chapters, two major factors were involved in explaining *symbiosis effect*: situational factors, which focused on thoughts from the respondents on the aspects of logistics and marketing within their HRWS, and personal factors, which focused on the innate feelings or views of the respondents on environmental issues, recycling, societal and governmental issues in general. The conversations between the researcher and respondents are summarized based on the transcriptions and memo taking (the act of recording reflective notes), and a summation of the findings (Appendix F). On the basis of the qualitative approach, the key findings were synthesized into major themes that constituted the representation of situational and personal factors and the conceptualization of symbiosis effect. The interview analyses are structured according to the concepts investigated derived from the literature reviews (Chapter 2). An overview and summary of the results of the first stage is to follow. The interview analyses are exploratory measures for defining the second stage of the quantitative phase. The coding system used in the qualitative analysis is not an entirety as a unit of measurement, but the meaning, discussions and anecdotes during the sessions are considered a pivotal part of the qualitative analysis (Strauss, 1987).

The analysis is based on the author’s reflections from memos and transcriptions, in order to form a tabulated structure in the first stage of analyses. The demographic analysis on the respondents was then profiled, whereby samples of householders were evenly represented according to their geographic areas: seven were from the City of Hull and five from the East Riding of Yorkshire.

The municipality was represented by two male officers aged between 25 – 35 years. The final sample (both households and municipalities) included nine females and five males aged between 24 – 52 years (mean age = 29), the householders having been recruited via convenience sampling among students at the University of Hull. More females (64%) than males (36%) participated in the interviews. This was consistent with past research on recycling (Smith, 2008), which noted that more women are likely to participate in research where environmental issues are a major concern. The recycling experience of respondents ranged from two to 20 years, with three of the respondents reporting that they had been recycling way before recycling initiatives ever started. The summary of the demographic background of the respondents is as follows (Table 4.1):

Item	Mean	Range	
Age	29yrs old	24-52 yrs. old	
Item	Number	Percentage	
Gender			
Male	5	35.7	
Female	9	64.3	
Total	14	100	
Item	Number	Percentage	
Recycling Experience (years)			
More than 4 yrs.	12	85.7	
Less than 4 yrs.	2	14.3	
Total	14	100	
Living in current property (years)			
More than 4 yrs.	9	64.3	
Less than 4 yrs.	5	35.7	
Total	14	100	
Country of Birth			
Item	Number	Percentage	
United Kingdom	6	42.9	
Other	8	57.1	
Total	14	100	
Status			
Item	Number	Percentage	
Student	8	57.1	
Working	6	49.1	
Total	14	100	

Type of Residential Area	Number	Percentage
Urban	12	85.7
Suburban	2	14.3
Total	14	100
Property Type	Number	Percentage
Flat/Studio/Apartment	2	14.3
House with Garden	10	71.4
House without Garden	2	14.3
Total	14	100
Number in Household	Number	Percentage
Single Occupant	1	0.07
Double Occupants	4	35.64
More than Two Occupants	9	64.29
Total	14	100

Table 4.1: Demographic Background for Stage 1

The majority of the themes were found in the interviews, some themes appearing frequently, for instance, convenience, accessibility and awareness, while others, for instance, symbiosis appeared rarely in either municipality. The following finding considers the whole sample of the 14 residents.

4.2.2 Personal and Situational Factors: Thematic Analysis

The next section offers discussion on the findings which is extended to a more meaningful expression using descriptive evaluation (Guest et al., 2014) to conserve the nature of the qualitative analysis. Using words to depict the number of respondents portraying the number of responses, the ranges chosen were: (12-14) – Most; (11–9) – Many; (8–5) – Several; (4–2) – Few; and 1 – One. These ranges reflect the frequency of themes, which was highlighted during the research inquiries based on the number of individuals mentioned in the related themes.

4.2.3 Personal Factors

The first factor is the personal factor, whereby personal behaviour on recycling is cognitively defined. The common themes depicted with regards to this factor were self-awareness, self-efficacy, knowledge and experience, social norms and household dynamics.

i. Household Dynamic

Many respondents believed that their environmental behaviour was initiated by their upbringing. This led to habitual practices which later became their family norms. Grønhøj and Thogersen (2009) defined this as an intergenerational transmission of values, attitudes and behaviours within the family settings. Most of their HRB was determined by their parents, who had repeatedly encouraged them to blend with the family norms. Some of them even extended these values by 'walking the talk' with their partners, housemates and spouses. An individual (who could be a flat/housemate, spouse or partner) can influence the way the other members of the household consume or dispose of their food or belongings, as some respondents implied.

ii. Social Norms

Some of the respondents had experienced living in a residential area where the community was avidly engaged in an environmental programme. This programme had successfully influenced their lifestyle and daily consumption. It started with media disseminating the environmental issues facing the world. The programme had encouraged the community to exchange ideas and come up with several awareness programmes that were practical for them. Some of the community members affiliated to charities diverted their usable items for charitable purposes. Hibbert et al. (2005) suggested that UK charities provide the most accessible channels for getting back usable goods from households. Most respondents were prompted to contribute their usable items, especially when charities offered 'pick-up' services in the local area.

Social and moral norms also had an enormous impact on the households when they perceived the frequent use of recycling bins in comparison with general bins. Some respondents scouted out their neighbours' bins, and admitted to having pre-conceived judgements towards their own HRB compared to others. Halvorsen (2008) pointed out that indicators related to the social and moral norms are likely to increase HRB.

It has been found that social norms have a moderating role in improving recycling behaviour. Bissing-Olson et al. (2016), consistent with this study, revealed that some respondents were exposed to moral obligation to recycle, which originated from informal settings spawned at work, school, or social gatherings.

iii. Knowledge and Experience

Most of the respondents agreed that recycling should begin in the education system, and continue as an ongoing process, empowered by the municipalities with regards to awareness and educating the public. One of them even mentioned that her children were the backbone in educating both parents on sorting the waste at home. Some preferred the idea of a multilingual booklet with depictive images that could help family members with low proficiency in English. In California model studies have been done to effectively disseminate recycling information to a diverse population (Jackson, 2002). Some of the respondents had been exposed to recycling at a very young age, when they learnt from the community, family values and beliefs to “never let something or anything go to waste”, which ultimately became a constant habit in their households. They believed awareness and exposure to recycling to be essential elements in HRB. Iverson (2016) found critical sustainable competency domains which include awareness, knowledge and skills (2016). Iverson’s (2016) study supported the respondents’ inclination towards habitual recycling and reducing waste by those individuals exposed to life learning on environmental and sustainability challenges.

iv. Self-awareness and Self-Efficacy

Self-awareness has been found to be underlying personal factor in environmental behaviour (including recycling and waste reduction) (Iverson, 2016). Self-efficacy derived from the qualitative inquiries in this study, most of the respondents agreeing that the public should be improving in self-awareness and self-responsibility. They were conscious that local constituents needlessly placed the responsibility onto the shoulders of the municipalities, instead of trying to alter their lifestyle and consumption patterns. Recycling is about integrative effort between both parties, as one of the respondents implied.

Self-responsibility derives from family upbringing, followed by formal education. When asked whether they thought that some citizens are just plain lazy, some of the respondents argued that laziness relates more to convenience, and that should the HRWS not be accommodated effectively in the direction of households' recycling needs, then effective HRB would potentially fail. As many of them agreed, a self-responsible attitude is closely related to constant engagement and education provided by municipalities.

4.2.4 Situational Factors

Situational factors showed the most obvious interplay in the qualitative inquiries, from a system arranged by the households themselves, to the public amenities which provided recycling services and had a direct effect on their daily HRB. Those elements coming under the domain of situational factors are convenience, advertising, education, accessibility and availability.

i. Convenience

Sorting and separating were among the simplest of the tasks involved in recycling chores within a minimal time-frame. Respondents who resided in 'non-flat' properties were at ease doing recycling chores, since they could move their wheelie bins closer to the kitchen door, compared with those living in a building full of other occupants. Some said it took them a while to adjust to living in flats: "...it is difficult when you are the only one concerned...."

Property type impacted a few respondents, one lamenting: "I lived in one property back home in Germany and the municipality there had provided us with multiple bins... But living here in a flat is a constant struggle ... I only have one bin and am never asked why....it is difficult to recycle here".

ii. Advertising

Television was the most common media option among the respondents, who felt they learnt a lot from the news and documentaries pertaining to environmental issues. They felt that neither governmental nor non-governmental bodies implemented the medium to promote recycling as extensively as they should.

Nevertheless, municipalities are trying to use social media and pamphlets to create awareness for households to fully understand HRWS. Before the initiation of recycling bins in 2009, many respondents agreed they were unaware of such a system, due to poor advertising, and that pamphlets were too 'wordy', with few images. Municipalities had been aware of the problem during the first initiation of the recycling bins, and had tried to mitigate it during the inception.

iii. Education

The majority of respondents ($n = 8$) also agreed that recycling awareness should commence during the school curriculum. In Zhang et al. (2016), education was found to be an important attribute in recycling behaviour, and was perceived as helping to build pro-environment psychology structures underlying the recycling behaviour. One reason that the respondents ($n = 5$) with children had started to recycle at source was due to their children being informed on the benefits of recycling at school and sharing the information at home. The information given out at school gave a sense of responsibility to the parents to emulate good HRB, which became a habitual behaviour in most households. Some of the respondents mentioned that the recycling programmes were very sporadic and seasonal, and that they perceived them as non-aggressive actions taken by the municipalities. The education strategy of the municipalities was not persuasive enough, due to the dilemma they faced in setting recycling strategic programmes, because of the different autonomies running across the municipality sectors (the waste departments had no autonomy over the marketing aspects in schools). This deterred the harmonization of sustainability agendas across all sectors.

iv. Accessibility and Availability

Logistics factors such as accessibility and availability were the main factors that made the respondents habitually engage in recycling activities. In a recent study, distance to recycling facilities (accessibility) was considered correlated to recycling behaviour (Lange et al., 2014). They perceived that the lack of services supporting HRWS would eventually diminish HRB levels. One of the respondents had problems getting rid of her electrical items, since she did not own a vehicle to transport them, and for her, using public transport was "a huge hassle"

and very inconvenient. Many respondents wished the recycling *drop-off* centres were also accessible to pedestrians, and some of them were anxious about having pressure from the municipalities to recycle, which, in their opinion, was unbalanced in comparison to the availability of HRWS. However, recently the municipalities have moved isolated recycling facilities to more accessible distributed facilities. However, other situational factors have become prominent in determining the ease or difficulty in accessing recycling facilities (Zhang et al., 2016). For example, curb-side collection programmes and local drop-off services make recycling an easier option. In addition, access to all these services would be even more popular if their provision was stable and predictable (Timlett & Williams, 2008). In fact, the measurement of accessibility considers all the above services, or similar ones, in evaluating the ease in obtaining access to recycling facilities.

As one respondent said, “.... it is just not right when you are entrusted with responsibility to protect the environment, but the recycling bins are not available at public places....” A few of them pointed out that availability was not restricted to facilities alone (bins, drop-off centres, liners) but also covered the scheduling and pick-up services offered. Scheduling is quite a ‘hassle’ in some areas in the East Riding, due to the geographic background of certain villages; respondents said households here have to be attentive to the schedules and changes made by the municipalities via the website and letters or flyers.

v. Engagement

Engagement in recycling at source was considered important, as mentioned in Bhate (2005), where householders who are kept well-informed by the municipality are more likely to participate in sorting and separating the recyclates at home compared to those who have limited engagement with the municipalities (Timlett & Williams, 2008). In ERY and Hull, the year 2009 was when recycling initiatives were introduced in both municipalities, most respondents observing that the municipalities were quite slow in engaging it with the public. Many of respondents had limited knowledge of the introduction, and had struggled with the changes, some having to contact the municipalities for further explanation on the procedures. In both ERY and Hull, the first introduction used coloured boxes, and items had to be separated out into the designated boxes according to the types of recyclate.

Respondents were in agreement that they were not participating as much as they could, due to the inconvenience of the recycling schemes. Hence, both municipalities responded that the 2009 recycling scheme was unsuccessful, and they preferred the current co-mingled blue wheelie bin; garden/food brown bin, and, or food caddies, which they thought were more acceptable to households. In addition, municipalities then discovered that engaging with the public could lead to an effective integration concomitant; for example, when they involved the households in their pamphlet designs to encourage recycling, which has resulted in a useful and hands-on recycling manual.

In summary, both situational and personal factors interplayed within the qualitative inquiries. The notion of 'one without the other' surfaced predominantly implying that both factors are equally important to motivate HRB, promoting better recycling rates and effective HRWS. Even though the qualitative analysis in the first stage was only based on 14 respondents, the richness of the data enabled subsequent ethnography analysis (a type of qualitative analysis), and using Spradley's method of analysis.

4.3 Extended Analysis

Thematic analyses have addressed the RQs (RQ1, RQ2, RQ3) in this study. However, the richness of the qualitative findings suggested the need to extend the thematic analysis, using ethnography analysis, a type of qualitative analysis (as in Roulston, 2010) which looked at the semantic relationship between themes (Aronson, 1994) and helped to explain the existence of symbiosis effect between the municipalities and households. Ethnography analysis is a qualitative technique that is applicable not just in ethnographic studies, but can be used in many forms of qualitative research (Lincoln et al., 2011).

4.3.1 Conceptualization of Symbiosis Effect

In understanding the *symbiosis effect*, the thematic analysis has been extended, adapting Spradley's method of analysis, to convey a relationship within the case study. It is defined as domain analysis, which includes nine types of universal semantic relationship typology (Table. 4.3).

Strict Inclusion	X is a kind of Y
Spatial	X is a place in Y. X is part of Y.
Cause-effect	X is a result of Y.
Rationale	X is a reason for doing Y.
Location for action	X is a place for doing Y.
Function	X is used for Y.
Means-end	X is a way to do Y.
Sequence	x is a step (stage) in Y.
Attribution	X is an attribute (characteristics) of Y.

Table 4.2: Universal Semantic Relationship Typology adopted from Spradley (1979)

Following the qualitative analysis (Roulston, 2010), the following sections maintain a qualitative approach in analysing the findings, where the semantic relationship is the meaning conceived from the 14 respondents' discourses. The first type of semantic relationship which existed in this study was cause and effect (X is a result of Y, X is a cause of Y: X is HRB and Y is engagement of the recycling facilities by the municipalities). An increase of HRB is a cause of better engagement from the municipalities. Most respondents had some knowledge of recycling, were somewhat aware of their consumption patterns, and what they placed in their bins.

Those who had experienced the transition from the one bin scheme to the new three bins scheme introduced by the local authorities were initially reluctant to participate, due to a perceived lack of effort to engage residents by their municipalities. However, over time, the municipalities did improve their engagement and communication, which subsequently led to an increment of HRB, as perceived by the 14 respondents. The second type of semantic relationship was rationale (X is a reason for doing Y: X is marketing and logistics initiatives by the municipalities and Y is recycling), whereby using an effective media to boost encouragement on recycling and the availability of HRWS are reasons why the households are into recycling. This scenario supported the symbiosis or interdependencies between systems and behaviour. Some of the respondents were from Germany, a country which has a very systematic waste and recycling management system, and they expressed an affective/emotional motivation that Burgess et al. (1998) defined as 'guilt' for not recycling as much as they would have in their home country.

This may be due to the stimuli from current local authority logistics and marketing initiatives for recycling behaviour were not as aggressive as they had experienced previously. This ethnography analysis has been cross-examined with the quantitative findings to further explicate the emergent of the symbiosis effect in the second phase of SED, which will be discussed in the next section of the quantitative phase. The categorization from the thematic analyses was used for the quantitative inquiries (questionnaires), and later piloted for further refinement in language and structure usage, and extended to the next phase of quantitative survey.

4.4 Development of theoretical framework

Initially, the conceptual framework (Chapter 1) was conceptualized in a preliminary round of gap-spotting in the literature review phase. The advantage of the stages in SED enables the researcher to make preliminary analysis on the assumptions and proposed model or framework (Creswell, 20008; Teddlie & Tashakkori, 2009). Hence, the revised version of the theoretical framework is based on the thematic analyses in tabulation and mapping in accordance with two primary factors (situational and personal factors) and real data. Some of the themes have their commonality confirmed in HRWS, and some were new aspects with implications on future recycling research. For example, most of the literature discussed engagement between municipalities and households (Barr et al., 2013; Hadjimanolis, 2013); however, in this finding, both municipalities and households agreed that the engagement goes beyond the concomitants, and extends to the retailers, universities and other organizations within geographic proximity of the respective municipalities.

Nevertheless, this study only explores the direct relationship between the municipality and its households. Thus, the additional key players within the scope of HRWS offer a prospect for future research. The thematic analyses and the ethnography analyses have highlighted some confirmatory (confirmed factors) and emergent (new factors) aspects that may contribute to the symbiosis perspective in understanding the relationship between the municipalities and its households (Fig. 4.2). The confirmatory aspects are labelled (C) and the new emergent aspects are labelled (E) in Figure 4.2 (below).

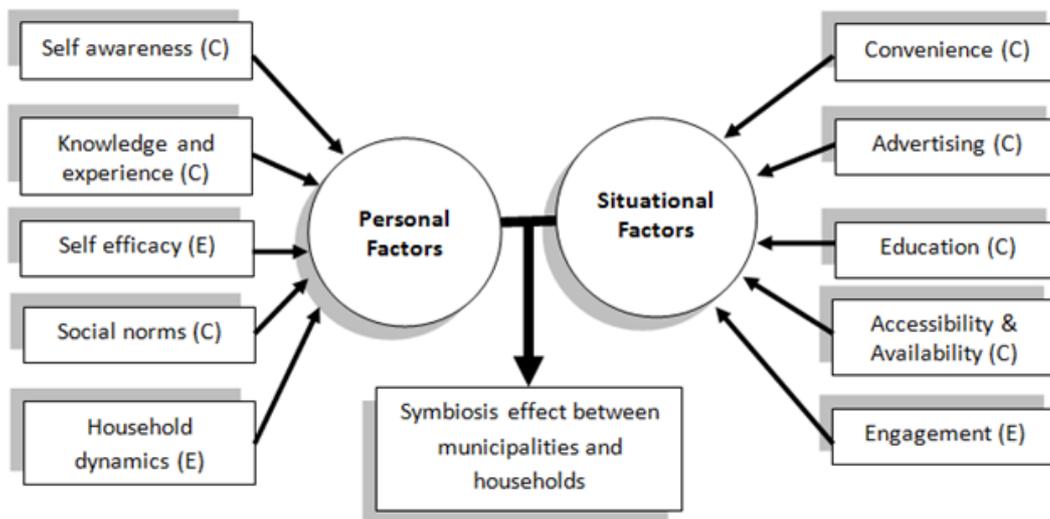


FIGURE 4.2: New conceptualization of symbiosis effect with relevant aspects in respect to personal and situational factors based on first stage Qualitative Phase I analyses.

In summary, Stage 1 of Qualitative Phase I has addressed the presupposition of ‘symbiosis effect’ between households and the municipality. The equally important factors (situational and personal) needed to be symbiotic in nature in order for the HRB to progress positively. Therefore, HRWS is considered effective and the reverse logistics is capitalized. The deliverables from this stage assisted the development of quantitative instrument in Stage 2 when addressing the RQs.

4.5 Stage Two: Quantitative Phase Analysis

This section discusses the major findings of the quantitative phase from Stage 2 of the SED (Fig. 4.3). The discussion concentrates on thoughts from the households on two factors: situational and personal. The section starts with a data screening process, which is crucial in searching abnormalities in data reporting, such as coding and inputting. The data is then checked for reliability and validity using Cronbach’s alpha and factor analysis.

Initial descriptive analyses are then presented to inform and describe the variables in the quantitative survey.

This is followed by cross-tabulation to summarise categorical data in the contingency table; next, the correlation analyses explain the emerged relationship between situational and personal factors. The final substantive analyses include multivariate, multiple regression and logistics regression, which examined both situational and personal factors associated with the household recycling behaviour. Since this survey derived from the qualitative phase, the findings are potentially relevant to both aspects (situational and personal factors) in HRWS for supporting the conceptualization of the symbiosis which emerged in this study.

<p>Stage 2: Quantitative Phase</p>	<ol style="list-style-type: none"> 1. Demographic Analysis 2. Reliability and Validity 3. Multiple Regressions 4. Power Analysis
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FIGURE 4.3: Stage 2 Quantitative Phase Steps of Analysis

4.5.1 Data Screening: Missing Values, Outliers and Normality

The quantitative data acquired at this stage needed to be screened so as to identify any abnormalities which commonly occur in data input processes (Pallant, 2010), for example, missing data and outliers. These particular processes are important to ensure the appropriateness of the data for further analysis within the overall research design (DiLalla & Dollinger, 2006). A total of 1000 postal surveys were distributed to both areas (500: East Riding of Yorkshire and 500: City of Hull), where each postal survey was distributed per household or dwelling (i.e. to the current occupier). A total of 222 questionnaires were returned, of which 10 were unanswered and had to be separated as missing values. Therefore, 212 questionnaires (Hull: 123 and East Riding of Yorkshire: 89) were usable; and with the online survey, only 200 respondents completed the questionnaires. Both types of data collection were consolidated for screening outliers and normality testing.

The accuracy of the results in the main analysis was ensured by analysing the descriptive, frequency and exploration data involved in the 412 cases (Postal: 212 and Online: 200).

The questionnaire comprises one negative statement item (Item 14). Thus, this item had to be re-coded to reverse score (Hartley, 2014; Hinkin, 1995). Therefore, the negative statement item scores were re-coded manually by reversing rating items; in this case, it was the original item scores converted to a low score (Pallant, 2010; Clark & Watson, 1995). Next, the data was checked for outliers (where one or more observed data is distinctly unique from the overall observation) (Tan, 2014; Saculinggan & Balase, 2013).

This analysis uses data descriptive analyses, including the frequency tabulation, to seek normality of the observed data (Saculinggan & Balase, 2013; Shapiro et al., 1968). Therefore, any data located outside the range and the skewness of observed data and kurtosis z-values should be somewhere in the span of -1.96 to +1.96, as suggested by Field (2001) and Bulmer (1979), which should show a normal distribution.

The 412 cases were then tested using the Kolmogorov Smirnov and Shapiro Wilk test with alpha level of 0.05; however, the result showed a rejection of null hypothesis ($p < 0.05$) which means that the sample distribution was outside the normality assumption (Saculinggan & Balase, 2013; Hair et al., 2009). This study has 412 cases which are considered as a large sample size ($n > 50$) (Field, 2009; Shapiro et al., 1968); therefore, visual inspections such as histograms, normal Q-Q plots and box plots have been applied, since they are relevant to screen normality (Field, 2001; Jarque & Bera, 1987). Due to the Kolmogorov Smirnov and Shapiro Wilk test, which is considered overly sensitive for larger sample sizes, a visual inspection was necessary in this study (Zhou & Shao, 2014; Saculinggan & Balase, 2013; Jarque & Bera, 1987).

4.5.2 Reliability and Validity

Before the actual statistical analyses have been completed with raw data, the screening process has to be implemented to eliminate the missing values, using frequencies and normalization graph.

Factor analysis was run in this study to identify commonality between variables that had interrelationship which involved multidimensional independent variables, and a dependent variable (Hair et al., 2009).

Factor analysis has the ability to produce meaningful patterns among the set of variables in matrices, representing the interrelations of attributes in a chosen population (Thompson, 2004; Lawley & Maxwell, 1971). Choosing 'the right rule-of-thumb' was important to proceed effectively in this analysis, for a sample size of more than 300 cases (Tabachnick et al., 2001).

However, Hair et al. (2009) suggested this could also be used for a sample size of more than 100 cases, and both agreed a recommendation for minimal correlation coefficients of over 0.30 whereby: ± 0.30 = minimal; ± 0.40 = important and ± 0.50 = significant (as in William et al., 2010). This factorability of 0.30 indicated the factors accounting for approximately 30% relationship within the data (shares the majority variances). Hence, it reflects a third of the variables which have higher variances attributes. Thus, it is ineffective to impose the variables that are correlated in-between items or expose to multicollinearity where two or more predictors are highly correlated. Furthermore, factor analysis enables items which are in the common factors group and therefore, by using this analysis, it is easier to construct reliability analysis before extending to statistical analysis to represent the latent variables.

To ensure inter-item internal consistency, it is recommended to measure internal consistency by conducting a test with Cronbach's alpha for the coefficients (Henson, 2001; Tucker & Lewis, 1973). This test indicates the homogeneity of items in the measurement, measuring the latent variables that imply a variable, or a set of variables consistently measures what it has intended to measure (Yi & Gong, 2013). The Cronbach's alpha test validates the prior test of factor analysis in order to abstain from high correlation between items of measurement (variables).

Therefore, items that represent situational factors measure situational responses, and, vice versa, items that represent personal factors measure personal responses. A reliability analysis was conducted on the scales used to measure items of personal and situational factors. As a general rule-of-thumb, Cronbach's Alpha reliability value is acceptable at more than 0.60 (Clark & Watson, 1995). Nevertheless, Nunnally (1978) recommends that instruments used in basic research have a reliability of about 0.70 or higher. In trying to

promote robustness in the reliability testing, this study also applied a computational method using the Monte Carlo (MC) Simulation: parallel analysis (Field, 2001; Harwell, 1992) to indemnify some assumption violations (non-normality) on the statistical tests. The items of each construct in this study, following the factor and reliability analysis, later the same items computed in MC simulation software.

According to this study, factor analysis revealed homogeneity of items in a single questionnaire and could also determine the items at 70% and above KMO level; $p < 0.05$ Bartlett significant value. It was consistent when cross-validated using MC computation (Table 4.3). The process of quantitatively integrating MC results is similar to meta-analyses in any other social science empirical research; thus, the relevance to the statistical theory that projects the effects of assumption violations and that is prevalent for the statistical tests selection (Kisbu-Sakarya et al., 2013; Harwell, 1992). The test was further validated by the qualitative analysis and the previous empirical studies, since the items were based on *a-priori* instrument.

Factor analyses, reliability test and MC simulation were also used to assess the goodness of measures for validity and reliability (Vehkalahti, 2000). This is similar to psychometric cogency discussion in Nunnally (1978) and Peter and Churchill Jr. (1986). Therefore, the reliability and validity of the constructs were measured by the direct input of all 52 items using the Likert's scale. The reason not to group according to the variable representation (personal or situational factors) and run the above mentioned tests was due to the inconsistency of suggestions for subjects or items per variable in social science literature (Field, 2001; Habing, 2003; Thompson, 2004; Field, 2009).

Therefore, using MC in complementing those statistical tests was highly recommended, as it resulted in more specific statements concerning the sample size (Field, 2001; Habing, 2003). Thus, this study revealed a reliable inter-item measurement at $\alpha = 0.806$, satisfying Nunnally's (1978) recommendation) (Table. 4.4).

Furthermore, either test of validity (factor analysis and MC computational) showed both eigenvalue of 1 or more at 25 items which is reliable for quantitative analysis.

Item	Reliability Test (α)	Validity Test: KMO and Bartlett's Test (Sig)	Parallel Analysis using Monte Carlo for Validity
52 (Likert Scale)	0.806	25 items at eigenvalue of 1 and PCA(v) extraction of 0.4 and above	25 items at eigenvalue of 1
		KMO: 0.834 BARTLETT: 0.000	

*eigenvalue means consolidate variances in one test

Table 4.3: Reliability and Validity test for measurement

In summary, the reliability and validity measures are important to address before the actual analysis has been done. This is to avoid Type I and II errors. Therefore, precautionary measures were taken in this study so as to comply with some of the 'rules-of-thumb' in previous social science work (Field, 2009; Hair et al., 2009; Cohen et al., 1983).

4.6 Quantitative Analyses and Results

The next section begins by describing the demographic background of the sample from the population, and progressing towards in-depth statistical analysis, for which this study applied multivariate analyses, multiple regressions and logistics regression. The particular analyses were required to address the RQs (Table 4.4), which is relevant to the quantitative approach in investigating the trends and patterns prevalent in understanding the situational or personal factors as pre-condition aspects in the interaction between householders and HRWS. This section only reports on the findings from the quantitative analysis. The discussions on the findings appear in Chapter 5.

Research Question (s) addressed in the Quantitative instrument RQ	Concepts Investigated	Items
RQ1: What is the reason behind the HRB between different municipalities?	Personal factors	11
RQ2: What are the different factors associated with household recycling systems that may affect HRB?	Situational factors	16
	Personal factors:	10

	Population Profile(s)	
RQ3: What are the interactions and symbiosis effects and the conditions that support the symbiosis between household recycling systems and household recycling behaviour?	Interaction	28

Table 4.4: RQs and Concepts Investigated in Quantitative Analysis

4.6.1 Personal Factor: Demographic Analyses (Table. 4.6)

The descriptive analysis begins with the demographic analyses by means of the analysis of a descriptive profile sample of a population with regard to the socio-economic background. Hence, it was essential for this study to know the demographic background, since it is part of the personal factor, which is considered as one of the major constructs for inferential statistical analysis in further sections. A preliminary analysis of the data reveals that the samples were composed of a majority age group from 51 or older (36.7%) and that the female respondents were composed of 61.9% compared to the males at 38.1%.

Some studies have shown that knowledge of recycling waste results in a positive inclination to sort and separate at source (Babaei et al., 2015), and this study found that most of the respondents had more than four years of recycling experience (74.5%). These 75% respondents had had some experience of voluntary recycling before the inception of the 2009 recycling scheme. ERY and Hull recycling schemes were similar in urbanized areas, where they mostly used co-mingled bins and general bins, as well as food waste/garden waste bins (food waste bins were usually only for non-garden properties in both areas). However, while a greater number of ERY areas are either suburban or rural, the recycling schemes are similar to the urbanized areas, although the scheduling of recycling waste collection is not the same (ERY, 2012; Hull, 2012).

This study found that most of the properties were located in urbanised locations (55.6%) and that the majority of respondents had been living in the same property for more than four years (69.4%). In addition, most of the properties had a garden (73.5%), and most of the households were more than double occupancies (48.6%). Almost half of the sample population was from the East Riding of Yorkshire (46.6%) and half from the City of Hull

(53.4%). More than 50% of the respondents were currently working (50.7%) and the rest were either studying (25.5%) or on pension scheme (20.1%).

Some studies revealed a deprivation level using income level as the unit of measurement to determine HRB performance (Ashenmiller, 2009; Woodard et al., 2004). Demographic analyses in this study excluded income level as a unit measurement, due to previous studies having found inconsistency as a strong predictor (Miafodzyeva & Brandt, 2013; Bhate, 2005). However, a recent HRB study found that demographic background, including income level, was not a strong predictor of HRB (Miliute-Plepiene et al., 2016). Hence, this study used demographic profiles for controlling the representativeness of the sample in a population.

Item	Frequency	Percentage	
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	
Total	412	100	
Item	Number	Percentage	
Gender			
Male	157	38.1	
Female	255	61.9	
Total	412	100	
Item		Number	Percentage
Recycling Experience (years)	More than 4 yrs.	307	74.5
	Less than 4 yrs.	105	25.5
	Total	412	100
Living in current property (years)	More than 4 yrs.	286	69.4
	Less than 4 yrs.	126	30.6
	Total	412	100
Country of Birth	Number	Percentage	
United Kingdom	277	67.2	
Other	135	32.8	
Total	412	100	
Status	Number	Percentage	
Student	105	25.5	
Working	209	50.7	
Pensioner	83	20.1	

Others	15	3.6
Total	412	100
Type of Residential Area	Number	Percentage
Urban	229	55.6
Suburban	154	37.4
Rural	29	7.0
Total	412	100
Property Type	Number	Percentage
Flat/Studio/Apartment	52	12.6
House with Garden	303	73.5
House without Garden	57	13.8
Total	412	100
Number of Household	Number	Percentage
Single Occupant	76	18.4
Double Occupants	136	33.0
More Than Two Occupants	200	48.6
Total	412	100

Table 4.5: Demographic Background

4.6.2 Personal Factors: Chi-Square Tests

The demographic analysis in the previous section has shown the background of the chosen sample from a population. In this particular section, the analysis is taken further to evaluate the difference between two distinct municipalities. In the earlier stage of the Qualitative Phase I, analyses, the proposition of the symbiosis effect and an update of a new theoretical framework have been described thoroughly. Hence, for the quantitative analysis to adhere to the mixed methodology approach, the flow of the analysis is described by following the theoretical framework underlined by the relevant RQs. The first section of the analyses addressed **RQ1: What is the reason behind the HRB between different municipalities?** In this section, chi-square tests are used to address the RQ1, and the details of the cross-tabulation and chi-square tests can be retrieved from Appendix G. The analyses are focused on aspects of the personal factors (self-awareness, knowledge and experience, social norms, self-efficacy and household dynamics).

In the earlier chapters, a preliminary understanding based on literature reviews (Abbot et al., 2013) showed that the geographical and socio-demographical differences of a region result in a totally different recycling propensity. It assumed that the geographical and demographical differences between the residents residing in the East Riding of Yorkshire

and the City of Hull may show differences in thoughts and views in the scope of HRWS. First, this study applied chi-square tests to investigate the relationship between demographic factors for both municipalities in relation to recycling experiences (Table 4.6).

The findings show (Table 4.7) that most of the demographic factors have a significant relationship ($p < 0.05$) with householders' recycling experiences, with the exception of gender differences and the number of dwellings/households ($p > 0.05$). In addition, the type of residential area is not significant to Hull Council ($p > 0.05$), but is significant to ERY Council ($p < 0.05$), with a weak relation between the residential area and recycling experience in relation to the different municipalities. Next, in the analysis on the personal factor differences of both municipalities, the findings show (Table 4.7) that no significant relation was found between municipalities and personal factors ($p > 0.05$). Hence, both municipalities had weak relations, or no conclusive relations with the personal factors of their householders. This is supported in Miafodzyeva et al. (2013) and Miliute-Plepiene et al. (2016), where variables such as socio-demographic factors are considered a weak predictor in the initiation of HRB, if these variables are tested in isolation.

Details of the cross-tabulation between demographic factors and recycling experience are found in Appendix G.

Demographic Factor(s)	Recycling Experience (n=412)			
	HULL		EAST RIDING OF YORKSHIRE	
	Pearson Chi-Square (Sig.)	Spearman Correlation (value)	Pearson Chi-Square (Sig.)	Spearman Correlation (value)
Age	0.000	0.284	0.000	0.331
Gender	0.158	0.117	0.193	-0.112
Living in current property (years)	0.000	-0.149	0.000	-0.015
Country of Birth	0.000	-0.347	0.000	-0.322
Working Status	0.000	0.321	0.001	0.194
Type of Residential Area	0.267	0.056	0.031	0.207
Property Type	0.000	0.040	0.001	0.137
Number of Household	0.190	-0.046	0.074	0.064

Table 4.6: Chi-Square Test on Demographic aspects of HRB based on Municipality

Next, in the analysis on the personal factor differences in both municipalities, the findings show (Table 4.7) there was no significant relation between municipalities and personal factors ($p > 0.05$). Hence, both municipalities had weak relations or no definite relations to the personal factors of their householders.

Personal Factor(s)	Council	
	Pearson Chi-Square (Sig.)	Spearman Correlation (value)
Self-Awareness	0.879	-0.031
Knowledge and experience	0.201	-0.050
Social Norm	0.553	0.009
Self-Efficacy	0.836	0.018
Household Dynamic	0.194	0.039

Table 4.7: Chi-Square Test on Personal Factors of HRB based on Municipality

In the previous literature, recycling items which are cardboard-based, paper-based, metal or alloy-based, glass bottles and plastic-based are commonly found in the UK households recycling stream (WRAP, 2010). In this analysis (Fig. 4.5), the most common recycled materials, such as glass, newspaper and plastic items, were categorized as ‘regulars’ in the household recycling routine (more than 90%), together with packaging material and cardboard boxes; white A4 paper and tin cans were also easily sorted for recycling in the household (more than 80%). Around 78% of the 412 households recycled aluminium materials, and under 60% recycled clothing and textiles, which, some of them noted in the questionnaires, were given to charity. Other materials that households recycled were vehicles parts, outdated electrical products, old furniture and garden waste or by-products, which comprised less than 21% out of the 412 households.

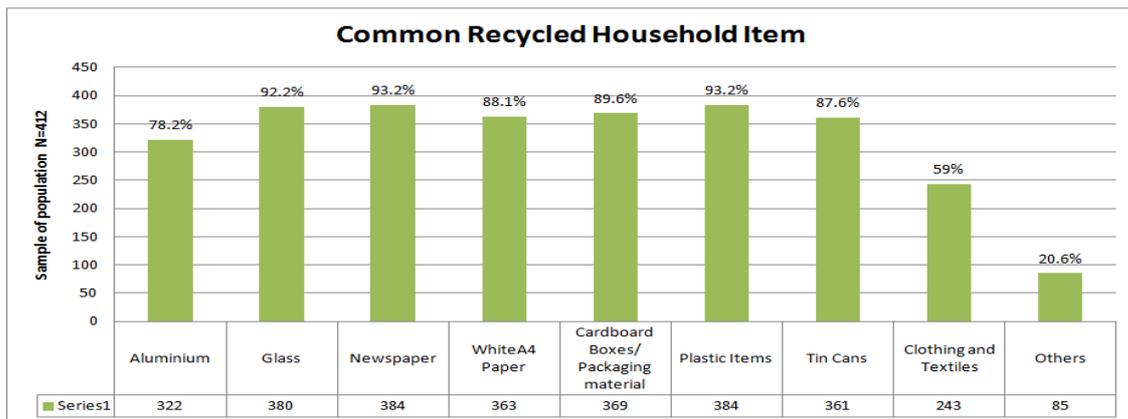


Figure 4.4: Common Recycled Items

When comparing the commonality of recycling between municipalities, both municipalities recycled different materials in similar proportions (Fig. 4.6). However, in the option 'others', City of Hull households were inclined towards 'up-cycling', such as re-using most of the recycling items, or giving those items to their extended families or friends. The East Riding of Yorkshire households were more likely to send their reusable items to various charities.

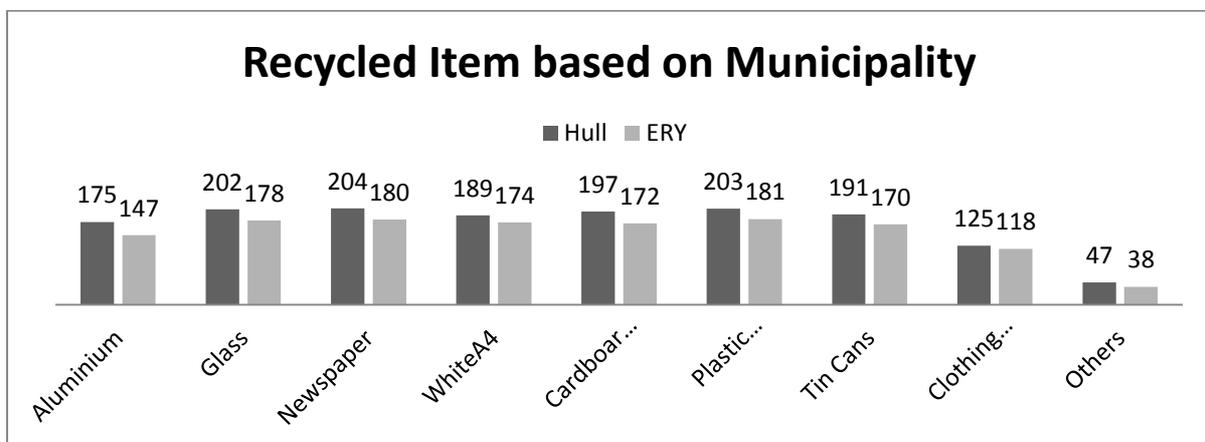


Figure 4.5: Recycled Items based on Municipality

To further analyse the relationship between residential areas with common recyclates, recycled based on municipalities, as well as the relationship between property types and common recyclates recycled, the same chi-square tests are applied (Table 4.8).

Type of Recyclates	Council			
	Area Type (Urban/Sub/Rural)		Property Type (flat/with Garden/ wo Garden)	
Pearson Chi-Square (Sig.)/ Spearman Correlation (value)	Hull	ERY	Hull	ERY
Aluminium	0.719	0.404	0.708	0.107
	0.042	-0.009	0.018	0.101
Glass	0.546	0.750	0.748	0.214
	-0.005	0.004	-0.015	-0.075
Newspaper	0.214	0.606	0.717	0.116
	-0.019	0.009	0.053	-0.123
WhiteA4	0.066	0.300	0.233	0.375
	-0.079	-0.019	0.031	-0.101
Cardboard Boxes/Packaging Material	0.787	0.581	0.228	0.615
	0.036	0.007	0.070	-0.030
Plastic Items	0.701	0.519	0.038	0.810
	-0.045	0.071	0.119	0.003
Tin Cans	0.055	0.793	0.053	0.391
	0.106	-0.043	0.008	-0.060
Clothing and Textiles	0.543	0.991	0.641	0.663
	-0.024	0.009	-0.010	-0.034
Others	0.651	0.086	0.640	0.413
	0.062	0.087	-0.015	-0.031

Table 4.8: Chi-Square Test on Residential Areas and Property with Common Recyclates of HRB based on Municipality

Table 4.8 above shows there is no statistically significant association between recyclates type with area type or property type based on municipality ($p > 0.05$), with only one exception of the plastic item with a weak relation that was significantly associated with property type in Hull ($p < 0.05$). Referring to the same table, the correlation of the association between recyclates with either area type or property type based on the municipality is very weak or veering towards no relation (the value is towards zero). However, some of the correlation is either negative or positive, depending on the municipality. The examples are highlighted in the table (Table 4.8).

The Chi-Square analyses in this section have shown that the relationship between demographic attributes and personal factors is not significant, or is very weak in both

municipalities (Hull and ERY). Hence, RQ1 has been addressed, that there is very limited, or no association between demographic profiles and personal factors within difference municipalities.

4.6.3 Control Questions: Inter-Reliability

Items used as control questions	(Questionnaire pages 3 and 4)
It is good that the environment is taken more into account, and personally for me, it is a disadvantage that more effort is expected to protect the environment.	
It is good that the environment is taken more into account, but personally for me, it is an advantage that I can now increase my effort to protect the environment.	

Table 4.9: Control questions used for reliability

The control item (Q14 and Q15) in the questionnaire development went through a pilot stage to address labelling of response scale options (agreement continuum and frequency continuum, etc.) (Lietz, 2008). The specific questions were developed not to directly investigate any aspects from the personal factors of HRB (Table. 4.10), but to ensure that the respondents read and accordingly replied to all the survey questions (Bradburn et al., 2004). The control items were calculated for reliability testing (Table. 4.11), whereby the test satisfied Nunnally’s recommendation (0.70 and above).

Reliability Statistics	
Cronbach's Alpha	N of Items
0.719	2

Table 4.10: Inter-reliability Test

4.6.4 Personal and Situational Factors: Correlation Analysis

Earlier sections have described the aspects of personal factors (self-awareness, self-efficacy, knowledge and experience, social norms and household dynamics) in HRB, using descriptive analysis.

In this category, the aspects derived from situational factors (convenience, engagement, accessibility and availability) and the aspects from personal factors are explored to pursue correlation and predicting values. Hence, to investigate the symbiosis effect between HRWS and HRB, the analysis starts with correlation, as this method explores the existence of a relationship between HRWS and HRB.

Appropriate analysis, such as multiple regressions, could be applied as the ‘correlation’ and satisfied (Field, 2009; Cohen et al., 1983). The RQs addressed in this section were as follows (Table. 4.12):

Research Question (s) addressed in the Quantitative instrument RQ	Concepts Investigated	Items
RQ2: What are the different factors associated with household recycling systems that may affect HRB?	Situational factors	16**
	Personal factors: Population Profile(s)	10*
RQ3: What are the interactions and symbiosis effects and the conditions that support the symbiosis between household recycling systems and household recycling behaviour?	Interaction	28**
Personal and Situational Factors: Measurement used in Questionnaire design * Item 1 - 11 are labelled as personal factors (Questionnaire page 1- 4) ** Item 12 - 52 are labelled as situational factors (Questionnaire page 5 - 6)		

Table 4.11: RQs addressed in Correlation Analysis

In this section, the research questions can be answered by initial understanding of the existence of a relationship between personal and situational factors, followed by the analyses progressing to substantive analysis (multiple regression, logistic regression and multivariate). The correlation of Pearson is used to analyse the direction and strength of the relationship between two or more variables, as well as indicating whether two or more variables are co-varied (Lee Rodgers & Nicewander, 1988; Cohen et al., 1983). This analysis is applied in order to test the relationship between the demographical aspects and personal factors (Items 1-11).

And to test the relationship between situational factors (engagement, accessibility and availability, convenience) with demographical factors and a *combination* of personal factors, Items 1–11 were transformed to one composite factor. Composite factors or variables are formed because the composite represents the multidimensional concept of an attribute (McGregor, 1992), i.e. in this study the personal and the situational factors.

Pearson's correlation analysis started when all items that constituted personal or situational factors were formed into relevant composite factors, and then statistical correlation was tested on the mentioned composite factors, as well as demographic items. The items which tested at more than 0.05 significant level were omitted for further analyses. The correlation table between these two factors is shown in Table 4.12.

It indicated that personal factors have a significant relation with situational factors ($p < 0.01$) with positive correlation ($r (412) = +0.41$). Four demographic items (age, marital status, employment and number of years' recycling) had a positive relation with both factors ($r (412) > +0.10$), and correlation between personal factors with those four demographic items had a significant relation ($p < 0.01$). However, household employment had a significant level, at ($p < 0.01$) on situational factors, and household age and marital status were at ($p < 0.05$) significance level, recycling experience having no significant relation with the situational factors.

Factor(s)	PEARSON'S CORRELATION					Sig. (2-tailed)
	Situational	Age	Marital Status	Employment	Number of Years Recycling	
Personal*	0.408	0.242	0.197	0.230	0.154	0.00
Situational*	1	0.104	0.120	0.168	n.s	0.01

*Both factors are formed into composite factors (i.e. Item1 + item2+..)

Table 4.12: Correlation Table

The composite personal factors, with the exception of personal knowledge and number of years of householders' recycling experience, were extended to individual attributes of situational factors (engagement, convenience, accessibility and availability) (Table. 4.14). Individual knowledge and recycling experience were considered as central components from personal attributes based on previous empirical studies on HRB (Woodard et al., 2006). The result shows the engagement from the municipalities ($r (412) = +0.71$) implying a strong correlation, as well as personal knowledge ($r (412) = +0.77$) with personal factors at p -value < 0.00 . Convenience was moderately correlated ($r (412) = +0.44$) at p -value < 0.00 ; however, accessibility and availability ($r (412) = +0.27$), as well as the householders'

recycling experience ($r(412) = +0.11$) had weaker correlation with personal factors at $p\text{-value} \leq 0.01$.

Knowledge or experience of a householder with regards to what they consumed, and in relation to post-consumption, such as how the item had been disposed of or taken care of, was considered critical when the consumers become more knowledgeable on what they consumed or disposed of, drastically influencing their HRB (Culliberg, 2014; Park & Ha, 2014; Thomas et al., 2013). The knowledge and experience of householders encompassed buying and recycling habits (looking at labels for recycling or disposal information) and sorting and separating routines at source (Thøgersen, 2006; Stern, 2000; Thøgersen & Grunert-Beckmann, 1997). When this study correlates personal factors, such as knowledge and experience, with the situational factors, the personal knowledge shows strong correlation with engagement from the municipality at ($r(412) = +0.60$) at $p\text{-value} < 0.00$, but weaker relation with convenience ($r(412) = +0.38$), accessibility and availability ($r(412) = +0.38$), as well as the householders' number of years of recycling ($r(412) = +0.02$) at $p\text{-value} \leq 0.01$.

The number of household recycling years had weak correlation with all attributes in situational factors at a significant value of 0.00. Pearson's analyses indicate that there is a relationship between personal and situational factors with positive direction. The correlation analyses on knowledge and experience coincide with Babaei et al. (2015), who suggested that recycling knowledge has a strong relation with HBR (2015).

Pearson's Correlation (Sig.)						
Item/factor (s)	Personal	Engagement	Knowledge and Experience	Convenience	Accessibility and Availability	Number of Years of Recycling
Personal	1.000 (0.00)	0.705(0.00)	0.767(0.00)	0.441(0.00)	0.272(0.00)	0.113(0.01)
Knowledge and Experience	0.767(0.00)	0.596(0.00)	1.000(0.00)	0.382(0.00)	0.381(0.00)	0.019(0.01)
Number of Years in Recycling	0.113(0.00)	0.108(0.00)	0.019(0.00)	0.039(0.00)	0.077(0.00)	1.000

Table 4.13: Correlation

The correlation analyses showed in retrospective that personal and situational factors were interdependent towards householder knowledge and experience, and number of years' recycling. Past literature supported that demographic attributes are central components of personal factors, which is consistent with the given analyses on the given sample of population ($n=412$). Personal and situational factors showed a positive relation with significant (p) in the correlation measure, which is a sufficient outcome to extend the analysis to multi-regression, whereby the particular correlation can be addressed as a causal relation to determine the symbiotic relation between personal and situational factors.

4.6.5 Findings that addressed RQ2 and RQ3 (Multi-Regression)

This section reports on the underpinning factors behind the symbiosis effect between the households and municipalities. Underpinning factors in previous literature notified the attitude changes (HRB) prior to attitudinal factors (Barr et al., 2013) and situational factors are not clearly defined as central predictors (Abbott et al., 2011). This study uses RQ2 and RQ3 to address the quintessential question of whether both personal and situational factors are in fact interdependent, which depicts the symbiotic nature of both factors.

Hence, multi-regression analysis was selected to examine whether personal factors interacted with situational factors (engagement, availability and accessibility) and to test whether engagement (communication) moderated the relationship between personal and situational factors. The process began with entering the sets of predictors into the regression block, which in this study were considered as situational factors with demographical items.

As mentioned earlier, the correlation analyses demonstrated the existence of bivariate relationships of personal and situational variables with significant tendency. This analysis was suggested by Field (Vanneste et al., 2013; 2001) in addressing the strength and direction between variables before proceeding to multiple regression. Multi-regression testing was also used to reveal the existence of confounding variables (demographical items) in association with either personal or situational factors (engagement, accessibility

and availability). This analysis was relevant in addressing examination of the relationship, using the information from the independent variables, which would improve the accuracy in predicting values for the dependent variable, as recommended by numerous authors (Cleff, 2014; Ramkissoon et al., 2013; Field, 2009).

Afterwards, an F-test was used to determine if the relationship could be generalized to the population represented by the sample, and a T-test was used to evaluate the individual relationship between each independent variable and the dependent variable. In addition, multiple regression analysis is a statistical analysis that provides an understanding of how much variance in the dependent variable is explained by independent variables (Sekaran & Bougie, 2010). The usage of ANOVA was to seek the variances in population means as well as supporting the overall multiple regression analyses. Based on correlation analyses (Table. 4.14), there were some positive relations between personal and situational factors. However, it cannot be determined whether the existence of situational factors influenced the personal factors which later determined the overall HRB.

Therefore, using multiple regressions for both factors and demographical items could assist in understanding more about the relationship between predictor variables (situational) and a dependent or criterion variable (personal). When the personal factors were predicted (Table. 4.28), it was found that situational factors ($\beta=+0.41$, $p < 0.01$) were significant predictors. Moreover the demographic items, such as age ($\beta=+0.20$, $p < 0.01$), marital status ($\beta=+0.15$, $p < 0.01$), employment ($\beta=+0.166$, $p < 0.01$) and number of years of recycling ($\beta=+0.123$, $p < 0.01$) were considered as significant predictors as well.

Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig.
	B	Std. Error	Beta		
1 (Constant)	41.7	2.15		19.399	0.00
Situational Factors	0.167	0.018	0.408	9.057	0.00
2 (Constant)	39.200	2.170		18.061	0.00
Situational Factors	0.158	0.018	0.387	8.750	0.00
Age	0.977	0.215	0.201	4.551	0.00
3 (Constant)	39.956	2.186		18.277	0.00
Situational Factors	0.160	0.018	0.390	8.701	0.00
Marital Status	1.426	0.426	0.150	3.351	0.001

4 (Constant)	40.283	2.152		18.719	0.00
Situational Factors	0.156	0.018	0.380	8.448	0.00
Employment	1.353	0.367	0.166	3.686	0.00
5 (Constant)	38.795	2.380		16.302	0.00
Situational Factors	0.163	0.018	0.399	8.888	0.00
Number of Year Recycling	1.260	0.458	0.123	2.750	0.006

Table 4.14: Multiple Regression Model Coefficient Table

The results in the coefficient table (Table 4.14) show that situational factors and some demographic aspects within the personal factors were equally significant predictors that influenced overall personal factors (within HRB). Nevertheless, the overall model fit was $R^2 = 0.218$ (Table 4.16). The main effect of the situational factors was significant when applying univariate ANOVA (Table. 4.17), $F(1, 410) = 82.03$, $MSE = 33.44$, $p < 0.01$ as the main effect of age $F(1, 410) = 25.43$, $MSE = 37.79$, $p < 0.01$, marital status $F(1, 410) = 16.58$, $MSE = 38.57$, $p < 0.01$, employment $F(1, 410) = 22.86$, $MSE = 38.01$, $p < 0.01$ and number of years of recycling $F(1, 410) = 10.01$, $MSE = 39.17$, $p < 0.01$.

Based on the model fit (Table 4.15), it is shown that situational factors had an affect primarily regarding age group, marital status, employment and number of years of recycling. For example, different age groups reacted differently towards situational cues. However, the reaction was positively related to improvement in household recycling behaviour, rather than negatively implicated. In addition the ANOVA shows that situational factors were strong predictors of variation in marital status, employment status, age group and/or number of years the households had been recycling (Table 4.16).

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.455	0.207	0.203	5.648
2	0.460	0.211	0.206	5.639
3	0.464	0.215	0.207	5.633
4	0.467	0.218	0.209	5.629

Table 4.15: Multiple Regression Model Fit

ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	960.799	1	960.799	25.427	0.00
	Residual (age)	15492.199	410	37.786		
	Total	16452.998	411			
	Regression	639.494	1	639.494	16.580	0.00
	Residual (marital status)	15813.503	410	38.570		
	Total	16452.998	411			
	Regression	868.746	1	868.746	22.855	0.00
	Residual (employment)	15584.252	410	38.010		
	Total	16452.998	411			
	Regression	391.910	1	391.910	10.005	0.002
	Residual (num. year recycling)	16061.087	410	39.173		
	Total	16452.998	411			

Table 4.16: Multiple Regression Univariate ANOVA

The interaction of situational factors included the four demographic variables, with personal factors as dependent variable, which was also significant when applying bivariate ANOVA (Table 4.17), age $F(2, 409) = 53.34$, $MSE = 31.90$, $p < 0.01$, marital status $F(3, 408) = 36.47$, $MSE = 31.80$, $p < 0.01$, employment $F(4, 407) = 27.88$, $MSE = 31.73$, $p < 0.01$ and number of years recycling $F(5, 406) = 22.66$, $MSE = 31.68$, $p < 0.01$. In this bivariate model (Table 4.17), the analysis is extended to seek interaction between those two factors. Thus, it is shown the dependent variables (personal factors) were highly dependent on the situational factors in order for HRB to progress positively as previous correlation analyses concluded.

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	2743.075	1	2743.075	82.033	0.00
	Residual (Situational)	13709.92	410	33.439		
	Total	16453	411			
2	Regression	3403.748	2	1701.874	53.341	0.00
	Residual (Age)	13049.250	409	31.905		
3	Regression	3479.419	3	1159.806	36.474	0.00
	Residual (Marital Status)	12973.579	408	31.798		
4	Regression	3538.413	4	884.603	27.878	0.00
	Residual (Employment)	12914.585	407	31.731		
5	Regression	3589.111	5	717.822	22.655	0.00
	Residual (Num.Year Recycling)	12863.887	406	31.684		
	Total	16452.998	411			

Table 4.17: Multiple Regressions Bivariate ANOVA Table

The earlier multiple regression analyses using a composite situational factor as a baseline clearly acknowledged the research question in this Stage 2 of quantitative phase analysis. As a result, the analyses indicated that the existence of situational factors had an effect on personal factors, including demographic aspects. However, it is essential to investigate itemized situational factors when personal factors are predicted (Table 4.18). It was found that engagement from municipalities ($\beta=+0.36$, $p < 0.01$ in conjunction with convenience ($\beta=+0.11$, $p = 0.001$) and also accessibility and availability ($\beta= -0.13$, $p < 0.01$) were significant predictors. Thus, the overall model fit is $R^2= 0.702$ (Table 4.19). The overall main effect of situational factor is significant (Table 4.19), $F (1, 411) = 191.61$, $MSE = 12.06$, $p < 0.01$ being similar to earlier multiple regression analyses.

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	15.093	1.851		8.154	0.00
	Engagement	0.316	0.032	0.359	9.890	0.00
	Convenience	0.156	0.048	0.106	3.225	0.001
	Accessibility and Availability	-0.125	0.031	-0.126	-3.994	0.00

Table 4.18: Multiple Regression Model Coefficient Table

As shown in the coefficient table (Table 4.18), when the situational factors are itemized and regress with dependent variables, the result is similar. Thus, either the situational factors are consolidated or individually positioned in the interaction. It is still a significant relation whereby the situational factors were equally important in influencing the dependent variables, especially with major demographic aspects of personal factors as the model fit shows (Table 4.19). Therefore, this analysis showcases the important aspect of situational factors, such as facilitation of services and infrastructure (engagement, convenience and accessibility and availability) from the LAs had a significant contribution on HRB changes, as supported by Barr et al., (2013) in discussion on the integrated roles LAs should play in changing HRB (Babaei et al., 2015). Lakhan discussed the influence of property type in conjunction with the appropriate HRWS in significantly changing the household attitude to recycling at source (2016). This study found situational factors to be strong predictors in initiating HRB.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.838	0.702	0.699	3.473

ANOVA

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	11555.827	5	2311.165	191.607	0.000
	Residual	4897.171	406	12.062		
	Total	16452.998	411			

Table 4.19: Model Fit and Univariate ANOVA Table

In the literature reviews, demographic elements were found to be inconclusive in determining HRB; however this aspect of personal factors was important (Miliute-Plepiene et al., 2016). This analysis found the interaction of itemized situational factors including the four demographic variables, as dependent variable, was also significant when applying bivariate ANOVA (Table. 4.21), age $F(5, 406) = 191.61$, $MSE = 12.06$, $p < 0.01$, marital status $F(6, 405) = 162.10$, $MSE = 11.94$, $p < 0.01$, employment $F(7, 404) = 139.83$, $MSE = 11.90$, $p < 0.01$ and number of years of recycling $F(8, 403) = 122.44$, $MSE = 11.90$, $p < 0.01$. This analysis as tabulated in Table 4.20 shows that the demographic aspects hadve a role in the interaction between the itemized situational factors. The demographic differences, such as age, marital status, changes in employment and recycling experience were affected differently by situational factors, and would in turn influence HRB. Therefore this analysis has clarified that demographic aspects did not solely influence household HRB, but interacted with situational factors in order to initiate HRB.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1 Age	0.838	0.702	0.699	3.473
2 Marital Status	0.840	0.706	0.702	3.456
3 Employment	0.841	0.708	0.703	3.449
4 Num. Year Recycling	0.842	0.709	0.703	3.450

ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	11555.827	5	2311.165	191.607	0.000
	Residual (Age)	4897.171	406	12.062		
	Total	16452.998	411			
2	Regression	11615.924	6	1935.987	162.097	0.000
	Residual (Marital Status)	4837.073	405	11.943		
	Total	16452.998	411			
3	Regression	11646.210	7	1663.744	139.834	0.000
	Residual (Employment)	4806.787	404	11.898		
	Total	16452.998	411			
4	Regression	11657.020	8	1457.127	122.441	0.000
	Residual (num. Year Recycling)	4795.978	403	11.901		
	Total	16452.998	411			

Table 4.20: Model Fit and Bivariate ANOVA Table

Afterwards, the analyses investigated the moderating effect of engagement (communication) on the interaction between personal and situational factors. This study used engagement (communication) as a predictor variable on both personal and situational factors as dependent. The interaction of engagement (communication attributes for situational factors) with personal factors as dependent variable as well as situational factors was also significant when applying univariate ANOVA (Table. 4.22), personal $F(3, 408) = 8.149$, $MSE = 38.05$, $p < 0.01$ and situational $F(3, 408) = 373.66$, $MSE = 64.423$, $p < 0.01$.

Model Summary

Model (factor)	R	R Square	Adjusted R Square	Std. Error of the Estimate
1 (personal)	0.238	0.057	0.050	5.529
1 (situational)	0.856	0.733	0.731	8.026

ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	930.067	3	310.022	8.149	0.000
	Residual (personal)	15522.931	408	38.046		
	Total	16452.998	411			
1	Regression	72216.429	3	24072.143	373.656	0.000
	Residual (situational)	26284.686	408	64.423		
	Total	98501.114	411			

Table 4.21: Model Fit and Univariate ANOVA Table

Babaei et al. (2015) discussed how the interaction of personal factors, such as knowledge of a household with facilitation from the LAs significantly affected HRB, and Brekke et al. (2010) supported the importance of interaction in the cultivation of recycling at source. The analyses were consistent when composite situational factors as predictor and composite personal factors as dependent variable in earlier analyses of multiple regressions. Hence, larger R^2 produces bigger values of F . This study shows that engagement aspects of situational factors showed a stronger relation with situational factors in comparison to personal factors with significant p -value = 0.00. The multi-regressions gave strong support to the existence of symbiosis effect between personal and situational factors, together with engagement as a moderating effect on the interaction. This juxtaposing of both personal and situational factors needed to be mutually interacted. The analyses were only based on certain attributes from the demographic profiles and situational factors, without considering other demographic factors such as deprivation indices and property ownership, or other situational factors such as proximity to the public amenities and recycling services and facilities. Recent studies have shown that demographic attributes are only part of the larger predictions of HRB (Miliute-Plepiene et al., 2016), and only single out some of the situational factors (Foxall & Yani-de-Soriano, 2005). They do not determine the overall HRB; therefore, future research will need to consider this attribute for further understanding of HRB.

The multiple regression analyses have shown the ANOVA tests were conclusive with regards to differences between personal factor variables if situational factors are predicted. Hence, the F value is moderately large in line with larger R^2 therefore, the personal factor inclines to differentiate when situational factors are manipulated. Similarly, in Latif et al. (2013), the situational factors were strong predictors in manipulating HRB from the source in pursuing a sustainable living (2013).

4.6.6 Personal and Situational Factors: Multiple Analysis of Variance

The previous section has shown that situational factors (itemized or composite) are significant predictors, directed by factors such as accessibility and availability or

convenience etc., playing a significant role in changing householders' behaviour towards home recycling. The study involved measuring the impact of more than one variable on the same item in combination, i.e. the main effect of situational factors with the personal factors or vice-versa.

This particular analysis was to address the interdependency of personal and situational factors in manipulating or influencing individual behaviour, i.e. HRB, hence supporting the assumption that the symbiosis effect does exist when both factors are interacted.

In the initial research design and literature reviews, some variables (recycling knowledge, working status, availability and accessibility) were assumed to be crucial, as these factors had been tested empirically (Keramitsoglou & Tsagarakis, 2013; Wagner, 2013; Hadjimanolis, 2013), and some emerged during the qualitative inquiry (Stage 1 of Qualitative Phase I analyses). Thus, it was appropriate to use multivariate analysis to construct a model that could describe the relationship between a single outcome variable and a set of predicting variables (Tabachnick et al., 2001; Hair et al., 2009).

Past studies within the scope of HRWS and HRB (Williams & Cole, 2013; Abbott et al., 2011; Jesson & Stone, 2009; Davis et al., 2006; Lyas et al., 2005; Woodard et al., 2005; Tonglet et al., 2004; Woodard et al., 2004 Tucker & Speirs, 2003; Barr et al., 2003; Friends of the Earth, 2002; Coggins, 2001; Tucker et al., 2000) had discovered correlated variables (personal and situational factors) in the projection of HRB. This study tries to perform a single, overall statistical test on a set of variables in order to understand how independent variables could influence some forms of response on the dependent variables.

Within a multivariate analysis, there is a need to check the assumption of homogeneity of covariance across the groups using $p > 0.01$ as criterion (Hair et al., 2009). This revealed that *Box's M* (847.92) was significant (Table. 4.22), ($p < 0.01$) which entailed significant differences among the independent variables in the covariance matrices. The test shows that situational factors influence personal factors differently, with a confounding factor

being employment status. Therefore, the test extended the prior analyses to reveal that employment status was considered a strong confounding factor engaging with the interaction between situational and personal factors respectively.

Box's Test of Equality of Covariance Matrices

Box's M	847.916
F	1.237
df1	483
df2	12856.197
Sig.	0.000

Table 4.22: Box's Test of Equality of Covariance Matrices

Even though, the p -value was considered lower than 0.001 (the assumption was the p -value should be higher than the criterion level i.e. more than p -value 0.05 or 0.01) significant levels; the analysis preceded to Wilk's Lambda as an appropriate test to use. Hence, this study had exceeded the minimum sample size ($n > 91$) as suggested in Hair et al. (2009) and Tabachnick et al. (2001) for multivariate analysis. Hence, this study revealed a one-way MANOVA (Table. 4.23) which had a significant multivariate main effect for situational factors, Wilk's $\lambda = 0.233$, $F(438, 2001.5) = 1.26$, $p < 0.001$.

Multivariate Tests

Effect (Factors)		Value	F	Hypothesis df	Error df	Sig.
Intercept	Pillai's Trace	0.987	4234.981	6.00	333.000	0.000
	Wilk's Lambda	0.013	4234.981	6.000	333.000	0.000
Situational	Pillai's Trace	1.274	1.249	438.00	2028.000	0.001
	Wilk's Lambda	0.233	1.261	438.00	2001.530	0.001

Table 4.23: Multivariate Tests Table

However, in order to understand what are the particular dependent variables that are affected by the situational factors, the univariate main effects were examined. There was a significant number of univariate main effects (Table 4.24) for situational factors, obtained from personal factors, $F(73, 412) = 2.16$, $p < 0.001$; and employment, $F(73, 412) = 1.35$, $p < 0.05$. Therefore, the situational factors (Table 4.23) had a significant effect on personal factors and employment status in order to influence HRB.

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.
Situational Factors	Number of Years Recycling	32.245	73	0.442	1.189	n.s
	Personal Factors	5228.229	73	71.620	2.157	0.000
	Number of Years Living in Current Property	21.030	73	0.288	0.936	n.s
	Age	118.286	73	1.620	0.943	n.s
	Marital Status	35.416	73	0.485	1.113	n.s
	Employment	55.868	73	0.765	1.347	0.042
Total			412			

Table 4.24: Multivariate Tests (Between Subjects)

The previous analysis has shown that situational factors significantly affected personal factors in conveying HRB. Thus, the analysis was explored further in conjunction with the confounding variables (demographical items) and composite situational factors in predicting personal factors. The homoscedasticity (homogeneity of variance) test shows a null hypothesis of equal variances of rejection and revealed that *Box's M* (570.26) was significant ($p < 0.01$) (Table 4. 25), which entailed significant differences among the independent variables in the covariance matrices. A one-way MANOVA had a significant multivariate main effect for personal factors (Table 4.26), Wilk's $\lambda = 0.432$ $F(210, 2256) = 1.54$, $p < 0.001$. Given the significance of the overall test, the univariate main effects were examined.

Box's Test of Equality of Covariance Matrices

Box's M	570.261
F	1.192
df1	399bn
df2	23261.391
Sig.	0.005

Table 4.25: Box's Test of Equality of Covariance Matrices

Multivariate Tests

Effect (Factors)	Value	F	Hypothesis df	Error df	Sig.	
Personal	Pillai's Trace	0.754	1.543	210.000	2256.000	0.000
	Wilk's Lambda	0.432	1.600	210.000	2206.837	0.000

Table 4.26: Multivariate Tests Table

Significant univariate main effects for personal factors were obtained from situational factors $F(35, 411) = 3.96$, $p < 0.001$ (Table. 4.27) and confounding variables: employment, F

(35,411) = 0.930 as well as number of years living in current property, $F(35,411) = 1.47$ at $p < 0.05$ and age $F(35,411) = 3.19$, $p < 0.001$. However, both marital status and recycling experience had no effect (Table 4.27) on personal factors as the $p > 0.05$. This particular analysis puts personal factors as independent variable, and both situational and demographical aspects as dependent variables. It is shown in this analysis (Table 4.27) that personal factors were equally significant predictors as situational factors in previous analysis to convey HRB. In addition, personal factors were significantly affected by the changes in confounding variables, especially the length of time living at the same property, employment status and the different age groups. These changes then led to stronger or weaker HRB.

Source (Factors)	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.
Personal	Number of Year Recycling	15.940	35	0.455	1.207	n.s
	Number of Years Living in Current Property	15.089	35	0.431	1.474	0.044
	Age	111.559	35	3.187	2.040	0.001
	Marital Status	21.018	35	0.601	1.396	n.s
	Employment	32.558	35	0.930	1.625	0.016
	Situational Factors	26520.979	35	757.742	3.958	0.000

Table 4.27: Multivariate Tests (Between Subject) Table

In previous multivariate analyses, the composite situational factors were found to be significant when tested with both composite personal factors and demographical aspects of personal factors. Thus, it was essential to cross-examine both situational and personal factors in the next sections, including the confounding variables (demographical items) individually. A one-way MANOVA had a significant multivariate main effect for composite personal factors (Table. 4.27), Wilk's $\lambda = 0.199$ $F(140, 1488) = 5.317$, $p < 0.001$.

Given the significance of the overall test, the univariate main effects were examined. Significant univariate main effects for personal factors were obtained from itemized situational factors (Table 4.28): engagement, $F(35,411) = 12.52$, knowledge, $F(35,411) = 19.72$ at $p < 0.01$, convenience, $F(35,411) = 19.72$ at $p < 4.06$, and accessibility and availability $F(35,411) = 1.85$, $p < 0.01$. In this section, the analysis shows that four aspects of

situational factors were significantly dependent on personal factors (Table 4.29). Therefore, there was an interaction between the dependent variable (aspects of situational factors) and the independent variable (personal factors).

Multivariate Tests						
Effect (Factors)		Value	F	Hypothesis df	Error df	Sig.
Personal	Pillai's Trace	1.016	3.658	140	1504.000	0.000
	Wilk's Lambda	0.199	5.317	140	1487.866	0.000

Table 4.28: Multivariate Tests Table

Source (Factors)	Dependent Variable	Type III Sum of Squares	Df	Mean Square	F	Sig.
Personal	Engagement	11443.855	35	326.967	12.518	0.000
	Knowledge	14848.728	35	424.249	19.719	0.000
	Convenience	2077.930	35	59.369	4.062	0.000
	Accessibility and Availability	2416.148	35	69.033	1.845	0.003

Table 4.29: Multivariate Tests (Between Subject) Table

Here, the analyses were further tested with confounding variables (demographical aspects of personal factors) alongside itemized situational factors. A one-way MANOVA had a significant multivariate main effect for demographical factors (Table. 4.30): employment, Wilk's $\lambda = 0.923$ $F(12, 1019) = 2.62$, $p < 0.01$ and country of birth, Wilk's $\lambda = 0.923$ $F(12, 1161) = 2.61$, $p < 0.01$. Significant univariate main effects for itemized situational factors were obtained from confounding variables (Table 4.31): marital for engagement $F(2, 411) = 3.27$, $p < 0.05$, employment for engagement, $F(3,411) = 6.15$ as well as knowledge, $F(3,411) = 3.51$ at $p < 0.05$ and convenience, $F(3,411) = 3.26$ at $p < 0.05$.

Multivariate Tests						
Effect		Value	F	Hypothesis df	Error df	Sig.
Employment	Pillai's Trace	0.079	2.608	12	1161	0.002
	Wilk's Lambda	0.923	2.621	12	1018.906	0.002
Country of Birth	Pillai's Trace	0.052	5.313	4	385	0.000
	Wilk's Lambda	0.948	5.313	4	385	0.000

Table 4.30: Multivariate Tests Table

Lastly, country of birth had an effect on knowledge $F(1,411) = 11.47$, $p < 0.01$ and convenience, $F(1,411) = 5.70$ at $p < 0.05$.

This analysis shows confounding variables such as demographical aspects of population (Table 4.31) significantly affected the situational factors individually.

Tests of Between-Subjects Effects						
Source	Dependent Variable	Type III Sum of Squares	Df	Mean Square	F	Sig.
Marital	Engagement	296.610	2	148.305	3.268	0.039
	Knowledge	259.927	2	129.964	2.446	n.s
	Convenience	65.258	2	32.629	1.860	n.s
	Accessibility and Availability	8.799	2	4.399	0.112	n.s
Employment	Engagement	837.169	3	279.056	6.149	0.000
	Knowledge	559.694	3	186.565	3.512	0.015
	Convenience	171.486	3	57.162	3.258	0.022
	Accessibility and Availability	151.967	3	50.656	1.285	n.s
Country of Birth	Engagement	8.067	1	8.067	0.178	n.s
	Knowledge	609.221	1	609.221	11.468	0.001
	Convenience	100.022	1	100.022	5.700	0.017
	Accessibility and Availability	3.184	1	3.184	0.081	n.s

Table 4.31: Multivariate Tests (Between Subject) Table

The analysis also explored both confounding variables (demographical aspects of personal factors) and itemized personal factors with composite situational factors. A one-way MANOVA had a significant multivariate main effect for composite situational factors (Table 4.32), Wilk's $\lambda = 0.02$ $F(1387, 6013) = 1.09$, $p < 0.05$. Significant univariate main effects for composite situational factors with itemized personal factors and confounding variables (Table 4.33): P2 $F(73, 411) = 1.35$, $p < 0.05$, P3, $F(73,411) = 1.74$ as well as P5, $F(73,411) = 1.60$ at $p < 0.01$, and P8, $F(73,411) = 1.74$ at $p < 0.01$. Lastly, only employment from confounding variables had an effect with composite situational factors $F(73,411) = 1.35$, $p < 0.05$.

Multivariate Tests

Effect (Factors)		Value	F	Hypothesis df	Error df	Sig.
Situational	Pillai's Trace	3.596	1.081	1387	6422	0.030
	Wilk's' Lambda	0.016	1.085	1387	6012.647	0.025

Table 4.32: Multivariate Tests Table

Tests of Between-Subjects Effects						
Source (Factors)	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.
Situational	Self -Awareness	55.841	73	0.765	1.353	0.04
	Self-Efficacy	163.528	73	2.24	1.74	0.001
	Knowledge and Experience	147.324	73	2.018	1.604	0.003
	Age	118.286	73	1.62	0.943	n.s
	Gender	13.568	73	0.186	0.751	n.s
	Marital Status	35.416	73	0.485	1.113	n.s
	Number of Households	63.211	73	0.866	1.103	n.s
	Employment	55.868	73	0.765	1.347	0.042
	Number of Years Living in Current Property	21.03	73	0.288	0.936	n.s
	Number of Years Recycling	32.245	73	0.442	1.189	n.s
	Area Type	27.599	73	0.378	0.959	n.s
	Property Type	18.725	73	0.257	0.961	n.s
	Country of Birth	15.09	73	0.207	0.923	n.s
	Name of Municipality	19.354	73	0.265	1.077	n.s

Table 4.33: Multivariate Tests (Between Subject) Table

Multivariate tests had given some insightful interpretations of the effect between subjects, which supported the existence of symbiosis effect between personal and situational factors (itemized or composited). MANOVA and Box's M test, in particular, successfully addressed what factors should be considered significant, such as employment status, self-awareness, self-efficacy and knowledge and experience in engagement of interaction between situational and personal factors. Timlett and Williams (2008) supported the notion of public participation reflected in HRB changes led to recycling performance, whereby the public participation was influenced by the effectiveness of situational factors, such as public engagement and convenience of the HRWS. In addition, the importance of situational factors was highlighted in multivariate tests, in line with Bhate's (2005) conceptualization of the consumer behaviour settings that influenced HRB (Foxal & Yani-de-Soriano, 2005).

In reference to previous literature, the interaction between underlying factors of HRB was limited to factors that influence or change HRB. However, this study has shown that factors from the findings not only changed HRB, but interacted with other factors in order to change HRB.

The multivariate tests showed that aspects such as self-awareness, self-efficacy, knowledge and experience, social norms and household dynamics encapsulated in personal or

situational factors (engagement, accessibility and availability, convenience) had an effect with the confounding variable (demographical aspects of personal factors). Therefore, there was a significant difference in inter-subject effects that conveyed the relationship between a single outcome variable and a set of predicting variables in these analyses. One variable for personal factors is self-efficacy, referred to here as the tendency of a person to control or manage their own behavioural change and actions (Lin & Hsu, 2013; Forlani, 2013; Walton & Austin, 2011; Koos, 2011; Ward & Gleiber, 1993). It was found that the self-efficacy, self-awareness and knowledge and experience of a household was significantly affected by situational factors (Latif et al., 2013; Foxall & Yani-de-Soriano, 2015; Schultz et al., 1995), whereby a household would change its HRB when the right or effective method of HRWS became visible. The tendency of a household to follow a routine of sorting and separating at source could be aided by clear and simple instructions from the LAs (Babaei et al., 2015). These analyses have shown both factors are equally important in changing HRB at source.

To conclude this section, the situational factors as independent variables interacted with dependent variables from personal factors. However, employment status represented a confounding variable, whereby the interaction between personal factors and situational factors was significantly affected when there were changes in the employment status, culminating in differences in HRB.

4.6.7 Personal Factors with Confounding Variable (Demographical Aspects): logistic regression analyses

In the first part of the quantitative analysis in this particular study, the aspects of personal factors were explored by application of descriptive analyses consisting of cross-tabulation and frequency. Hence, the measurement in the questionnaire design did not exclusively apply the 5-point Likert scale, but some of the items were designed to accommodate categorical outcome, i.e. true/false; yes/no (Cleff, 2014). Hence, this study produced a non-linear response from research inquiries which applied a variable with a binary outcome and violated the assumptions of conventional linear regression (Field, 2009).

Logistic regression has been proposed as a way of modelling the relationship between an outcome and a set of predicting covariates (Hosmer et al., 1997). It addresses predictors with categorical responses (Agresti, 2014) and is accessible to discrete categories of occurrences which also predict the probability of an occurring event, given the known values of the covariates (Field, 2009: 219-220).

Furthermore, the regression is able to deal with non-linearity, where the relationship between the dependent and independent variables is not expressed as the best-fitting straight line; rather it forms an S-shape (Hair et al., 2009) which is essential for dichotomous variables.

This analysis applied the Hosmer-Lemeshow test for goodness of fit which is similar to a Chi-Square test, and indicates the extent to which the model provides a better fit than a null model with no predictors, or, in a different interpretation, how well the model fits the data, as in log-linear modelling. This study aims to research the reasons behind householders' recycling initiatives with confounding variables (demographical aspects of personal factors). First of all, the overall significance was tested using the Chi-Square goodness-of-fit test (Table 4.34) where the assumption of accepting H_0 : the model is a good fit when the p -value ≥ 0.01 and rejecting if the test is significant where H_1 : the model is not a good fit when the p -value ≤ 0.01 . Therefore, a test of the full model against a constant only model was statistically significant for reasons behind HRB that indicated the model had a good fit accepting the null hypothesis.

Omnibus Tests of Model Coefficients

			Chi-square	df	Sig.
Step 1	Regulation	Step	38.565	22	0.016
		Block	38.565	22	0.016
		Model	38.565	22	0.016
	Environment	Step	29.907	22	0.121
		Block	29.907	22	0.121
		Model	29.907	22	0.121
	Image	Step	25.323	22	0.282

	Block	25.323	22	0.282
	Model	25.323	22	0.282
Conscious Society	Step	24.663	22	0.313
	Block	24.663	22	0.313
	Model	24.663	22	0.313
Financial	Step	30.464	22	0.108
	Block	30.464	22	0.108
	Model	30.464	22	0.108
Do Not Know	Step	42.092	22	0.006
	Block	42.092	22	0.006
	Model	42.092	22	0.006
Other	Step	36.475	22	0.027
	Block	36.475	22	0.027
	Model	36.475	22	0.027

Table 4.34: Model Chi-Square

In the earlier section on quantitative analyses, using Chi-Square tests was specifically to investigate the differences between the municipalities (Hull and ERY). The findings found that there was limited dissimilarity between the municipalities, both being somewhat homogenous in nature. Hence using logistics regressions, this model shows that all reasons behind the recycling initiatives of householders were considered liable. This shows that householders had 'calculated' reasons for home recycling. The particular reason predicts the HRB of householders.

The next step of analysis commenced as the goodness-of-fit test was enforced (Field, 2009). Wald's criterion (Table 4.35) demonstrates that recycling reasons based on 'regulation' made a significant contribution to prediction ($p < 0.05$) along with 'the environment' and 'image'. Other reasons were not considered as significant predictors. EXP (B) value indicates

that when a number of households were raised by one unit (one person), the odds ratio was three times as large, and therefore, the householders were three times more likely to base their reasons for recycling on municipality regulations, and students were six times more likely to give regulations as their reason for recycling in comparison with working people and pensioners. Subsequently, where there was an increase in the unit staying at a current address, or increases in years of recycling awareness and engagement from the year of inception, the odds ratio was three times as much, and therefore, the householders were three times more likely to base their reason for recycling on the environment.

As for 'image' being the reason for recycling, this indicates that EXP (B) value was raised by approximately four times as much when one additional unit was raised; those who were working, unemployed people, or those on benefits were four times more likely to use 'image' as their reason for recycling. The option "do not know" and "other" being the reason for recycling shown in the analysis is significant (Table 4.34). However, a test of the full model against a constant only model was not significant, indicating that the predictors as a set did not reliably distinguish between "do not know" and other reasons for recycling. In line with Kaiser et al. (2016), the reasoning behind actual HRB was not weighted alone by an individual's environmental protection goals; however, acts of environmental action (recycling, conservation and preservation) formed the actual HRB (Thomas et al., 2013).

Baseline Model		B	S.E.	Wald	df	Sig.	Exp(B)
Regulation	Double Occupants	1.008	0.476	4.48	1	0.034	2.74
	Student	1.792	0.643	7.759	1	0.005	6.003
	Constant	-0.717	0.997	0.517	1	0.472	0.488
Environment	4 or More Year Living Equal to the year of Scheme Introduction	1.19	0.565	4.443	1	0.035	3.289
	Constant	1.167	0.552	4.468	1	0.035	3.211
	Constant	-3.497	1.501	5.429	1	0.02	0.03
Image	Working	1.386	0.654	4.489	1	0.034	3.998
	Other	1.319	0.66	3.988	1	0.046	3.738
	Constant	-0.041	1.065	0.002	1	0.969	0.959

Table 4.35: Variables in the Equation

Observed	Prediction Success	%Yes	%No	%Overall	%Diff.
Regulation	Step 0	0.00	100.00	65.00	0.00
	Step 1	16.70	91.00	65.00	
Environment	Step 0	100.00	0.00	86.90	0.00
	Step 1	100.00	0.00	86.90	
Image	Step 0	0.00	100.00	74.00	0.30
	Step 1	5.60	98.40	74.30	
Conscious Society	Step 0	100.00	0.00	65.30	0.40
	Step 1	92.60	12.60	64.90	
Financial	Step 0	0.00	100.00	85.70	0.20
	Step 1	1.70	100.00	85.90	
Do Not Know	Step 0	0.00	100.00	97.10	0.00
	Step 1	0.00	100.00	97.10	
Other	Step 0	0.00	100.00	84.00	0.20
	Step 1	1.50	100.00	84.20	
Average		29.86	71.57	79.74	0.16

Table 4.36: Prediction Success in Percentage

Prediction success for overall reasoning from this regression (Table 4.36) was approximately 80% (72% for No and 30% for Yes). Subsequently, the Nagelkerke's R^2 was less than 0.42 (Table 4.37) for the overall reasoning behind HRB, which indicates a moderately weak relationship between prediction and grouping. Then, the Hosmer and Lemeshow's (H-L) goodness-of-fit test was used to validate the Chi-Square goodness-of-fit test. The test divided subjects into deciles (10 sub-sections) based on predicted probabilities, then computed a Chi-Square from observed and expected frequencies (Hosmer et al., 1997).

After that, a probability (p) value was computed from the Chi-Square distribution to test the fit of the logistic model (Hosmer et al., 1997). If the H-L goodness-of-fit test statistic is greater than 0.05, it is a well-fitting model; thus the test accepts the null hypothesis and there is difference between observed and model-predicted values. The logistic model (Table 4.38) was a well-fit model which concluded that the use of home recycling by householders was affected by particular reasoning which moulded HRB development.

Baseline Model Reasons	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square	Hosmer and Lemeshow		
				Chi-square	df	Sig.
Regulation	494.683	0.089	0.123	6.229	8	0.622
Environment	290.144	0.070	0.130	10.036	8	0.262
Image	446.409	0.060	0.088	8.016	8	0.432

Conscious Society	507.332	0.058	0.080	5.302	8	0.725
Financial	307.188	0.073	0.130	10.569	8	0.227
Other	326.078	0.085	0.145	2.948	8	0.938

Table 4.37: Model Fit and Hosmer and Lemeshow Test

Next, this study examined the differences in recyclates (materials recycled) supplied by the householder with confounding variables (demographical aspects of personal factors) and composite situational factors. First of all, the overall significance was tested using Chi-Square goodness-of-fit (Table 4.38), where the assumption of accepting the H_0 : the model is a good fit when the p -value ≥ 0.01 and rejecting it if the test is significant where H_1 : the model is not a good fit when the p -value ≤ 0.01 . Therefore, a test of the full model against a constant only model was statistically significant for recyclates such as aluminium, glass, newspaper, A4 white paper and cardboard (aluminium: *chi square* = 53.822, $p < 0.05$ with $df = 22$, glass: *chi square* = 45.838, $p < 0.05$ with $df = 22$, newspaper: *chi square* = 46.955, $p < 0.01$ with $df = 20$, A4whitepaper:*chi square* = 37.269, $p < 0.05$ with $df = 20$, cardboard: *chi square* = 52.858, $p < 0.01$ with $df = 20$). This indicates that some householders were indifferent with regards to aluminium, glass, newspaper, A4 white paper and cardboard as common recyclates for home recycling.

On the other hand, plastics, tin cans, clothing and other recyclates were considered as common materials for home recycling (*plastics: chi square* = 35.035, $p < 0.05$ with $df = 20$, and *tin cans: chi square* = 36.253, $p < 0.05$ with $df = 20$), as well as clothing and other recyclates. Table 4.36 indicates the model had a good fit; however, the situational factors and demographic aspects of personal factors were found to be weak predictors of the householder knowledge of recycling materials.

Omnibus Tests of Model Coefficients

Aluminium		Chi-square	df	Sig.
Step 1	Step	53.822	22	0.000
	Block	53.822	22	0.000
	Model	53.822	22	0.000
Glass				
Step 1	Step	45.838	20	0.001
	Block	45.838	20	0.001
	Model	45.838	20	0.001
Newspaper				

Step 1	Step	46.955	20	0.001
	Block	46.955	20	0.001
	Model	46.955	20	0.001
A4White paper				
Step 1	Step	37.269	20	0.011
	Block	37.269	20	0.011
	Model	37.269	20	0.011
Cardboard				
Step 1	Step	52.858	20	0.000
	Block	52.858	20	0.000
	Model	52.858	20	0.000
Plastics				
Step 1	Step	35.035	20	0.020
	Block	35.035	20	0.020
	Model	35.035	20	0.020
Tin Cans				
Step 1	Step	36.253	20	0.014
	Block	36.253	20	0.014
	Model	36.253	20	0.014
Clothing				
Step 1	Step	28.895	20	0.090
	Block	28.895	20	0.090
	Model	28.895	20	0.090
Others				
Step 1	Step	21.788	20	0.352
	Block	21.788	20	0.352
	Model	21.788	20	0.352

Table 4.38: Model Chi-Square

The Wald criterion (Table 4.39) demonstrates that the most common materials were usually recycled, apart from plastics ($p = 0.057$) which made a significant contribution to prediction ($p < 0.05$). These analyses concluded that an increase of unit in the aspects (engagement, accessibility and availability, convenience) of situational factors from the municipalities meant the odds ratio was one time as much, and therefore the householders were likely to be aware of tin cans as common recyclates. As for clothing, also categorized as common recyclates, the analyses indicated EXP (B) value to have increased to approximately five times as much when one additional unit was raised; those who were in retirement were four times as likely to consider clothing as common recyclates (Table 4.39).

Recyclates	B	S.E.	Wald	df	Sig.	Exp (B)
Tin Cans						
Situational Factors	-0.030	0.011	7.180	1	0.007	0.971
Constant	1.988	2.000	0.988	1	0.320	7.301
Clothing						
In-Retirement	1.525	0.729	4.371	1	0.037	4.593
Constant	0.610	1.303	0.219	1	0.640	1.841

Table 4.39: Variables in the Equation

Observed	Prediction Success	%Yes	%No	%Overall	%Diff.
Plastics	Step 0	100	0	93.2	0.2
	Step 1	99.7	0	93	
Tin Cans	Step 0	100	0	87.6	0
	Step 1	100	0	87.6	
Clothing	Step 0	100	0	59	3.4
	Step 1	81.9	34.3	62.4	
Others	Step 0	0	100	79.4	0.3
	Step 1	1.2	99.4	79.1	
Average		87.63	15.01	84.67	

Table 4.40: Prediction Success in Percentage

The prediction success (Table 4.40) for overall reasoning was approximately 84.7% (15.01% for not recycled and 87.6% for yes recycled). Thus, the test indicates that Nagelkerke's R^2 was less than 0.28 (Table 4.41) for overall reasoning behind HRB, indicating a moderately weak relationship between prediction and grouping. Then, the Hosmer and Lemeshow (H-L) goodness-of-fit test (Table 4.41) was used to validate the Chi-Square goodness-of-fit test. If the H-L goodness-of-fit test statistic is greater than 0.05, it is a well-fitting model; thus the test accepts the null hypothesis and there is a difference between observed and model-predicted values. Therefore, it was a well-fitted model especially for recyclates such as plastics, tin cans, clothing and others, excluding aluminium, glass, newspapers, A4 paper and cardboard.

Recyclates	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square	Hosmer and Lemeshow		
				Chi-square	df	Sig.
Plastics	169.591	0.082	0.208	7.819	8	0.451
Tin Cans	272.254	0.084	0.160	2.736	8	0.950
Clothing	528.894	0.068	0.091	5.809	8	0.669
Others	397.651	0.052	0.081	7.365	8	0.498

Table 4.41: Model Fit and Hosmer and Lemeshow Test Table

In conclusion, analysis on the reasons behind HRB and the knowledge of recyclates supplied by the householders in this regression showed a moderately good-fit model. Nagelkerke's measure was a correction of Cox and Snell's, allowing the measure to use the full 0-1 range which in these analyses implied a good-fit model. However, the range between less than 0.28 and 0.42 is close to zero, hence, the model was a moderate improvement over the null model with no predictors. Even so, the Hosmer and Lemeshow goodness-of-fit Chi-Square test indicated that most of the models did fit the data, with exception of two or three variables. Accuracy of prediction slightly improved over the null model, but constituted lower than 3.5% which Nagelkerke's Pseudo R^2 is skewed to zero than one. Nevertheless, most of the predictors' situational factors were found to be significant and moderately strong predictors for both occurrences.

4.7 Summary

This chapter has focused on two major analyses: Qualitative Stage 1 and Quantitative Stage 2, in accordance with the mixed methodology approach of SED. The first qualitative stage of analysis used both thematic and ethnography analysis to address RQs 1, 2 and 3, which explored the themes within the scope of HRWS and HRB, and extended the proposition of symbiosis effect and a new theoretical framework. The Qualitative Phase I findings correspond to the empirical studies which simultaneously discussed the themes within the scope of HRWS and HRB (Bhate, 2005; Timlett & Williams, 2008; Keramitsoglou & Tsagarakis, 2013). Preliminarily, from ethnography analyses it appears that interactions (symbiosis effect) between personal factors and situational factors do exist, which coincides with Norm Activation Model (Biel & Thøgersen, 2007). When the personal factors interact with situational factors, recycling behaviour will transform according to how effectively the effects (engagement, accessibility and availability, convenience) of situational factors are established.

From the qualitative analyses, a new theoretical framework was developed to guide the investigation for the quantitative analysis phase from Stage 2 of SED. The categorizations of the aspects for two major factors (personal and situational) derived from thematic analyses

and a-priori empirical studies within the scope of HRWS and HRB. The quantitative inquiry comprised a survey. The questionnaire design underwent a pilot test to ensure that the structure and syntax conformed to the RQs as well as the theoretical framework. The survey supported the qualitative analysis from the first stage of SED. The reliability and validity analysis indicates that the measurement used was sufficiently robust and credible for use in future research. The descriptive analyses show no difference in the aspects (self-awareness, self-efficacy, social norms, knowledge and experience and household dynamics) of personal factors between the householders from the East Riding of Yorkshire and the City of Hull.

As for the correlation, analysis reveals positive relationships between situational and personal factors, including four dominant demographical aspects of personal factors (age, marital status, employment and number of years of recycling). Multi-regression was used to investigate and support the qualitative analyses on the proposition of symbiosis effect. This study reveals a strong effect between personal and situational factors which interplay with the demographical aspects of personal factors (age, marital status, employment and number of years of recycling), and that each aspect of personal factors supported the interaction between personal and situational factors.

The study then applied multivariate analysis to explore the situational factors instigating the relationship between personal factors with the demographical aspects of personal factors (age, marital status, employment and number of years of recycling) in order for HRB to establish. Thus, this study reveals that situational factors have the tendency to interact in a positive direction with the demographical aspects of personal factors (age, marital status, employment and number of years of recycling), to stimulate and establish HRB. The study applied logistic regression to address some items in the instrument which had categorical outcomes. Hence, the analysis was used to explore the assessment on reasoning by the respondents with regards to the establishment of HRB, and their awareness of recycling channels provided by the municipality.

The analyses indicated that confounding variables (demographical aspects of personal factors) and situational factors somewhat influenced the respondents' reasoning for

recycling, and that their knowledge of certain recycles was triggered by the interaction between demographical aspects of personal factors with aspects (engagement, accessibility and availability, convenience) of situational factors. The following chapter analyses the final phase of research inquiry that uses both findings from Qualitative Phase 1 and quantitative stages of SED within the discourses between individuals in a focus group, and two semi-structured interviews, as well as overall discussion from Stages 1 and 2 of the SED. The summary of Stages 1 and 2 of the SED results is presented in Table 4.42.

	Research Questions	Results	
		Stage 1: Qualitative	Stage 2: Quantitative
1	What is the reasoning behind the HRB between different municipalities?	<ul style="list-style-type: none"> Supported the significant reasons behind HRB are environmental issues No differences between municipalities in relation to reasoning. 	<ul style="list-style-type: none"> Supported the significant reasons behind HRB are environmental issues No differences between municipalities in relation to reasoning.
2	What are the different factors associated with HRWS that may affect HRB, and how do they affect HRB?	<ul style="list-style-type: none"> Supported the significant factors are from situational factors (accessibility and availability) in conjunction with the right engagement can significantly change the HRB 	<ul style="list-style-type: none"> Supported the significant predictors especially convenience; accessibility and availability as precursor factors with mediator factors of municipality engagement as well as ALL attributes in personal factors affected in changing HRB, in which demographical aspects are considered as confounding factors.
3	What are the interactions (symbiosis effects) and the conditions that support the symbiosis between HRWS and HRB?	<ul style="list-style-type: none"> Supported the personal factors interacting with situational factors; the recycling behaviour will transform according to how effectively the effects (engagement, accessibility and availability, convenience) of situational factor are established 	<ul style="list-style-type: none"> Supported the significant preliminary interaction between personal and situational that represented symbiosis effect in changing HRB. Significant predictors from precursors (engagement, accessibility and availability, convenience) in order to stimulate personal factors and transform HRB.

Table 4.42: A Summary of First and Second Stage of SED results addressing the RQs

CHAPTER FIVE: Triangulation and Discussion

5.1 Introduction

The findings from Stages 1 and 2 have addressed the overall RQs of this study and it is feasible to suggest that symbiosis effect has emerged during the interaction between personal and situational factors based on the prior findings. Hence, to follow Creswell method of SED (2008), the final stage is reserved for triangulating, rather than seeking new findings.

The first part of this discussion is directed at the outcomes from Stage 3 of the sequential exploratory design (SED). The two previous stages of SED addressed the overall RQs (1, 2, 3) respectively. However, the last stage (second qualitative stage) is a triangulation of the two separate analyses (quantitative and qualitative) validity of overall findings (Lincoln et al., 2011). The triangulation technique adds a sense of ‘completeness’ to the mixed methodology approach (Fig. 5.1). The application of methodological triangulation (more than two methods used) in the research design favoured a robust inference and interpretation of the phenomenon when both analyses converged (Bryman, 2004).

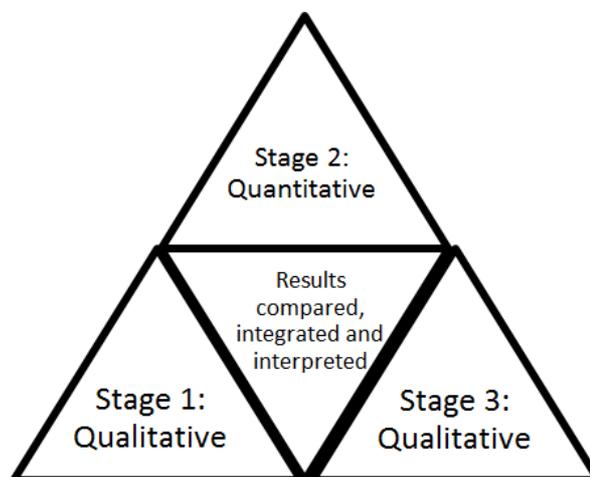


FIGURE 5.1: Qualitative and Quantitative Convergent in Mixed methodology Approach

The second part of the discussion concentrates on the overall findings from the mixed methodology approach of SED in reference to the research questions, literature review and theoretical framework. The section begins with a discussion of the first stage from

Qualitative Phase I findings. The second stage of quantitative findings, and the final stage of Qualitative II findings are then discussed in reference to the overall RQs (1, 2, 3). Discussion in the final sections focuses on new developments for future research found in Stage 3 of the SED, and includes limitation, mitigation and contributions, as well as a refined theoretical model.

5.2 Qualitative Phase II: Reflection of Stages One and Two in SED

Two major analyses in previous stages found: Analysis of the qualitative phase revealed a preliminary proposition of symbiosis effect and a development of revised theoretical framework. As the quantitative phase commenced, analyses of Pearson's correlation revealed a positive relation between situational and personal factors. In addition, the analyses encapsulated the four dominant demographical aspects of personal factors (age, marital status, employment and number of years of recycling) as also having a positive relation. The regressions in the quantitative analyses supported the proposition of symbiosis existence in order for HRB to establish. Moreover, the analysis from this study revealed a strong effect between personal and situational factors.

These two factors connected with the demographical aspects of personal factors (age, marital status, employment and number of years of recycling), each aspect of the personal factors being a confounding variable of the interaction between personal and situational factors. Furthermore, this study reveals that situational factors had a tendency to interact in a positive direction with the demographical aspects of personal factors (age, marital status, employment and number of years of recycling) for HRB to establish. The confounding variables (demographical aspects of personal factors) and situational factors found in this study suggest that the reasoning of a household to embark on recycling and their knowledge of certain recyclates was triggered by the interaction.

The interaction between demographical aspects of personal factors with aspects of situational factors (engagement, accessibility and availability, convenience) was found to be mutually related.

Thus, the final qualitative data analysis (Fig. 5.1) involved a triangulation process on Stages 1 and 2 findings, employing a focus group and semi-structured interviews. These qualitative methods of inquiries were chosen to seek verification on the outcomes from the first stage of Qualitative Phase I analyses and second stage of the quantitative phase analyses. The discussion (interview) guide was used to seek cross-validation between the two outcomes.

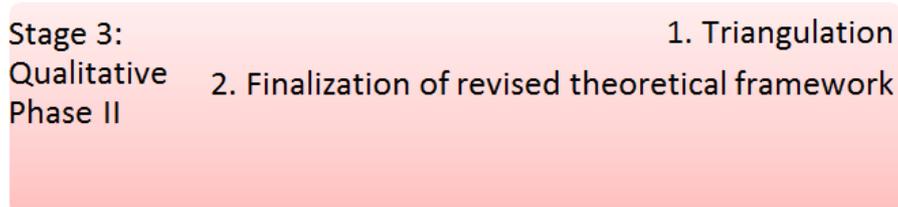


FIGURE 5.2: Stage 3-Qualitative Phase II Analysis Overview

5.3 The Demographic Analysis: Focus Group and Interviews

The focus group was comprised of householders, and the semi-structured interviews were conducted with representatives of both respective municipalities (the City of Hull and the East Riding of Yorkshire). Both sessions (focus group and interviews) used the same interview schedule, in order to ensure consistency in validating across the sample of population (householders and municipalities) (Bryman, 2008). In this triangulation phase, the sampling was convenience stratified random, where the target respondents were filtered based on their municipality. The participation from householders was recruited via convenience sampling among students at the University of Hull.

Using university students as subjects in social science research has been debated for its reliability and empirical value (McNemar, 1960). It was possible to evaluate the potential generalizability of research results using university student subjects to a non-student (adult) population, as argued by Peterson (2014). Peterson's (2014) study showed university student subjects to be slightly, but consistently more homogeneous (less variable) than non-student subjects, both within and across scales. Hence, this study used Peterson's argument in choosing a sample from university students, as the subjects would not interfere with the overall results. Furthermore, the study was not investigating new findings here, but sought

to examine and bring the Stage 1 and Stage 2 findings into a uniform interpretation. The sample representation from householders of the geographic areas was evenly represented: eight were from the City of Hull and seven from the East Riding of Yorkshire.

The municipality was represented by two officers aged between 25 – 35 years. The final sample (both householders and municipalities) included seven females and eight males aged between 25 - 45 years (mean age = 35). The study found a fairly balanced group of males (53.3%) and females (46.7%) had participated in the qualitative inquiries. The Stage 3 sample size (around 5-50 participants were advised) followed the recommendation of previous authors in qualitative sampling strategy (Mason, 2010). The summary of the demographic background of the members is as follows (Table 5.1):

Item	Mean	Range
Age	35 yrs. old	25 - 45 yrs. old
Item	Number	Percentage
Gender		
Male	8	53.3
Female	7	46.7
Total	15	100
Country of Birth		
United Kingdom	8	53.3
Other	7	46.7
Total	15	100
Status		
Student	6	40.0
Working	9	60.0
Pensioner	0	0
Others	0	0
Total	15	100
Municipality		
City of Hull	8	53.3
East Riding of Yorkshire	7	46.7
Total	15	100
Type of Residential Area		
Urban	10	66.7
Suburban	4	26.7
Rural	1	6.6
Total	15	100
Property Type		
Flat/Studio/Apartment	0	0
House with Garden	12	80.0
House without Garden	3	20.0
Total	15	100
Number of Household		
Single Occupant	1	6.6
Double Occupants	4	26.7
More Than Two Occupants	10	66.7

Total	15	100	
Item	Years	Number	Percentage
Recycling Experience (years)	More than 4 yrs.	13	86.7
	Less than 4 yrs.	2	13.3
	Total	15	100
Living in current property (years)	More than 4 yrs.	12	80.0
	Less than 4 yrs.	3	20.0
	Total	15	100

Table 5.1: Demographic Background for Stage 3 ($n = 15$)

5.4 Qualitative Phase II: Triangulation Phase

The triangulation phase was essential to cross-examine both stages in the SED, and from this, the findings were formed into consensus feedback representing the overall study. Hence, the application of micro-interlocutor analysis (an analysis technique in getting uniform feedback), was used to ensure consensus views from multiple members of a focus group (Onwuegbuzie et al., 2010). This reflected the overall study outcome. The focus group and interview data from this stage were combined, as the discussion and interview guide used during the sessions was standardized. This phase was not to search for new data or phenomena, but to iterate what had been found in the previous stages (Stages 1 and 2) (Bryman, 2008).

This study has explored the relationship between households and municipalities in relation to home recycling. In the first stage, semi-structured interviews were used to explore the existence of a symbiotic relationship between households and municipalities, as well as the common themes used with regards to home recycling. These themes were further explored in the quantitative stage to confirm the interaction between personal and situational factors, representing both households and municipalities. Hence, the application of a triangulation technique to cross-examine both findings by using a focus group and semi-structured interviews to investigate uniformity of the overall findings was necessary. Table 5.2 shows the overall RQs used to guide the overall discussion in the focus group as well as interviews for this final stage.

Research Questions (RQ)	Objective(s)	Discussion Question (s) for Focus Group and Interview
1.What is the reasoning behind HRB between different municipalities	To reveal how household recycling behaviour affects the provision of HRWS by the municipalities	<ul style="list-style-type: none"> i. Have you heard the word “sustainability”? If yes, what does sustainability mean to you in regard to waste management? Do you think that sustainability can be achieved? Why/ why not? ii. Have you heard the word “waste-to-energy”? If yes, what does waste-to-energy mean to you in regard to household waste?
2. What are the different factors associated with HRWS that may affect HRB, and how do they affect HRB?	To reveal how factors associated with HRWS affect HRB	<p>Personal Factors</p> <ul style="list-style-type: none"> i. Do you think that householders’ knowledge of recycling influences their HRB? How? ii. Who would you say is more likely to be effective recyclers, those who are situated in affluent areas, or are they less likely in the mentioned area? Why? iii. Do you think knowledge is gained through family norms? iv. Do you think that “where you are from” influences your HRB? Why? v. Have you heard the word “transient” population? <i>Transient is temporary residents such as university students.</i> vi. Do you think that those who are considering transient are more likely to be oblivious (ignorant) of the HRB norm? vii. Do you think that the working environment somehow influences HRB? Why? What factors from the working environment trigger HRB? viii. Do you think that this study environment somehow influences HRB? Why? What factors from this study environment trigger HRB? ix. Do you think marital status/cohabitation influences HRB? How? Why? x. Do you think your family members or housemates influence your HRB? How? Why?
		<p>Situational Factors</p> <ul style="list-style-type: none"> i. Do you think that convenience influences your HRB? How? ii. What would you say is more likely to be convenient, the services or facilities (show pictures on various bin type)? iii. If the services or facilities are not convenient, what would you do? Why?

		<ul style="list-style-type: none"> iv. Do you think that accessibility and availability influences householders? How? v. How does HRWS accessibility and availability affect households? How are the householders affected by these factors? Why?
<p>4. What are the interaction and symbiosis effects and what are the conditions that support the symbiosis between HRWS and HRB?</p>	<p>To reveal and explain the pre-condition phase between HRWS and HRB</p>	<ul style="list-style-type: none"> i. Engagement from municipalities has been found to be an important factor in motivating householders to recycle – do you agree? For this question, what is your thought on behalf of the municipality? What activities describe engagement by municipalities? ii. Who do you think this engagement will benefit most? Why? iii. Have you heard the word “symbiosis”? If yes, what does symbiosis mean to you in regard to waste management? <i>Symbiosis is mutual interdependencies between two or more factors.</i> iv. Do you think that effective HRB is when the municipalities HRWS and householders are mutually benefiting each other? Why? v. Do you think in order for HRB to progress effectively, certain situational factors must be available first, to motivate a person to recycle? Why/ why not? vi. Do you think pamphlets given by the municipalities are the main reference for householders? Why/why not? vii. Where do you get other recycling information? Why do you go there? <i>Probe to find out what participants think of the municipality recycling programmes.</i> viii. What kinds of recycling information would be most helpful to you? Probe for communication tools flyers, TV programmes, etc. ix. Do you think education (tertiary as well as primary and high school) is the platform to convey recycling awareness? Why/why not?

Table 5.2: The Research Question addresses the relevant objectives in Stage 3 of Qualitative Phase II (Focus Group and Semi-structured interview)

As recommended by Onwuegbuzie et al. (2010), the responses have been coded to show the homogeneity across the sessions, either during the focus group, or interviews, as tabulated in Appendix H. Hence, the data from the two methods of inquiries were combined for the final stage, so as to follow the triangulation process, as recommended by Bryman (2008). Triangulation is considered a verification process of the key findings from previous stages or research approaches (Creswell, 2008). Appendix H is a tabulation of the responses, and a representation of whether the sample of the population was in consensus with regards to the themes outlined by Stages 1 and 2. These analyses were not aiming to convey a new interpretation, but to seek commonness (homogeneity of the themes from previous findings); therefore there is no weight or validation of strength on certain findings (Bryman, 2008). Thus, the findings from the triangulation are to portray the caveat of SED (Creswell, 2008).

The multi micro-interlocutor analysis (Onwuegbuzie et al., 2010) found in this triangulation phase that most of the themes were in agreement across the sample. However, there were some isolated issues with regards to key players in HRWS. Some of the isolated issues were that the respondents highlighted other key players apart from municipalities (retailers, manufacturers and central government) that were considered equally important in instilling HRB. The triangulation processes between findings from Stages 1 and 2 have been cross-examined, and from this tabulation analysis, the majority of respondents were in agreement with the outcomes from previous stages, and the warrantability of the results had been addressed. In addressing the reasoning behind HRB, it is conclusive to say that the majority agreed that environmental issues were the underlying reason behind householders' determination to recycle. However, the determination in recycling was manipulated by the percussive elements in the situational factors (convenience, availability and accessibility) and in response to mediating factors of engagement. The majority was in agreement on the notion of pre-cursors/pre-conditions of situational factors.

Thus, the triangulation phase in Stage 3 of the SED reveals a relatively high consensus among the focus group members and semi-structured interviews on the overarching

themes (qualitative) and statistical inferences (quantitative) emerging from Stages 1 and 2. The themes that emerged verified that both situational and personal factors are equally important to instigate symbiosis effect between HRWS and HRB.

The next subsequent sections (5.4.1 – 5.4.3) are verifications in addressing the RQs from the triangulation phase. The section is reported in a qualitative statement as the final stage in the qualitative approach.

5.4.1 Verification in addressing RQ1 for Stage 1 of Qualitative Phase I and Stage 2 of Quantitative Phase. *What is the reasoning behind the HRB between different municipalities?*

RQ1 is focused on the reasons behind HRB. Much research has found that reasons for recycling are essentially subjective (Izagirre-Olaizola et al., 2015). Most of the empirical findings revealed that environmental concerns were the main reasons for awareness of HRB (Steg & Vlek, 2009; Barr et al., 2003; Stern, 2000). Recently, some studies have suggested that environmental concerns are closely related to sustainability issues and the understanding of the triple bottom line that relates to home recycling (the aspect of environment by Marans, 2015). According to Stages 1 and 2 analyses, the householders recycled mainly because of environmental concerns. In the triangulation phase, the verification of RQ1 found positive indications of a relationship between sustainability and household recycling waste management.

Ten of the focus group members showed agreement without clarification. However, the common responses from the inquiries were on the lines of “...not create waste and balancing the natural environment by being responsible towards it”, two members not providing any response to questions. On the other hand, one member stated, “*mutual causality*” when referring to sustainability:

“It is about the relationship between human and nature, both directly impacting each other. Thus we need to have balance...”

Similarly, in the interviews, the meaning and concept of sustainability had become significant compared to five years ago. Hence, sustainability was a strategic element in the household waste recycling management. However, one member noted:

“Sustainability is ambiguous word... thus I don’t think householders can grasp that...”

In relation to engagement, one member implied:

“..I don’t think we can use that word in our engagement though...”

In clarification of the aforementioned statement, the member added that “sustainability” was too general a term for engagement, that sustainability was ambiguous due to many interpretations, and difficult to use as a “tag-line” in encouraging recycling at source (Izagirre-Olaizola et al., 2015).

“Engagement should be relatable to the householders therefore when we engage with a slogan that is clear and concise. They can act on it directly”.

Across the inquiries, most members agreed that sustainability was an over-valued concept, which meant something completely different to householders compared with municipalities. In particular, sustainability for the municipalities was more concerned with the aspects of situational factors, while for the householders, it was more about behavioural effects (personal factors) on the environment.

In Stage 1, some of the discussions were in-depth with regards to recapturing back the waste in the system, especially among the municipalities. The householders were favourable to the idea of waste being converted to energy when the subject came up within the qualitative inquiries. The municipalities agreed that energy from waste would be a strategic move for a local authority, but without the necessary support from Central Government and political bodies in influencing their local constituents, the novel move would not be successful. In the final stage, the discussions were on the same idea of energy recovery from waste; nine out 13 focus group members were not aware of the concept, were quite appreciative of the explanation and positively accepted the notion of converting waste to energy, to benefit the whole community. However, one said:

“It has to be clearly informed by the municipalities in order for the public to fully understand”.

The main issue in converting waste to energy for most of them was the management of the process and the procedure of handling the waste and recyclates. Interestingly, in the interviews, one member had had a consultation on this concept years ago. However it did not turn out well:

“It does not go well down here... It is not a popular subject... personally it is good thing for me as long it goes through the waste hierarchy and we recover energy from that... but here due to political differences, people misunderstood the whole idea of it”.

When probed on the concept, “Do you think people misunderstood waste-to-energy?” one response was:

“It is back to not in my backyard attitude (NIMBY) ... they don’t want to understand even though is good for them”.

The idea of recovering energy from waste channels was quite interesting from the municipalities’ perspective, as compared to the householders. The latter was convinced that the behavioural aspects of the householders required major changes; however, the householders were convinced that with the right engagement from the municipalities, the public would eventually accept the concept of converting waste to energy. Neutralizing NIMBYism among the public was a challenge for policy-makers as well as municipalities with regards to renewal energy, such as waste to energy (Esaïasson, 2014). NIMBY is a type of objection perspective from the public when there is a lack of trust in the policy-makers and governmental bodies (Cass & Walker, 2009).

Therefore, it might be suggested that there should be an integrated framework of public involvement in awareness and education on sustainable initiatives for public benefit (Mankad et al., 2015). In the triangulation phase, when probed on education, “Do you think people need to be educated on this?” one response was:

“...is not about education alone but this is a massive project. If we don’t have some back-up from central government as well as statutory duties for such a big green

effort like this, it is unlikely to achieve. I can say maybe in 20 years' time, people will embrace this".

The notion that something is “filthy and dirty”, such as waste and waste water, requires a strategic plan for social acceptance (Mankad et al., 2015). Therefore, it is suggested that engagement between local government and municipalities with the public is necessary (Fry et al., 2015). Educating the public was considered one of the main themes in promoting sustainability and waste conversion to energy during the interviews.

Both members of the interview sessions agreed that municipalities had responsibility in creating awareness on recycling as a form of sustainability, one member noting:

“In an ideal world we would have everyone participating fully in recycling, unfortunately this isn't the case. Municipalities have to work hard to educate people, as well as think about the services they provide to make it as simple and easy as possible for the residents.”

In conclusion, the verification of RQ1 was conclusive in saying that the initiatives towards public acceptance of sustainable activities (recycling and converting waste to energy) by the municipalities required intensive public engagement and education, with direct involvement by policymakers and central authorities. This should ensure the seamless progression of the overall sustainable movement of HRWM.

5.4.2 Verification in addressing RQ2 for Stage 2 of the quantitative phase. What are the different factors associated with HRWS that may affect HRB, and how do they affect HRB?

i. Personal Factors

In this section, the verification addresses two main factors (personal and situational) in the progression of HRB, and verifies the emergence of symbiosis effect based on the interaction between these two factors. Hence, RQ2 focuses on two important factors in the overall research framework. Each attribute has many aspects that consolidate the overall factor. For personal factors, demographical aspects, such as marital status, employment, country of birth, recycling knowledge and experience were considered significant in Stage 2.

In addition, other aspects of personal factors such as self-awareness, self-efficacy and household dynamics are equally significant. Hence, in this triangulation phase, the personal factors were cross-examined. The next verification addressed the behavioural aspects primarily related to demographical aspects, such as marital status, employment, country of birth, recycling knowledge and experience that have somehow significantly implicated or influenced HRB in comparison to other personal factors. Eight of the 15 members from the two methods of inquiry believed that recycling knowledge and experience had strongly affected their HRB. However, one argued:

“It is not cognition alone but with emotion... the selfless respects to the nature are important”.

Knowledge was considered important, but most of the members agreed that it has to be translated into behavioural habits and awareness of one’s surroundings (*the notion of self-awareness*). Eight of the 15 members from the two methods of inquiry believed that education went hand-in-hand with family values and norms, as one noted:

“Yes family’s values and norms are important but it has to be with education”,

With one member vividly recalling:

“..I start recycle when I start studying here because the information is available and the system is already in placed”.

Hence, the normalization starts as one learnt or was educated in the process (*the notion of self-efficacy*). Another member added:

“Family values and norms are just a supporting elements and education is the basis of normalization”,

But this particular member extended the comment on “education”:

“When I said education I meant the media and government making us aware”.

From the interviews, the two members agreed that demographic profiles did have implications on the recycling patterns in certain areas:

“Those living in lower income areas with higher deprivation level tend to have lower recycling performance...” and:

“...but those areas are usually with higher rental property and turnover”.

The semi-structured interview members agreed that higher deprivation level areas usually had a large number of letting properties, which are occupied by a mostly transient population. In the following discussion, where you were born and bred was considered strongly by almost every member (n=15) of both method inquiries, when the questions were addressed for confirmation. Seven of the 15 members were born and raised outside Britain, the majority answering that they first learned about and experienced recycling in Britain:

"We see our surroundings here and followed the same".

When asked, "Do you think diverse background of the households really matters when they deal with waste?" another member commented:

"Some countries are unlikely to recycle...they easily throw anything in a bin as though they do not have conscience as 'you know what that is waste!'"

Interestingly, one native born member added:

"I think is not about where you are from but the conscience of a person on their daily consumption and waste..." (The notion of self-awareness).

When probed again on where they were from impacting their recycling behaviour, most of them disagreed that it had any impact on behaviour. According to some of them:

"This is back on their behaviour in their home country";

"Some of them really do not care as they said 'I paid for these and I can do anything!' as though they disconnect what they do with the world".

In addition, one member commented on "disconnect":

"..again is about mutual causality...people just do not know what they do impacting the environment" (the notion of self-efficacy).

The semi-structured interview members agreed that a transient population was the most difficult to engage in recycling activities. One responded:

"Sometimes you tried to go to their property but they would not let you in as they did not trust you unless you are their friends and the landlord...here we see landlord plays critical role in disseminating recycling to their tenants especially those whom are non-local...".

When we asked, “What is the solution?” one answered:

“We try now to have multiple languages in our pamphlet in order to promote them on recycling”.

The cultural themes are very profound in the above sections and some empirical studies have suggested that to be successful, recycling campaigns should take into consideration the local conditions and cultural, situational, or demographic factors of the households addressed (Tonglet et al., 2004, Timlett & Williams, 2008, Hadjimanolis, 2013; Keramitsoglou & Tsagarakis, 2013).

There was the discussion confirming how working status influenced the behavioural aspect of householders with regards to recycling. Six out of 15 members from both method inquiries agreed that working status somehow affects the recycling behaviour of householders, who were more concerned about the exposure they received, whether they were working or studying.

The main themes that emerged were of different perspectives and level of awareness. As one answered:

“I think the student is living in a bubble compared to working environment as they are more exposing to current situation”.

Another member added:

“Oh it is true, students tend to have limited self-awareness and low connecting with real world” (the notion of self-awareness).

In contrast, another member believed it depends on their surroundings, as one said:

“If the surroundings are encouraging on recycling ultimately people will react to that”.

The surroundings discussed were concerned with the stimuli projected, either in workplace or study place, which encouraged recycling. In addition, the semi-structured interview members showed mixed responses. Generally, the overarching themes focused on the education of individuals. When asked to clarify, one said:

“Yes I do agree at some stages in your working or studying life, some awareness affects your conscience on environment, however, it has to be repetitive awareness

regardless if you are working or studying... then the behavioural changes will take place”.

In addition to awareness, one added:

“The municipality tries to internalize recycling culture that we have for our public...it is difficult because it incurs cost and other organizational pressure”.

Organizational pressures, such as culture, financial constraints and other related constraints that slowed down the follow-up processes were considered an obstacle for household recycling waste programmes to go through effectively in some municipalities. On the other hand, household dynamics were considered important in the personal factors of HRB. Household dynamics focus on the relationships within the household, such the marital status, cohabitation, civil partners, shared accommodation and family dwelling. This part of the question was essentially probing towards dual or more householders in one dwelling.

This could involve the legal contract of marriage or cohabitation. Most of them (n=15) agreed that partner/household members played a role in influencing their spouse or partner/ member. As one said:

“It is a huge influence when you are with someone that really cares on the environment”.

From the interviews, two members agreed that certain dynamics of a household, such as size of dwelling, affects household recycling behaviour, but not in the same way as matrimonial status, as the previous findings implied. As one said:

“It is back to peer pressure... one is impacting each other... pester power”.

In the first part of verification of RQ2, there were many diverse responses, and interrelated factors emerged that coincided with the demographical aspects. For example, the socio-economic background of a householder cannot be translated as the denominator of HRB. However, most respondents believed that it was interdependently related to other personal factors, such as self-awareness, self-efficacy and household dynamics. Interestingly, the responses from the householders focused on individual self-awareness and self-efficacy with demographic aspects in the progression of HRB.

However, the municipalities were more concerned with the socio-economic background of individuals, and more or less agreed that the household dynamics, and knowledge and experience of individuals strongly influenced the progression of HRB.

ii. Situational Factors

The next section is the verification of situational factors that emerged in Stages 1 and 2 as significant elements in instilling HRB. The main aspects from situational factors found to be significant in the second stage were: convenience, engagement, accessibility and availability. Convenience was considered one of the overarching themes in the triangulation phase. The majority of the members (n=15) from both methods of inquiry supported unanimously that convenience plays a major role in changing the HRB pattern, one member noting:

"..provided with tools to make it easier for me to separate and sorting my waste".

Specific response included:

"...they provide the right bins for different items... that's convenience for me... if they don't have that, people will be more discouraged to recycle. If you have the blue bin staring at you every single day, it reminds you to separate your waste".

From the interviews, the responses were focused on the accessibility and availability of the services provided by the municipalities. A common problem was with food waste caddies. One municipality had done a survey in March 2014, due to poor performance for this provision, and the most common householder response was:

"Some people dislike them because they are dirty, smelly and would not put in the kitchen due to the aesthetic of it and the access to the liners".

When probed on the food waste issues with regards to schedule change based on seasons, which was convenient for the householders, the response was:

"I can see that, but it will be a cost for us in managing the changes. You see the people that pick up the waste in summer will be the same in the winter. I know it is

good to have frequent collection for food waste in summer in compared to winter ... the thing is we do not optimize our labour, we are not efficient in that way”.

Besides convenience, accessibility and availability were considered significant aspects of situational factors, and the majority of the members (n=15) from both methods of inquiry supported unanimously that these aspects played a critical role in HRWS and were closely related to “convenience,” as one member highlighted. Another member related this on municipality engagement and awareness programmes:

“... emphasizing the communication on these aspects to the householders...”.

From the interviews, the two members agreed that accessibility and availability were the main factors influencing householders. Both of them agreed the most difficult factor was the drop-in centre that is accessible to all the householders. One municipality tried having a mobile pick-up for small electrical items; however it was exposed to fly-tipping and “haphazard” exposed items when waiting for collection.

When probed on other pick-up services (larger items and unwearable clothing items), it was difficult to have these functioning as part of collection scheduling because of the variability and cost. Thus, the two members believed it has to be based on an “on-call” arrangement, rather than as part of the system.

Almost every member (n=15) from both methods of inquiry believed engagement was an important aspect of situational factors. Six out of 15 members gave their detailed opinions without hesitation. The most common responses related to rental turnover, temporary dwelling and specifically non-British households. Some typical responses appear below.

The first member from the focus group highlighted the diversity of dwellings and the need to communicate on the recycling culture according to the nature of letting or rental turnover.

“I think engagement is important for the area like my area that has international students due to many of them being from countries that do not impose recycling as

part of their households' waste recycling system, and this area has very high rental turnover".

The second member from the focus group then highlighted the behavioural aspects of householders, such as self-efficacy and self-awareness, noting:

"Sometimes the awareness is unlikely resonances to the householders' behaviour due to them not being aware of what they have done and its impact to the environment".

Next, the third member from the focus group, remarking on the communication packs from the municipalities to encourage householders to recycle, noted:

"The pamphlet is clear on the procedures but lack of information on reasoning of why we need to recycle. I think that's why it is difficult for them to grasp the need to recycle".

Lastly, the fourth member from the focus group highlighted the role of landlords in HRB:

"I think here landlord has a crucial role in ensuring the tenants understand the recycling procedure".

From the interviews, two members agreed that engagement played a significant role in changing HRB. One member noted:

"If an area is performing well, we don't put our resources there...it will be in local press and our website...we've got other areas that are not doing the provision properly this where put our resources into...".

The engagement by the municipality was varied and customized to the lack of performance in particular areas, where a mitigation process was usually done to rectify the problem, in order to change the recycling performance. As one member noted:

"We are focusing on specific areas where the performance is poor and has problems. Information such as tonnage from the green bin as well other bins now is analysed; therefore we have the information. Then we send officers to that area. We use

evidences to engage with towns, parishes and villages to make them recycle effectively”.

One member added that demographic profiles in each area had an impact on household recycling behaviour, noting:

“Where you live, how educated you are, how much time you have, these have some effect on recycling”.

Another member added that higher rental area or turnover was prone to lower recycling performance:

“..it gets lost between tenants, so we have to engage with landlords... here our engagement is more on getting the evidences and react on that”.

Another member from the interview group touched on the behavioural aspects of personal factors, such as self-efficacy and self-awareness:

“There will be no behavioural changes if there is no engagement. We want them to be conscientious on what they are doing before they put the waste in the bin”.

When a question probed, “Do you think people can change?” both members interviewed agreed that personal factors could be influenced or changed by proper engagement:

“Definitely with the right engagement people can change”.

The same member extended the comment:

“...but I wholeheartedly (and from years of personal experience) agree with you that better communication and engagement is now vital. We have reached as far as we can with simple leaflets - the last 50% of the population need a lot more, new methods of engagement, and better reasons they should bother to listen”.

The verification of situational factors mainly confirmed that convenience plays a vital role in HRWS implementation without the exclusion of engagement, accessibility and availability. Both householders and municipalities agreed on the interplay of self-awareness and self-

efficacy with aspects of the situational factors. The agreement warranted the existence of symbiosis effect, without initiating the notation of symbiosis effect in the discussion.

In conclusion, the verification of RQ2 has confirmed that both the situational and personal factors emerging in Stage 1 and 2 are equally supportive and mutually dependent. Thus, the neutrality of the form of inquiries (Creswell, 2008) created organic revelation of the symbiosis effect between these two factors. The next section is verification of the notion on symbiosis effect.

5.4.3 Verification in addressing RQ3 for Stage 1 of Qualitative Phase I and Stage 2 of quantitative phase. *What are the interactions (symbiosis effects) and the conditions that support the symbiosis between HRWS and HRB?*

The last verification was on the symbiosis effect between the HRWS and HRB. The discussions were very interesting, in part because not all the members (n=10) knew the meaning of symbiosis. Only five out of 15 members had come across it, and referred it as “a relationship with mutual benefits”. Once the term had been defined, most of them agreed on the symbiosis perspective for looking at both HRWS and HRB. One member touched on the self-efficacy and self-awareness aspects of personal factors, noting:

“We are in symbiotic relationship but are we aware on that is not about municipality alone but it is about us, those living in the surrounding area, we also responsible”.

Another member expanded on this:

“..again is about educating people to recycle. Yes I agree we should have all the facilities and services. If people do not want to recycle, they would not recycle. It has to come together with education in repetitive manner throughout the system”.

From the interviews, two members felt municipalities should focus on practicality and affordability as well as political interest when considering the public voices. Thus, this symbiosis perspective should be at the top level of strategic consideration, rather than simply operational. As one member noted:

“Yes I agree we need to see both HRWS and HRB aspects in unison rather than in isolation but operationally, I would think it will be difficult to do”.

And another member of the interviews group noted:

“But we can fix it without money and without anything new or untried. Food waste, 20% to 30% of residual waste, half of England is landfilling it, several good technologies exist, and all it needs is legislation. There are two very good treatments waiting to step up – IVC (in-vessel composting) and AD (anaerobic digestion). If our leaders were not so busy looking at their re-electability maybe we would see a landfill ban on food? And before we get loads of reasons not to, please look at Norway 2000, SI901 in Eire a couple of years back, or Scotland this Jan 1st. Those who say it can't be done should not interrupt those doing it”.

HCC and ERYC have shown their commitment to the circular economy by investing waste-to-energy programmes such as IVC and AD through their strategic partnering in addressing bio-waste issues (letsrecycle.com, 2015). This particular move by both HCC and ERYC has shown the Government and private sectors that working symbiotically to address HRWS can result in more sustainable ways of diverting the waste from landfill (Jacobsen, 2006). Governmental roles were seen as the major driver to encourage public recycling, as one member noted:

“If we had help from the Government we could see a huge reduction in the vast amount of useful stuff being sent to UK tips. All we need is help with the costs of PR and PR materials”.

Awareness from the municipalities was considered a mediating factor in materializing the symbiosis effect between HRWS and HRB. Hence the verification addressed whether the medium used by the municipalities was currently effective or needed some improvements to promote changes in HRB. Most of the members from both methods of inquiry (n=15) relied on pamphlets given by the municipalities as their main reference. Most of them depended on the municipalities for recycling information. Some of the members (n=7) implied that more needed to be done to ensure that the public got the right messages on

recycling from easy to access websites (the current website was too wordy). As one member noted:

“Yes I rely for most of info on recycling from the municipality webpage or emails. I just wish they were in better design”.

Some members from the focus group (n=5) drew attention to the marketing aspects of situational factors, and self-efficacy and self-awareness aspects of personal factors, one member noting:

“The web pages from university promoting this info are considered more effective”.

A member of the focus group highlighted the roles of other stakeholders in the backward movement of HRWS:

“Awareness should start from induction programmes in the university”.

Another member of the focus group added:

“It is about coexistence in one surrounding, we should understand our roles in the community as much as the producers, universities, charities, etc.”

From the interviews, the two members responded without hesitation that most of the municipalities' communication tools were currently effective and flexible, based on the areas, and they believed that some of householders' behavioural changes were as a result of the awareness packs, such as multilingual information packs, reminder tags, information stickers, etc.

The verification of RQ3 is a confirmation that the symbiosis effect between personal and situational factors does exist to aid the progression of HRB. Thus, the householders were more concerned with the self-efficacy and self-awareness level of individuals in relation to the situational factors as stimulus. The municipalities agreed on the relevance of the symbiotic relation between HRWS and HRB; however, this concept has yet to be perceptively modelled by policy-makers and legislators. Engagement and awareness were considered to be the backbone in indirectly creating the symbiosis effect between these two factors.

5.5 Qualitative Phase II: Reflection of Final Stage in SED

This section is to report the consensus or agreement of responses following the micro-interlocutor analysis, suggested by Onwuegbuzie and colleagues (2010) to quantify for analysis of the pattern of homogeneity from the overall findings (Table 5.4).

The first discussion is in regard to the two main outcomes from the first stage (Qualitative Phase 1: interviews), comprising the discourses on sustainability and waste-to-energy when reflected on the focus group and the interviews. The consensus on the outcomes was towards unanimous (Avg. = 3.9). Both members of the focus group and the interviews agreed that sustainable issues and waste management were interrelated, that the concept of sustainability was ambiguous, and that for practicality, the notion of “sustainable” should be clear and applicable to the households (Tudor et al., 2011). As for the waste-to-energy, the reflections were mixed, as for the focus group the notion of waste-to-energy was fairly vague, as they rarely received any information from the municipalities on it. However, after further discussion on the notion, most of them agreed that if the LAs put more effort into the dissemination of information with regards to sustainable ways of energy recovery, they felt that households would voluntarily participate in the notion (Keramitsoglou & Tsagarakis, 2013).

Reflections on RQ1 by the interview members were quite different, as they were more aware of the notion of waste-to-energy, and believed it was something that the policy-makers and the constituents’ representatives should focus on and have active involvement in. Hence, the project on waste-to-energy has been a focal point of waste strategic agenda for HCC and ERYC, leading to the development of IVC and AD plants (letsrecycle.com, 2015).

Next, in the reflections for RQ2, there were 12 discussion points for both the focus group and the interviews. Most of the discussion points resulted in agreement across the group on highlighting the importance of the precursors of situational factors such as engagement, education and convenience, as well as accessibility and availability of the facilitation of HRWS (Latif et al., 2013; Foxall & Yani-de-Soriano, 2005; Schultz et al., 1995).

Moreover, personal factors such as self-efficacy and self-awareness were considered important for households. It was thought that both attributes were manifested with the right stimuli (situational factors), and that knowledge of recycling was important in conjunction with the right situational factors. In addition to residential location, the reflections were consistent with the previous findings (GLA, 2011) that, while areas of high deprivation are supposed to be low in recycling performance, this was not the case in certain areas of the ERYC and the HCC, as reflected in the interviews. Furthermore, when the discourses focused on the transient population, members from both the focus group and the interviews were in agreement on the roles played by HCC and the ERYC, where closer engagement, using multiple languages for communication tools (brochures) and a door-to-door approach were considered successful factors in encouraging households to recycle (Saphores et al., 2012; Fitzgerald & Gonen, 2011).

From the reflections in Stage 3, it was found that the major aspects of situational factors were convenience, accessibility and availability, as well as the mediating factors of engagement and education from the municipalities. These were considered overarching themes during the discourses, and were consistent with Stage 1 and 2 findings (RQ3. avg. = 5.0).

Research Question with Discussion Item (D)	Average
RESEARCH QUESTION 1 (RQ1)	
D1. Have you heard the word “sustainability”? If yes, what does sustainability mean to you in regard to waste management? Do you think that sustainability can be achieved? Why/why not?	3.9
D2. Have you heard the words “waste-to-energy”? If yes, what does waste-to-energy mean to you in regard to households’ waste?	2.9
RESEARCH QUESTION 2 (RQ2)	
D1. Do you think that householder’s knowledge of recycling influences their HRB? How?	4.5
D2. Who would you say are more likely to be effective recyclers, those situated in affluent areas or are they less likely from the mentioned area? Why?	3.3
D3. Do you think knowledge is gained through family norms?	5.0
D5. Do you think that “where you are from” influences your HRB? Why? Have you heard the word “transient” population? <i>Transient is temporary residents such as university students.</i> Do you think that someone who is considered transient is more likely to be oblivious (ignorant) of the HRB norms?	2.9

D6. Do you think that the working environment somehow influences HRB? Why? What factors from the working environment trigger HRB? Do you think that this study environment somehow influences HRB? Why? What factors from this study environment trigger HRB?	4.4
D7. Do you think marital status/cohabitation influences HRB? How? Why? Do you think your family members or housemate have influence on your HRB? How? Why?	4.0
D8. Do you think that convenience influences your HRB? How?	4.3
D9. What would you say is more likely to be convenient, the services or facilities (show pictures on various bin type)?	4.5
D10. If the services or facilities are not convenient, what would you do? Why?	4.3
D11. Do you think that accessibility and availability influences householders? How?	5.0
D12. How does HRWS accessibility and availability effect households? How are the householders affected by these factors? Why?	5.0
RESEARCH QUESTION 3 (RQ3)	
D1. Engagement from municipalities has been found to be an important factor in motivating householders to recycle. For this question, what are your thoughts on behalf of the municipality? What activities describe engagement by municipalities? Who do you think this engagement will benefit most? Why?	4.4
D2. Have you heard the word “symbiosis”? If yes, what does symbiosis mean to you in regard to waste management? Symbiosis <i>is mutual interdependencies between two or more factors.</i>	2.7
D3. Do you think in order for the symbiosis effect to take place, and have an effective HRB is when the municipalities’ HRWS and householders are mutually benefiting each other? Why?	4.3
D4. Do you think in order for HRB to progress effectively, certain situational factors must be available first, which will motivate a person to recycle? Why/why not?	5.0
D5. Do you think pamphlets given by the municipalities are the main reference for householder? Why/why not?	4.3
D6. Where do you get other recycling information? Why/why not? Why do you go there? <i>Probe to find out what participants think of the municipality recycling programmes.</i>	3.1
D7. What kinds of recycling information would be most helpful to you? <i>Probe for communication tools, flyers, TV programmes, etc.</i> Do you think education (tertiary as well as primary and high school) is the platform to convey recycling awareness? Why/why not?	3.5
Overall Average	4.1
Code	
SE = Provided significant statement or example suggesting agreement	5
A = Indicated agreement (i.e. verbal or non-verbal)	4
NR = Did not indicate agreement or disagreement (i.e. no response)	3
D = Indicated disagreement (i.e. verbal or non-verbal)	2
SD = Provided significant statement or example suggesting disagreement	1

Table 5.4: Average for Consensus of both methods of inquiry

On the other hand, the aspects of personal factors, such as self-efficacy and self-awareness were the main themes that emerged that are considered pivotal for householders to have in order to achieve a sustainable (habitual) HRB (RQ2. Avg. = 4.14).

The term 'symbiosis' was not a common term for most focus group members. However, when it was explained and discussed, eventually all members (n=15) from both methods of inquiry were in agreement (RQ4. avg. = 3.91) that HRWS and HRB depicted a symbiotic relation.

The final qualitative stage was completed with verification on each research question using triangulation process. The two methods of inquiry, focus group and semi-structured interview, presented an opportunity to triangulate and verify the interaction between situational and personal factors discussed. Micro-interlocutor analysis, as recommended by Onwuegbuzie et al. (2010) gave the quantitative value in order to seek a pattern of responses in the focus group and across multiple methods of inquiry, making the analyses more rigorous and cohesive. The research questions (RQ1, RQ2, RQ3) were evidently triangulated using this technique of micro-interlocutor. The notion of symbiosis effect on the relationship between household recycling waste systems and the householders clearly emerged was verified in the discourses. Although the members of both methods of inquiry were not necessarily representative of the City of Hull and the East Riding of Yorkshire residents, the opinions obtained provide insightful information which the municipalities could take advantage of.

Furthermore, insightful information obtained from members of the focus group was critical to the development of any campaign, because it considered 'what' factors are important to drive the public to recycle, and provided insight on 'symbiosis effect' that had not been well understood. More importantly, it gave an awareness of the issues most relevant to the householders. The majority of the participants agreed that public involvement in the design of recycling schemes is critical to the success of a recycling campaign, because these are the individuals who can best determine what motivates them, and what would help them to develop a sustainable HRB. They could also provide insight on the perceived barriers that keep them from recycling frequently.

In conclusion, the final stage achieved verification of all factors (situational and personal) that influence HRB and HRWS, and confirmed that symbiosis effect does take place when

the factors interact. In addition, some new themes (role of other stakeholders in backward movement) emerged during the discussion from both methods of inquiry, which were not under the research unit of analysis; however, these new themes could be considered in future research. The next section's discussions focus on the overall arguments from Stage 1 of Qualitative Phase I to Stage 3 of Qualitative Phase II, presented in accordance with the stages within the SED.

5.6 Discussion

In this section, the discussion is directed at the findings relating to stages in the SED. Overall RQs (1, 2, 3) are addressed in all stages. Thus, the discussion encompasses the relationship between the empirical findings and the research questions, literature review and theoretical framework. The section starts with the first qualitative findings and the iteration with previous empirical findings and prior theories.

In the next section, the discussion focuses on the synthesis from quantitative analyses of 412 cases sampled from the City of Hull and the East Riding of Yorkshire population. The next section posits the verification (triangulation) of two earlier findings and the relevant empirical literature. Finally, the section amalgamates the overall findings and transferability to a broader population, as well as looking at the limitations and future research considerations.

5.6.1 Stage 1: Qualitative Phase I

This stage was considered vital as it laid the foundation for the subsequent stages. The earlier version of conceptual model has been developed based on underpinning theories and models from a review of the literature (Fig. 5.3). In Qualitative Phase 1 analysis, the composition of the underlying themes was represented by a group of themes, either for situational or personal factors (Fig. 5.4). The situational and personal factors were either confirmed or emerged during this first stage. Thus, it refined the earlier conceptual framework which was based on gap-spotting from literature reviews (Fig. 5.3).

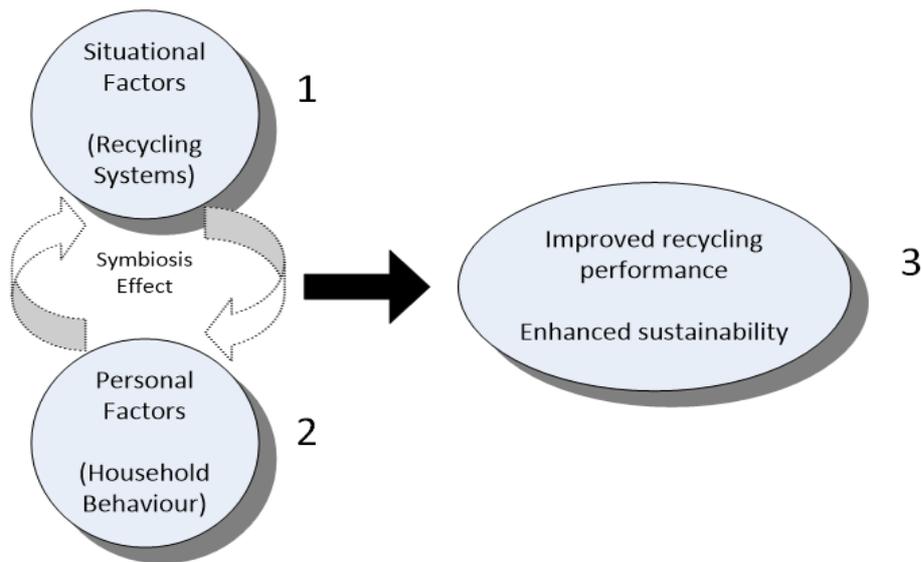


FIGURE 5.3: Proposed theoretical framework-Author Conceptualization

The revised version of theoretical framework is more concise and laid the foundation of the quantitative approach in Stage 2. The revised theoretical framework (Fig. 5.4) includes factors that considered an emergent (E) (factors that have rarely been discussed in relation to HRB in previous studies), and a confirmation (C) (factors that have been significant factors in relation to HRB in previous studies).

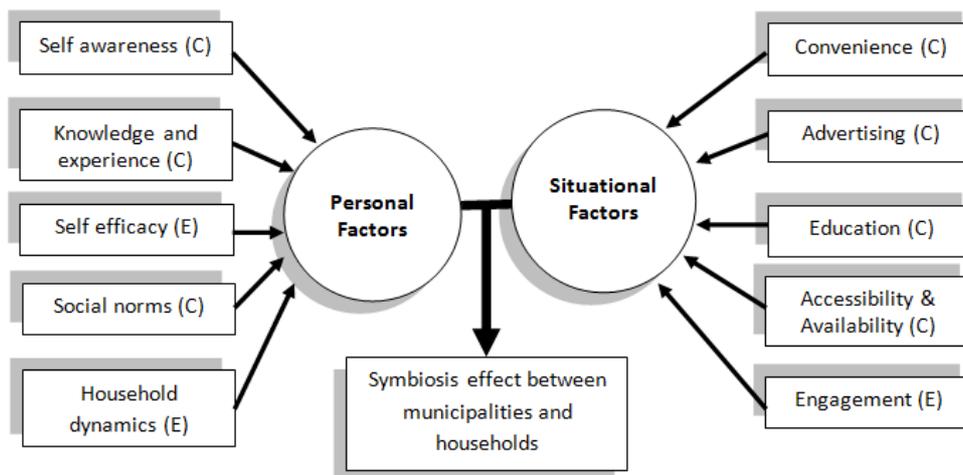


FIGURE 5.4 Thematic analysis network of Conceptualization on *Symbiosis Effect* between Municipalities and Households ($n=14$).

Analysis of the transcripts revealed that 'self-awareness', 'knowledge', 'experience', 'self-efficacy', 'social norms' and 'household dynamics' (number of people per household and type of dwelling, i.e. marital status, family, cohabitants) were relevant personal factors (Park & Ha, 2014; Stern et al., 1999). Respondents were inclined to the view that individuals should have some sort of awareness within themselves in regard to recycling, due to recent changes in the environment. Hence, they suggested that accountability towards the environment should be shared with the municipality. Similarly, De Groot et al. (2016) supported self-efficacy, self-awareness and social norms as normative conduct in recycling behaviour (Fielding & Hornsey, 2016).

In addition to social norms, the general argument from the respondents was that the public does not dictate the behaviour of individuals, but the household dynamic was considered an epitome in setting the norm, especially relating to HRB (i.e. parents making the rules in sorting and separating the rubbish, or partners or housemates showing pro-environmental behaviour such as recycling, saving energy consumption and reusing or upcycling repetitively). The dominant member of the household in portraying HRB will to some degree influence the rest of the household (Thøgersen & Grunert-Beckmann, 1997). In some studies, the social norm was only stimulated by exposure to certain situational settings (Bhate, 2005; De Groot et al., 2016), whereas the first stage of SED revealed that social norms can derive from within the household as well as the household surroundings.

Respondents in general agreed that prior knowledge and individual experience somewhat influenced their tendency to recycle. For example, respondents from Germany reported that they still recycled in the UK, but not as conscientiously as in their home country. This is because the supportive factors, such as accessibility and availability of recycling banks were insufficient in comparison to their home country. It is known from previous empirical findings that knowledge and experience were considered to be significant aspects in personal factors to improve HRB (Barr, 2013, 2003; Babaei, 2015).

Recent studies have shown that the difference between individuals with or without prior knowledge or experience of recycling significantly influences their overall recycling

behaviour (Lackhan, 2016; Kashyap & Iyer, 2015; Boonrod et al., 2015). The interesting part of the first stage was that the discourse usually moved between both factors in one discussion, whichever type was the most ostensible subject. For instance, when discussing knowledge and experience, the responses were usually related to having prior knowledge on recycling being equally important to attending an awareness programme from the municipality. In this first stage as well, the aspects of situational factors that were considered as underpinning themes were 'availability and accessibility', 'convenience', 'advertising', 'education' and 'engagement'.

These situational factors were derived from many aspects identifiable in logistics and supply chain discourse, particularly backward movement (product, services or waste) and flows (Grant et al., 2013; McKinnon et al., 2012; Cherret et al., 2010). In addition, Cherret et al. (2010) and McLeod et al. (2008) discussed in detail the requirement of reverse logistics in HRWS, whereby the backward movement should be seamless and sustainable, focusing on availability and accessibility, as well as convenience to the public.

Therefore, the aspects of situational factors, such as the provision of services and facilities from municipalities (wheelie bins, bin liners, schedule times, drop-in centres, customer services etc.) are further considered here as 'availability' and 'accessibility'; the process of sorting with given instructions (a municipality recycling manual) is considered as 'convenience' or 'the ease of doing' (after Wagner, 2013); 'education' (municipality involvement in inducing a recycling culture (after Young et al., 2013); 'advertising' (getting awareness messages across to households (after Wong et al., 2013); 'engagement' (direct communication on recycling, i.e. door-to-door consultation, and a road awareness programme (after Fischer et al., 2012). The most frequent theme used in discussing situational factors was convenience. Respondents ($n=14$) were happy when the co-mingled bin was introduced. Some of them agreed that the HRB level changed when new bins were introduced, in comparison to the previous provision (multiple bins).

As Wagner (2013) found, individuals preferred something that was easy to follow and do, therefore a routine behaviour such as HRB could be manifestly affected.

Other situational factors were equally important when the discussion of these aspects was related to symbiosis effect with the respondents, whereby the emergent and confirmed themes were recognised during the discussion on interdependency between personal and situational factors. In the Stage 1 analysis, the themes that emerged and were confirmed from the thematic analysis reflected 'information richness', particularly when most of the respondents consistently discussed both situational and personal factors in one discussion, even though the interview questions were intentionally separated in addressing those two factors. Information richness is considered useful and has value (Rubin & Rubin, 2012) where the data can extend its current analysis. Using the ethnography analysis (Spradley's method), the 'cause and effect' relationship posits the initial suggestion of symbiosis effect between HRWS and HRB.

For example, the first stage of SED found that householders agreed that without the 'accessibility', 'availability' and 'convenience' of HRWS, they were reluctant to be actively involved in the recycling process (a point broadly support by Barr et. al., 2013). On the other hand, the 'rationale' relationship postulates that the pre-condition of situational factors enables HRB to have an effect. For example, the first stage of SED found that engagement from municipalities with regards to recycling activities had changed some of the non-recycling householders out of the 14 to be more concerned about the environment and aware of their daily consumption. Some of these 14 householders were transient population (i.e. students, immigrants), and some of them had not been exposed to recycling initiatives in their home country (Soysal, 2012). Furthermore, these transient respondents had experienced recycling behaviour at first hand, through observation of their housemates or partners (household dynamics).

Culiberg (2014) posits that moral responsibility, such as recycling behaviour and pro-environmental behaviour can best be explained as emanating from a structured household. Therefore, householders were less willing to participate if there was an ambiguity in promoting recycling behaviour. Particularly in this stage, self-efficacy and household dynamics were emergent themes that the householders agreed as tangible attributes or

aspects in personal factors that induced moral responsibility (Park & Ha, 2014). Thus, personal factors from the aspects of self-efficacy, self-awareness, knowledge and experience, social norms and household dynamics were considered to be overarching themes in the first stage of SED.

On the other hand, situational factors from the aspects of convenience, advertising, education, engagement, availability and accessibility were found interchangeably and repeatedly during the discourses. Engagement from the municipalities, in particular, was considered to be an overlaying condition to endorse positive HRB. For example, the higher spatial coverage of availability and accessibility for recycling provisions and facilities tended to initiate positive behavioural change, as most of the householders believed during the discourses. Primarily, the elements of availability and accessibility (logistics) and convenience (the ease of doing) were the most common themes, which, in Spradley's typology (1979), portrayed a 'cause and effect' and 'rationale' relation. Spradley's typology posits that 'availability' and 'accessibility' (logistics) and 'convenience' (the ease of doing) represents the pre-condition/precursory factors (situational factors). These situational factors interact with the personal factors (self-awareness, self-efficacy and household dynamics) that influence HRB.

Furthermore, the importance of interaction and engagement from the municipality and its implication on HRB is similar to Brekke et al's. (2010) explanation of how social interaction is important to promote sustainable ascribed behaviour, i.e. recycling behaviour and pro-environmental behaviour. This can best be explained by the '*consumer behaviour setting*' model introduced by Foxall (1999) which suggested that behavioural change is manipulated by the situational setting and mediated by interaction between the socio-actors (Bhate, 2005; Foxall & Yani-de-Soriano, 2005).

From the 14 diverse householders in Stage 1, it was too early to make an assumption and the sample size was too small to make inference on differences between the two municipalities (City of Hull and East Riding of Yorkshire). However, it was found that both

municipalities' households were homogenous with regards to their views on the initial introduction of HRWS and subsequent changes made by their respective municipality.

To relate the first stage findings with the Norm Activation Model (Biel & Thøgersen, 2007), the provisional findings posit situational factors as a pre-condition for the personal factors to activate. Hence, the analysis from the first stage postulates HRB changes in accordance to how effectively the situational factors were established (Kleinschafer & Morrison, 2013; Brekke et al., 2010). The first stage of Qualitative Phase I analyses encapsulated the existence of interactions (symbiosis effect) between personal factors and situational factors.

A symbiosis effect was apparent in Stage 1, in that it seemed that HRB would alter in accordance with changes made by recycling schemes introduced by municipalities. Findings in this respect were similar to those of Woodard et al. (2005), who examined instances where municipalities introduced new schemes and a resultant improvement of 12% from the previous percentage of recyclates collected was achieved. Woodard and colleagues' work is similar to that of Williams and Cole (2013) who explored trials of two different schemes (co-mingled and sort/separate provisions) in which an improvement in recycling was noted. The work of the aforementioned authors pointed to cause and effect relations between improved recycling schemes and improved recycling rates. In addition, this work also found that interaction and engagement from the municipality were of significant importance. The results of Stage 1 broadly provided support for a conceptual framework (as mentioned in Chapter 2) as a viable basis for further theoretical development. This was a preliminary proposition based on 14 interviews with two different types of qualitative analyses (Braun & Clarke, 2006). Hence, the first stage had accomplished overall RQs and substantiated a clear ground for Stage 2 to follow-up.

Correspondingly, the first qualitative stage encapsulated the importance of rigour and warrantability (Bryman, 2008; Guba & Lincoln, 1994). The importance of rigour and warrantability is to ensure that the data gathered is authentic and organic (genuinely from the respondents' views of the world), as proposed by Guba and Lincoln (1994). For example, in this study, self-reflection on the recycling experience of the householders was prompted

by encouraging them to tell a story interactively, rather than directing structured responses (Roulston, 2010).

As Guba and Lincoln (1994) suggested, authentic and behavioural responses are important in qualitative analyses, as it sustains the novelty of the raw data with minimal researcher manipulation (even though it was allowed in this paradigm, as in Bryman, 2008). In addition, Qualitative Phase I analysis also furthered the rigour of the approach by thematically investigating the regularities of each theme emerging during the discourses (Aronson, 1994), and the regularities were cross-examined with previous literature (based on key words/themes used in the literature). Therefore, in this preliminary stage, it was essential to explore the proposition of 'symbiosis effect' by extending the thematic analysis to an ethnography analysis.

This ethnography analysis is similar to gathering early information prior to a larger study, for instance piloting a study (Wilson et al., 1998), whereby the analysis improves the quality and efficiency of the actual study. Hence, the ethnography analysis used in this study applied Spradley's (1979) semantic relationship typology (LeCompte, 2000). Spradley's semantic relationship typology explores semantic (study of meaning) relationships between themes (Roulston, 2010; Aronson, 1994). Two types of semantic relationship emerged in this study: cause and effect, and rationale. This particular typology redefines the initial conceptual framework to a revised version of the theoretical framework. However this theoretical framework was considered as the basis of the second stage, the quantitative phase.

5.6.2 Stage 2: Quantitative Phase

Stage 2 of the SED was applied to extend the analysis from the first stage and to address the overall RQs (1, 2, 3). This stage was considered critical to posit a symbiosis effect that was derived from the ethnography analysis in the first stage. In addition, the quantitative phase was used to determine which aspects within each factor (situational or personal) were considered significant.

The demographic analysis derived from this stage (Fig. 5.5) corresponded to the region population of Yorkshire and Humber (Fig. 5.6), in accordance with the gender and age group sub-set. The demographic analysis was used to address the socio-economic typology between the two sets of population.

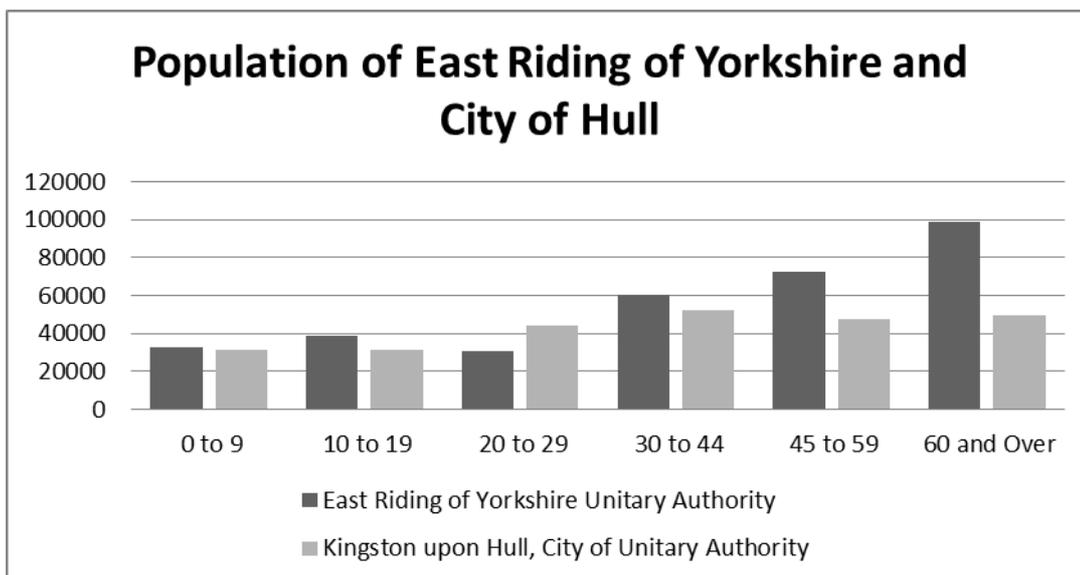


Figure 5.5: Calculation based on ONS demographic data using 2011 as baseline (from Nomis, on 15 October 2014)

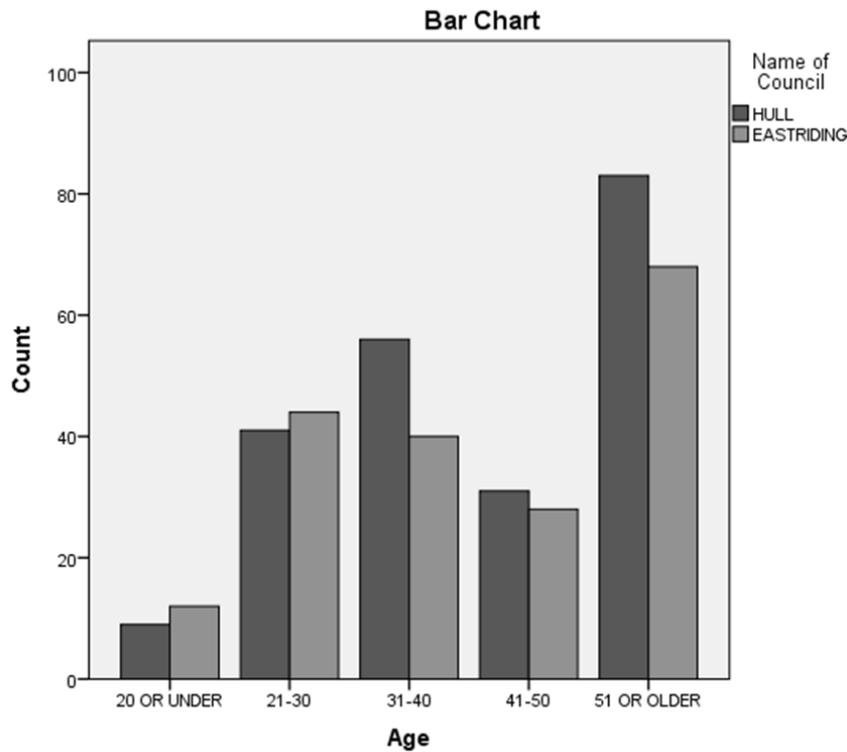


Figure 5.6: Sample of Population based on Municipality

The sample population in this study somewhat mirrored the actual population; the analysis put on forward in the stage is considered reliable (Henry, 1990). The frequency analyses posited some interesting facts on the personal factors of the householders between the distinct municipalities. Most of the previous findings stated there should be some differences between two distinct local constituents (urban vs. rural area).

This study found that there were no actual differences between the two municipalities with regards to their householders' reasons for recycling. For example, residents of both municipalities defined their motives for recycling as being grounded in a belief that recycling improved their environment, and that they wanted to live in an environmentally conscious society.

In some empirical works, the socio-demographic differences had some implication on the recycling performance (Pedrini & Ferri, 2014).

The City of Hull has considerably high deprivation rates in comparison to the East Riding of Yorkshire (Communities and Local Government 2007); therefore it might be expected that the City of Hull would regress rather than progress in recycling performance in contrast to the East Riding of Yorkshire, which is more affluent than the latter. For example, some studies showed that residents in areas of deprivation were less likely to recycle in comparison to residents of affluent residential areas (Harder & Woodard, 2007). However, from the last stage of the information given on recycling performance from both municipalities, it was not conclusive that the deprivation level had implications on recycling performance for either area, as representatives from both stated that there were deprived areas that had high recycling rates, consistent with the report from the Greater London Authority (GLA, 2011). Furthermore, both LAs agreed that there were many situational factors to consider when enhancing recycling performance, such as engagement, education, and accessibility and availability. This was reflected in Latif and colleagues' (2013) study on situational factors as having overarching attributes in the development of effective HRWS.

Since, the volume of the recyclates and general waste is the base line for the calculation of overall recycling performance, it can be misleading (EuropeanEnvironmentAgency, 2013), and the variation of overall recycling performance in England itself is scattered across the municipalities (DEFRA, 2011). Hence, to say one area is better than another can be wrongly interpreted (EuropeanEnvironmentAgency, 2013). For example, as reported in EEA (2013), an affluent area such as Inner London only achieved 16% recycling rate in 2011, the region contributing higher volumes of MSW. However regions such as Yorkshire and Humberside (where the City of Hull and the East Riding of Yorkshire are located) which were more likely to have areas of high deprivation, had achieved a higher recycling rate (above 45%) within the same year. The statistics provided by EEA, as well as DEFRA, posit a realization of MSW complexity, and that there is more to be done.

Abbot et al. (2013) stated that the variation in recycling performance throughout the United Kingdom, especially England was influenced by more than just socio-demographic elements, but could derive from geographical spatial setting (rural vs urban area) and situational factors of the HRWSs provided by the municipalities. The findings from this study highlighted that the City of Hull residents (urban type area) were inclined towards 'up-cycling', such as reusing or re-selling most of their recyclable items, or giving those items to extended family or friends. On the other hand, the East Riding of Yorkshire households were more likely to send their reusable items to various charities. It is clear that both municipalities had the same intention towards recycling (recover back the item to secondary channel), but the presupposition of recyclates was distinctly different (Pedrini, 2014).

In Stage 1, several aspects of personal factors (self-awareness, self-efficacy, household dynamics, social norms and knowledge and experience) underpinned HRB. In stage 2 of the quantitative phase, the analysis was to seek correlation and predictive values of the relationship between situational factors (convenience, engagement, accessibility, and availability) alongside the personal factors that underpin HRB. Therefore, a Pearson correlation was used to analyse the relationship between situational and personal factors.

It was also necessary to test the skewness (positive or negative) of the relationship between the situational factors (engagement, accessibility and availability, and convenience) and demographic factors (age, employment, knowledge experience and household dynamics). On top of that, combinations of personal factors (self-awareness, self-efficacy and social norms) were required to correlate with the situational factors (to get overall representation of the personal factors).

Overall representation of the personal factors was required to represent individual differences in the target constructs, i.e. a composite of personal factors and a composite of situational factors (DeCoster, 2004).

Hence, the compositional personal factors were used in the analysis because human behaviour is not constituted as a one-dimensional aspect (Ajzen, 2002; Bandura, 2001; Stern, 2000), and to use only one aspect (i.e. self-efficacy) for unit analysis is not representative of behavioural norms (Park & Ha, 2014). Social scientists have argued that human behaviour is a complex form of social cognition, as Bandura (2001) postulated in accordance with agentic (intentionality, forethought, self-reactiveness and self-reflectiveness) perspective:

“Through agentic action, people devise ways of adapting flexibly to remarkably diverse geographic, climatic and social environments... they figure out ways to circumvent physical and environmental constraints, redesign and construct environments to their liking, create styles of behaviour that enable them to realize desired outcomes, and pass on the effective ones to others by social modelling and other experiential modes of influence” (Bandura, 2001: 22).

Results from this study reveal that personal factors had a significant relationship with situational factors ($p < 0.01$) and vice versa, with a positive correlation ($r(412) = +0.41$). The analyses indicated that a socio-demographic profile of a local constituent had a positive correlation with factors contributing to HRB, and that there was a correlation between composite personal factors, with age group, household dynamics and employment status having the most significant relationship ($p < 0.01$). However, with regards to knowledge and experience aspects, recycling experience had no significant correlation with composite situational factors.

This was unsurprising, as some studies of pro-environmental behaviour have suggested that when a person is innately environmentally inclined (Tonglet et al., 2004; Kollmuss et al., 2002), i.e. high in knowledge and experience of recycling regimes, they tend to be proactively involved in recycling activities (Kalamas et al., 2013), with or without certain aspects of situational factors (i.e. engagement). To showcase that personal factors were significant in progressing HRB, correlation analysis was performed, and the result was

significant at ($p < 0.01$), showing that personal factors had a mutual relation with engagement, convenience, accessibility and availability.

Many previous studies have stipulated the positive relationship between situational and personal factors (Botetzagias et al., 2015; Akil & Ho, 2014; Barr et al., 2013; Thogersen, 1997), but the findings from Stage 2 grasp the individual aspects independently in accordance with the significant aspects: engagement, convenience, accessibility and availability, rather than vaguely postulating them as 'situational factors', as many researches have implied (Bahn & Claiborne, 2015; Zen & Siwar, 2015; Botetzagias et al., 2015; Barr et al., 2013). In order to examine whether personal factors interacted with situational factors (engagement, accessibility and availability), a multiple regression analysis was performed to test these assumptions.

Pearson's correlation clearly addressed the variables that play a role in manifesting the symbiosis effect between situational and personal factors, which this analysis has addressed in RQ2, by seeking factors that significantly relate to the interaction.

Multiple regression analysis (multi-regression, logistic regression and multivariate) was used to analyse the direction and strength of the relationship between the two sets of variables, as well to indicate whether these variables were covaried (a continuous predictor variable) (Cohen et al., 1983; Lee Rodgers & Nicewander, 1988).

The multiple regression analysis seemed relevant, as it addressed the assessment of various relationships, using the information from independent variables to improve the accuracy in predicting values for the dependent variable (after Field, 2009). These analyses also revealed the existence of confounding variables (demographic items) in association with either personal or situational factors (engagement, accessibility and availability).

The confounding variables addressed the important aspects of personal factors derived from the socio-demographic background of the population, similar to most behavioural studies on HRB, which strongly support that demographical aspects are attitudinal and innate to individual cognition (Ajzen, 2002; Bandura, 2001; Stern, 2000).

Thus, when personal factors with confounding variables were predicted, it was found that engagement, convenience, accessibility and availability at ($p < 0.01$) were significant predictors of recycling behaviour. The overall model fit derived from the regressions were towards 100% ($R^2 = 0.838$), a well-fitting regression model with results in predicted values close to the observed data values (Field, 2009).

This is a good model fit because the variability of the response data around its mean (cohesion pattern of the sample response) and the main effect of all situational factors was significant ($p < 0.01$). The analysis showed that the presupposition of symbiosis effect as predicted values was closely similar to the observed values from the sample of the population. For example, it was predicted that there is an interaction between situational and personal factors, where the observed values of the actual interaction is clearly presented in this study.

While there has been lack of similar research juxtaposing the symbiosis effect empirically to support that the interaction does exist between the two factors, Bhate's work (2005) revealed the interaction between situational and personal factors in some settings. Furthermore, some authors (Bahn & Claiborne, 2015; Zen & Siwar, 2015; Botetzagias et al., 2015; Barr et al., 2013) have loosely confirmed the strong relation between the two factors. This analysis has showed that both situational and composite personal factors interact to manifest HRB. Additionally, assertions made in previous literature have contained suggestions that different localities (based on geographical setting, such as deprived vs. affluent areas) strongly impact on recycling performance (Abbott et al., 2011; Hadjimanolis, 2013; Shaw et al., 2007). The findings from this stage show that deprivation versus affluence was not a strong predictor of beneficial HRB (there was no difference between ERY and Hull). Instead, we discard here a naïve association between deprivation and affluence with positive HRWS performance.

Rather, this study has revealed that geographical settings are part of a more complex symbiotic relationship, a point broadly supported by Akil and Ho (2014).

As Shrum (1994) supported, there are many underpinning factors that are compositional to HRB, and it is ineffective if the latter is studied within a fragmented view of recycling behaviour as predicted.

As the correlation analyses having been satisfied, a logistic regression was used to test the full model against a constant model. In earlier quantitative analysis, the reasons behind home recycling fell very much between “to serve an environmentally conscious society” and “to improve the environment”. Thus, by using logistics regression, we could predict the changes in a categorical variable with other categorical variables, such as demographical factors.

The results from the full model indicated that the motives of householders for HRB depended on changes in some demographic factors (one unit increase). They were likely to change their reasoning for HRB based on regulation if they were more than a one person household, and not working, but a student. The householders tended to base their reasoning on the environment if they had been living at their current address for more than four years, or had started recycling when the scheme was introduced.

The householders also tended to base their reasoning on self-image, whether they were working or unemployed/on benefit. The overall model was significant at the 0.05 level according to the model Chi-Square statistic. These analyses indicated that changes of population demographic background can predict the presupposition of home recycling (similar to Abbott et al., 2011; Hadjimanolis, 2013; Shaw et al., 2007). Therefore, the inclination towards sustainable HRB could be based upon changes in the socio-demographics of a population.

The model correctly predicted reasoning for recycling as regulation (65%), environment (86.9%) and image (74.3%) from the responses. From the logistic regression, even though assumptions could be made from the changes in socio-demographic background in predicting the reasoning behind home recycling, it needed to be done with caution, as the Nagelkerke’s Pseudo R² is skewed to zero than one (higher value is considered better model fit, as in Field, 2009).

Hence, the logistics regression addressed the initial relation between situational and personal factors interplayed with confounding variable (demographic profiles). These analyses have demonstrated that personal and situational factors interact in projecting HRB. Specifically, the reasoning behind HRB indicated that changes in demographic profiles had an effect on householders' inclination towards recycling.

In Stage 2, the inferential analysis was performed. When performed on the data, this demonstrated significance and greater confidence in the following discussion on the factors, a summary of which is presented in Fig. 5.5. First, the interaction between accessibility and availability, as well that between convenience and engagement (situational factors) with personal factors, were found to be the main predictors (precursors) of positive HRB.

Second, the composite personal factors' interaction between engagement or convenience, or accessibility and availability (situational factors) point to enhancement in HRB. Third, to project or manifest HRB in a way that increases recycling performance, households must be motivated by the right stimuli such as the engagement, convenience, accessibility and availability in HRWS. Keramitsoglou and Tsagarakis (2013) discussed such matters in respect to convenience and engagement.

In addition, it has previously been concluded that personal factors can be usefully sub-classified into five aspects (represented by the left column of Fig. 5.4). In the quantitative analyses, personal factors (self-awareness, self-efficacy and social norms) were transformed into a composite excluding some demographic aspects (age, employment, knowledge and experience, and household dynamics, such as number of inhabitants per household and marital status). The composite of personal factors was considered robust, as the contribution of each item to the composite score was weighted to reflect the target construct (DeCoster, 2004). Rather than investigate individual aspects of situational and personal factors, and to better satisfy this study's aim of examining symbiosis effect, the results of the analysis instead demonstrate the interaction between situational and personal 'composites'.

Thus, only the itemized situational factors were investigated because engagement, convenience, accessibility and availability (situational factors) were proposed precursors before the interaction was initiated. Furthermore, only knowledge, experience and household dynamics (personal factors) were explored, as these were demographic factors. In this study, the demographic factors have been established as an aspect of personal factors, as well as an extraneous variable that DeCoster (2004) referred to as a confounding variable (that correlates directly or inversely with both the dependent variable and the independent variable).

However, results suggest that ‘knowledge of recycling’ in households and of how long they have been recycling (knowledge and experience) positively interacted with situational factors and contributed to an improvement in HRB (this finding is consistent with Thogersen, 1997). Two situational factors, ‘advertising’ and ‘education’ were found to be insignificant in this study (hence their deletion in Fig. 5.7). Advertising and education were considered as continuous predictor variables (referred to as covariance in Pallant, 2010) and were indirectly correlated to the engagement aspect of situational factors.

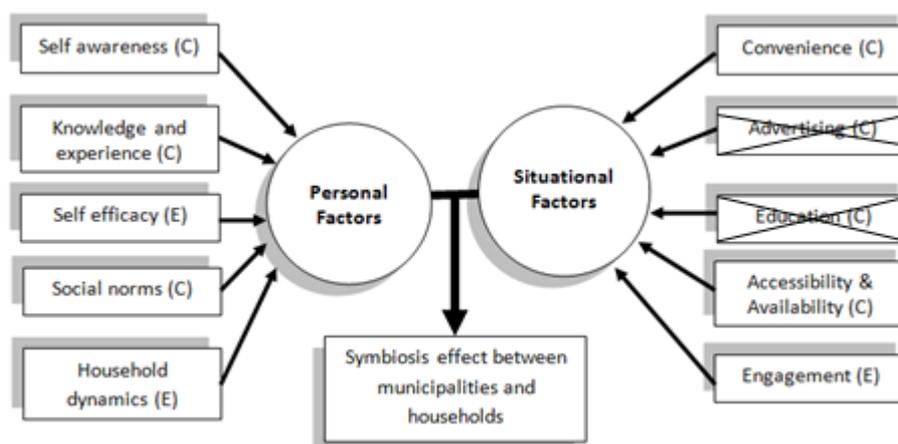


FIGURE 5.7 The Validation of thematic analyses from the first phase between Municipalities and Households ($n=412$).

The symbiosis effect suggested by this study tries to explain the factors underpinning HRB, whereby the two factors investigated were visualised as interacting with each other in

manifesting HRB. The quantitative phase analyses confirmed the proposition of symbiosis effect from the first phase of qualitative analyses. The quantitative analysis demonstrates and validates the first stage findings that higher interaction and engagement influenced sustainable HRB, and a higher spatial coverage of service provision and availability of recycling facilities improved the performance of recycling initiatives by municipalities.

The analyses used were robust and adequate, as it was a follow-up exploration on the proposition of symbiosis effect, and addressed the three research questions. In turn, the quantitative phase analyses supported the overall aim of the study, and revealed some assumptions for further verification in Stage 3. Hence, before the findings from Stage 2 were verified in Stage 3, further reliability and validity in the findings using power analysis (Faul et al., 2009) was deployed to the data to ensure sample adequacy (due to the use of a non-probability sample), to avoid Type I and II errors and promote overall statistical robustness. The reliability and validity of the findings using power analysis is discussed in Section 5.7 after the discussion on the triangulation phase of Stage 3.

5.6.3 Stage 3: Qualitative phase II

Stage 3 is the final stage in the mixed methodology approach, and is a triangulation phase (using qualitative approach). This stage addressed overall findings from Stages 1 and 2 with overall RQs (1, 2, 3), and found that the triangulation process supported the notion of symbiosis effect that was apparent in the earlier stages. Moreover, Stage 3 found that the findings of Stages 1 and 2 were in cohesion. Specifically, the provisional findings from Qualitative Phase I on the personal factors: self-awareness, self-efficacy, social norms, household dynamics, and knowledge and experience were considered important in HRB initiation. On the other hand, in the quantitative phase it was possible to make the deduction that the demographic aspects (employment, country of birth, household dynamics, knowledge and experience) were also an important sub-set of personal factors (Hibbert et al., 2005; Thogersen & Grunert-Beckmann, 1997).

The Qualitative Phase I findings also led to the preliminary assumption that the personal factors were only of equal importance if there was no abandonment of the situational

factors (engagement, convenience, accessibility and availability), in accordance with Thøgersen's suggested "objective preconditions for the behaviour" (1997). In addition, demographic factors were considered major determinants or antecedents in past literature, although authors had broadly discussed personal factors (Culiberg, 2014; Park & Ha, 2014; Ioannou et al., 2013; Keramitsoglou & Tsagarakis, 2013; Abbott et al., 2013; Thomas & Sharp, 2013; Brekke et al., 2010). Hence, these authors only covered minimal explanations of overall recycling behavioural change within the "objective precondition for the behaviour", i.e. situational factors (Akil & Ho, 2014; Barr et al., 2013; Thøgersen, 1997).

The overall stages triangulated the existence of situational factors (engagement, convenience, accessibility and availability). They also supported that situational factors influenced the personal factors in respect to: self-awareness, self-efficacy, social norms and demographical factors (employment, country of birth, household dynamics, knowledge and experience). These situational and personal factors were significant in having an effect on the recycling intention of the householder (Fig. 5.7). The summation of the triangulation process is illustrated in Fig. 5.7, showing that sequential *explanatory design* (Chapter 3) and the third stage constituted the overarching themes based on views from 15 members, and needing cross-verification with the earlier findings from Qualitative Phase I and the quantitative phase. The final stage (focus groups and interviews that were conducted) presented an opportunity to comprehend the interaction between situational and personal factors during the discourses. The views of householders on symbiosis effect between HRWS and HRB were further verified in the final stage discourses. Using multi method inquiries (focus group and interview) proved to be rigorous in accordance with Bryman (2008) and Mertens and Hesse-Biber (2013) in the final stage.

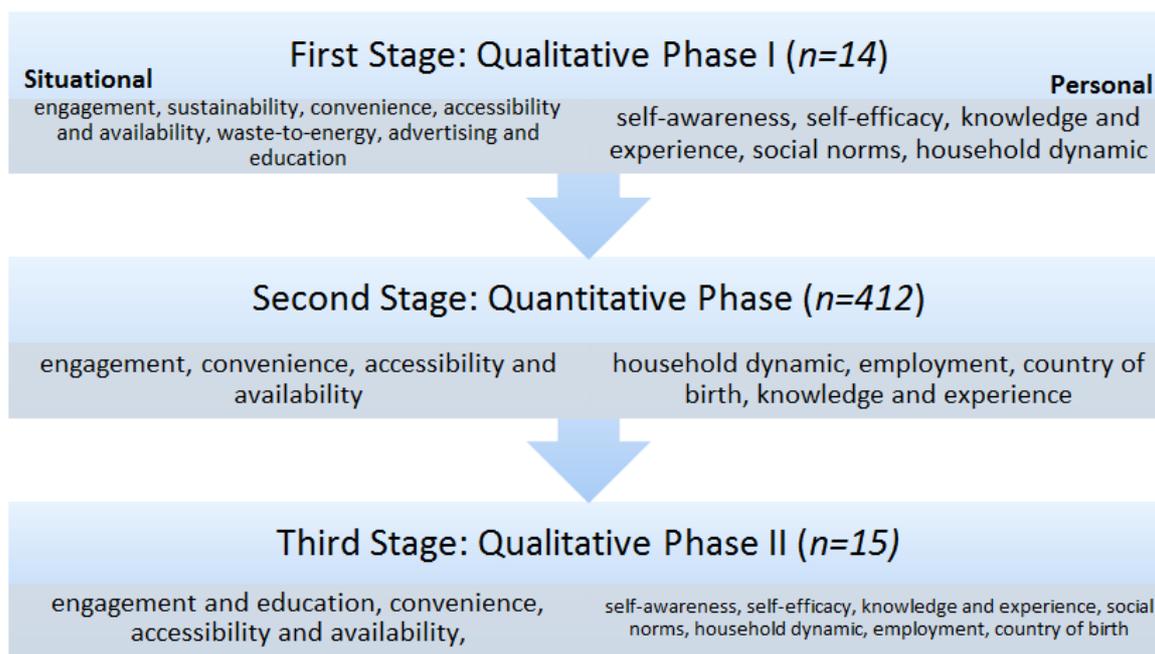


FIGURE 5.8: The sequential explanatory design with major themes and sample size

The overall study, together with past literature, has acknowledged the role of personal factors in predicting sustainable HRB. On the other hand, situational factors have been investigated with regards to changes or additions made to the HRWS operations, i.e. provision (co-mingled vs. sort and separate, after Lane & Wagner, 2013; Gellynck et al., 2011); collection schedule (fortnightly vs. weekly, after Williams & Cole, 2013; Abbott et al., 2011); introduction to incentive (Jeyaraj, 2014; Fitzgerald & Gonen, 2011; Harder & Woodard, 2007), which diluted the idea that the real initiation of sustainable HRB is altered by the interaction of two factors (situational and personal).

Chen and Tung (2010) suggested that a householder may identify a high degree of inconvenience or limitation from HRWS operations, and, in turn, the positive relation between personal factors and HRB will weaken. The author supports that adequate situational factors are necessary to initiate positive HRB and anticipate a progression in household recycling performance. This study does not only support that operational attributes of HRWS, i.e. provisions, schedules and incentives, are necessary, significant attributes for recycling performance (Jeyaraj, 2014; Lane & Wagner, 2013; Williams & Cole,

2013; Gellynck et al., 2011; Abbott et al., 2011; Fitzgerald & Gonen, 2011; Harder & Woodard, 2007), but the overall study concludes by extending the necessary operational attributes to form a sustainable HRWS requiring a holistic perceptive. This should include engagement and education, convenience, accessibility and availability). A holistic perceptive, as suggested from the overall findings, can be referred as an “overall situational condition” (Thogersen, 1997).

The synthesis of the interdisciplinary reviews from multiple lenses has acknowledged the two major enablers for improving recycling rates: municipalities and households, both of which contribute to advancing sustainability. This study has highlighted the robustness of mixed methodology approach that allows understanding of each of the major enablers in symbiosis perspective. It is apparent from this study that municipalities need to provide efficient and effective ways of recycling, and households need to exhibit better recycling behaviour (Jeyaraj, 2014; Lane & Wagner, 2013; Williams & Cole, 2013; Gellynck et al., 2011; Abbott et al., 2011; Fitzgerald & Gonen, 2011; Harder & Woodard, 2007). This ‘symbiosis effect’ between the recycling systems and households is a key to improvement, whereby the two enablers behaving ‘symbiotically’ together systemically could enhance sustainable living, and therefore be a significant source of social and natural good. In respect of the two earlier stages, the introduction of symbiosis effect perspective is a representation of the interaction between situational and personal factors, which was verified through the triangulation process in Stage 3. Accordingly, this notion was indirectly submerged in the triangulation process within Stage 3 as the ‘ingénue’, and participants termed symbiosis as “disconnected or connected with the environment”.

Symbiosis perspective is an uncommon subject matter in social science research, especially in logistics, waste management and marketing, the aforementioned disciplines commonly studying either situational and/or personal factors (the term associated with situational and personal interchange with operational and behavioural factors in most studies) within the discipline assumptions.

The discipline assumptions to some extent are lacking in perception on these two factors, which can be 'synergistic' and symbiotic in relationship. Fennell and Weaver (2005: 381) suggest that:

“...scientists who have been investigating phenomena strictly from a reductionist standpoint might also look laterally in discovering how other disciplinary standpoints, and their associated methodologies and theories, address broad problems. Complexity has thus set the foundation for the development of an epistemological bridge between social and natural sciences.”

On the other hand, industrial ecology (IE) theorists (Yu et al., 2014; Zhu & Ruth, 2014; Paquin et al., 2014; Jacobsen, 2006; Chertow, 2000) discussed the symbiosis perspective on a greater scale, i.e. integrated units or firms integrated by many stakeholders including external and internal environments (Porter, 2008). The revelation from the work of IE theorists is that the interrelation between system and human behaviour is symbiotic and behavioural (Paquin et al., 2014). On the other hand, organizational theorists like Ehrenreich (2002) used the symbiosis perspective to understand the concept of mutual support in subordinating systems. In addition, Fennell and Weaver (2005) discussed the symbiosis perspective in terms of tourism and sustainability (Uddhammar, 2006).

However, this study unfolds the symbiosis perception between concomitant actors in HRWM, specifically reverse logistics in waste management. This perception allows a holistic understanding between behaviour and systems. Hence, this study suggests that an interaction between key factors is relevant in understanding the overall performance and progression of certain outcomes, i.e. sustainable backward movement and high recycling rate. This perspective helped to understand views from the participants on moral obligation, i.e. recycling behaviour, referred to as altruism by Friedland and Cole (2013).

Moral obligation such as recycling behaviour interplayed with the pre-conditional factors of engagement, convenience, accessibility and availability. Hence, this perspective gave an awareness of the recycling issues that were most relevant to the householders, whose involvement is critical to the success of recycling performance.

Both householders and municipalities are concomitants and their respective roles in HRWS are important to provide insights on the perceived barriers that keep householders from recycling effectively and frequently.

5.7 Revisited Reliability and Validity: Power Analysis

Figure 5.4 was the focal basis on the structure of the quantitative approach, with relevant RQs. The quantitative analysis within this stage had gone through a rigid reliability and validity testing in order to refrain from Type I and II errors. First, the reliability of measurements used in the study was tested, a pilot study being used prior to the second stage of the study taking place. The result of the pilot study showed that the questionnaire design used was consistently reliable at $\alpha = 0.80$ following Nunnally's (1978) recommendation, and was comparable to previous empirical work using a similar measurement.

The quantitative analyses in Stage 2 of the SED commenced with exceptional rigour, because of the steps followed to undertake all types of analysis in accordance with the recommendations of previous works (Zumbo, 2014). This was to ensure the validity of the measurements used and the analyses applied (Field, 2009). However, it was crucial to know that the study was not implicated by Type I and II errors, even though the necessary tests had been undertaken. The reason is that the sample of population in this study was a non-probability sampling, which could be exposed as non-representation of the overall population (Cohen, 1992).

Even though many non-probability samplings have been used in social research with empiricist value, there should be a procedure (suggested by Cohen, 1992) that validates the analyses in isolation (the real data is not manipulated in the calculation).

The power analysis has been used in many statistical analyses for cross-validation between actual statistical analyses with a computer generated software analytical tool (Faul et al., 2009). Cohen (1992) mentioned that power analysis gave the actual statistical analysis its 'empiricist' status.

The analysis started with the sampling size and strategy, which this study designed based on Sekaran and Bougie's (2010) methods, using a 95% confidence level applied for a total population of two municipalities (588, 900), and a suggested sample size of 384 respondents/cases. As the fieldwork commenced, the sample size achieved (412 cases) was modestly substantial, at around 7.3% increment of the suggested sample size.

The power analysis commenced with the assumption that one would reject a null hypothesis, given that the null hypothesis is really false by a specified amount, and given certain other specifications, such as sample size and criterion of statistical significance (α) (Cohen, 1992). Thus, these tests should accept alternative hypotheses without contradicting the differences between variables (Cohen, 1992). It was essential that the analyses abstained from Type I and II errors. Hence, power analysis was used to validate the rigour of the chosen analysis (multiple regressions) and give insightful analysis if Type I and II errors existed. Power refers to the probability that the test will find a statistically significant difference, when such a difference actually exists (Cohen, 1992).

In other words, power is the probability that the null hypothesis would be rejected as it should be (thus avoiding a Type II error) (Cohen, 1992). It is generally accepted that power should be 0.8 or greater (Faul et al., 2009); i.e. 80% or greater should have a chance of finding a statistically significant difference when there is one. This study used 'a posteriori' or post hoc power analysis and confidence intervals for effect sizes, as suggested by Faul et al. (2009), which could be run through G*Power 3 computer generated software. On the other hand, Hoenig and Heisey (2001) suggested that 'observed power' from tests can be misleading, as it is perfectly correlated with the value of p which could be misleading on the importance of power analysis in the overall inferential statistical test. However, power analysis was not used to infer the results, but to ensure that sample size and questionnaire items were adequate for use, and to apply the necessary quantitative analysis (Faul et al., 2009; Cohen, 1992), rather than allowing exposure to Type I and II errors (Zumbo, 2014; Field, 2009).

This analysis was essential in explaining if Type I and II errors had occurred, and the allowing possibility of mitigation processes in dealing those errors (Faul et al., 2009). The cross-validation, starting with the sample size of 412 was computed in the statistical power analyses (G*Power3), and 52 items (raw from questionnaires) and 25 items (from factor analysis extraction) were used as a baseline for multiple linear regression power analysis. As for correlation, multivariate and logistic regression, there was no need to compute the predictors/cases in the programme (Faul et al., 2009). The recommended effect sizes used for these analyses were as follows: small ($f^2 = 0.01$), medium ($f^2 = 0.05$), and large ($f^2 = 0.10$) (Cohen, 1992). The alpha level used for this analysis was $p < 0.05$. The post hoc analyses revealed the statistical power for this study exceeded 0.99 for the detection of a moderate to large effect size.

Thus, there was more than adequate power (i.e. power > 0.80) at moderate to large effect size level, and, as predicted, the overall quantitative analyses satisfied most of the assumptions and recommendation from previous empirical studies. Hence, the overall analyses rejected the null hypothesis and accepted the alternate hypothesis, which revealed the differences in the findings of the quantitative phase of Stage 2. Therefore, this study is clear from Type I and II errors, the results being analysed in accordance with the recommendations from previous empirical studies.

Type of Test (s)*	Power
Correlation: Bivariate normal model	0.99
Linear multiple regression: Random model (25)	1.00
Linear multiple regression: Random model (52)	1.00
ANOVA: Fixed effects, special, main effects and interactions	0.96
ANOVA: Repeated measures, within-between interaction	1.00
MANOVA: Repeated measures, within-between interaction	0.99
MANOVA: Special effects and interactions	0.99
Goodness-of-fit tests: Contingency tables	0.99
Logistic regression	0.56

*all tests are computed as two-tails

Table 5.5: Statistical Power Analyses by G*Power3 (Faul et al., 2009)

5.8 Conclusion

Chapter 5 has offered a twofold discussion, the first section giving a description of the triangulation phase, and the second section outlining the overall arguments from all stages in the SED. The first stage was Qualitative Phase I that sought to both confirm constructs and ideas drawn from multiple disciplinary bodies of work, and to identify emergent themes that have yet defied significant discussion in these bodies of work. Exploratory findings suggested a symbiosis effect between personal factors and situational factors similar to that described in the Norm Activation Model (Biel & Thøgersen, 2007).

Five aspects of personal factors (self-awareness, self-efficacy, social norms, household dynamics and knowledge and experience), and six aspects of situational factors were identified (engagement, convenience, accessibility and availability). In the inductive process of analyses, two personal factors (self-efficacy and household dynamics) and one situational factor (engagement) were considered as emergent from the data, the remaining aspects being identifiable (confirmed) from existing literature.

The second stage of the quantitative phase sought to extend generalizability by performing several statistical tests on two samples drawn from two geographically adjacent municipal areas. The second stage of the SED took forward the themes identified earlier in Qualitative Phase I (Fig. 5.3) and looked to add greater generalizability to the first stage findings by examining symbiosis effects in two different areas of municipal concern. The descriptive analyses showed no differences in the aspects of self-awareness, self-efficacy, social norms, knowledge and experience, and household dynamics (personal factors) between householders from the East Riding of Yorkshire and the City of Hull.

The correlation analysis revealed positive relationships between situational and personal factors that included four dominant demographic (personal factors): age, household dynamics, employment, and knowledge and experience. When the study had satisfied the correlation analysis, a multi-regression analysis was applied to further support the symbiosis effect. The study revealed strong interplay between the personal and situational factors and demographic characteristics: age, household dynamics such as marital status, employment,

and knowledge and experience. Each personal factor suggested interaction between personal and situational factors. Many findings in existing literature have considered personal factors in the context of HRB and situational factors in the context of RL in isolation from each other. This study has found support for the importance of considering interaction between situational factors and personal factors when examining the effectiveness of an entire HRWS.

In order to further examine HRB, a multivariate analysis was employed to explore the situational factors as a precursor (precondition), and investigate the relationship between the personal factors and the demographic factors: age, household dynamics, employment, and knowledge and experience. Thus, this study reveals that there is a tendency for situational factors to interact positively with certain demographics. Using a logistic regression analysis, it was indicated that confounding variables, such as demographic factors (personal factors) and situational factors influence respondent motivation towards recycling. Recycling knowledge and experience of households (consumers) on certain recyclates was triggered by the interaction. Primarily, the interaction between demographic factors with aspects of situational factors (engagement, convenience, accessibility and availability) and recycling knowledge and experience was considered the most prominent during the analyses.

The third stage of SED was Qualitative Phase II, which sought to triangulate Stages 1 and 2. The triangulation process was a deductive approach with deployment of the focus group and semi-structured interviews. The deductive approach was able to verify the two stages in accordance. The aspects of personal factors, such as self-efficacy, self-awareness and some demographical factors, such as household dynamics and knowledge and experience were predominant themes in the discourses. Evidently all aspects of the situational factors were of equal importance as pre-condition factors for HRB to initiate, derived from the discourses. Even though the term, symbiosis was 'foreign' to most of the householders, the responses in the discourses were collectively in cohesion in reflecting the relationship between HRWS and HRB.

Behavioural theories such as norm activation, theory of planned behaviour, model of recycling behaviour and consumer behaviour setting were found to be important in encapsulating and explaining symbiosis.

Overall findings indicate that personal factors interacted with situational factors, and that HRB would transform in accordance with how effectively the situational factors (such as engagement, convenience, accessibility and availability) were designed and implemented by the municipalities. To conclude, the final stage of triangulation was to signify efficacy in the deployment of a mixed methodology approach in examining complex multi-dimensional and interdisciplinary problems. Furthermore, the inductive-deductive phasing incorporated different ontological assumptions, which were essential in a mixed methodology approach (Golicic and Davis, 2012).

Chapter Six: General Conclusions

6.1 Introduction

In this chapter, the main findings with regard to the research questions are summarised, and general conclusions based on the findings of the studies presented in this thesis are described. Furthermore, the strengths and limitations of the study are considered, and suggestions for further research into the interdisciplinary aspects using mixed methodology are presented. This chapter concludes with recommendations for three categories of stakeholders in household recycling waste management: policymakers, municipalities and householders. Many issues need to be considered in understanding HRB (Botetzagias et al., 2015); it is a multi-fragmented area, the composition of which can be formed from situational factors as well as personal factors (Werder & Depoe, 2006; Shrum et al., 1994).

6.2 The Symbiosis Effect between HRWS and HRB

The central aim of this study was to explain the concept of the symbiosis effect between household recycling systems and householders' recycling behaviour. Consistent with this call, the approach to examine the central question was to visit the subject through an interdisciplinary lens, as presented in Chapter 2. The overarching aim of this study presented in Chapters 2 and 3 was to reveal that a study conducted on a single discipline has limited ability to allow access to the complex multifaceted issues involved in managing household waste patterns and recycling behaviour (Botetzagias et al., 2015). As presented in Chapter 2, instead of pursuing a traditional gap-spotting approach to make a theoretical contribution, this study intended instead to make a revelatory and an incremental contribution (Corley and Gioia, 2011). The summary of the theoretical and practical contribution is as illustrated below.

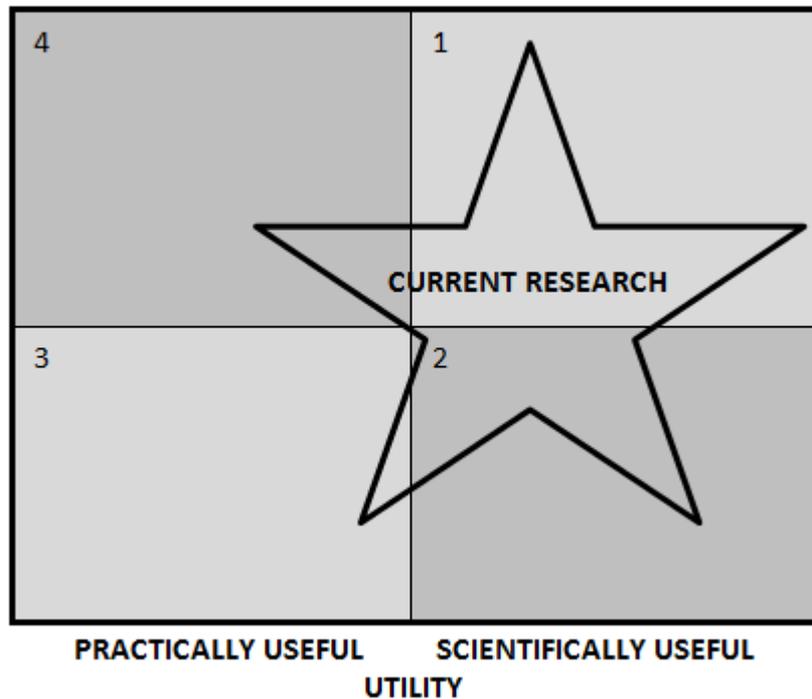


Figure 6.1: The Contribution of Knowledge Quadrant by Corley and Gioia (2011)

In Chapters 4 and 5, the identification of the interaction between situational and personal factors was discussed in overall stages in the SED. First, with respect to personal factors, the reasoning behind households' recycling behaviour in relation to the demographical aspects of the householders was explored to seek the underpinning factors.

The central aims of this study, presented in Chapters 4 and 5, were to reveal the underpinning factors which were the pre-condition of certain situational factors (engagement, convenience, accessibility and availability) and had an effect on the progression of HRB.

Symbiosis effect came into view as the interaction emerging between those two factors was found distinctively in the overall stages of SED, as presented in Chapters 4 and 5. The nexus between HRWS and HRB was revealed in Chapter 2, when the development of the initial conceptual framework was presented. Whereas the synthesis of literature put forth in this study was from the SCM, marketing and geography disciplines represented multiple views of HRWS and HRB.

The central aim of the literature review presented in Chapter 2 was to find studies replicating symbiosis perspective between situational and personal factors in HRWM.

However, to find the closest study was challenging and posited several vital questions concerning the backwards movement of household recycling waste systems. This study managed to realise the two objectives and answered three of these questions, as presented in Chapters 1, 2, 3, 4 and 5:

O_1 To reveal how household recycling behaviour affects the provision of HRWS by the municipalities:

RQ1: What is the reasoning behind HRB between the different municipalities?

RQ2: What are the different factors associated with household recycling systems which may affect HRB, and how do they affect household recycling behaviour?

O_2 To reveal and explain the pre-condition phase between HRWS and HRB:

RQ3: What are the interaction and symbiosis effects and what are the conditions which support the symbiosis between household recycling systems and household recycling behaviour?

The key elements portraying HRB and HRWS in the literature were personal and situational, respectively (Kalamas et al., 2014). Therefore, in the disposition of the research design, the relevant consideration was made to address the objectiveness and subjectivity of the subject matter (Households and HRWS) by a deployment of mixed methodology approach (Creswell, 2008; Teddlie & Tashakkori, 2009; Jick, 1979), as described in Chapter 3.

The initial aim was to explore the symbiosis effect between HRWS and HRB (represented by situational and personal factors) whereby the first stage, as described in Chapter 4, revealed the emergent symbiosis effect by using Spradley's method (qualitative analysis for $n=14$). In addition, the aspects for both factors (situational and personal) emerged and were confirmed by cross-verification with *a-prior* literature, described in Chapter 4. The basis of Stage 2 was derived from Stage 1 of the SED, as presented in Chapter 4.

The objectives of the second stage were to reveal the precondition factors and examine factors that significantly affected changes in HRB, and to verify the aspects of both situational and personal factors that emerged in the previous stage.

After the necessary quantitative analysis had been applied to address the relevant RQs (RQ1, RQ2, RQ3) and the notion of symbiosis effect had been confirmed and verified by the deployment of multiple regressions to add a sense of 'completeness' in mixed methodology, the triangulation phase was deployed to address the warrantability or validity of the overall findings (Denzin, 1970). The application of methodological triangulation (more than two methods used) in the research design favoured a robust inference and interpretation of phenomenon when both analyses converged (Bryman, 2008).

As presented in Chapter 5, this study extends reliability and validity analyses by the application of power analysis (Faul et al., 2009). This shows that the researcher was well aware that the sample of the population was derived from non-probability sampling. Therefore, to ensure the sample adequacy (the usage of a non-probability sample), and to abstain from Type I and II errors, the study supported the power analysis posit that overall quantitative method of analysis showed statistical robustness in delivering the results and was sufficient to triangulate Qualitative Phase II of the SED.

6.3 Summary of Overall Findings with regards to the RQs: the Overview

This section is a summary of the overall empirical findings relevant to the research questions (1, 2 & 3) of the study.

6.3.1 RQ1: What is the reasoning behind HRB between different municipalities?

The first research question was concerned with the reasons behind the actual HRB specifically showcased in the different municipalities. It may be concluded that there was no difference between the different municipalities, which was where this study differed from previous studies, which supported the assumption that different deprivation levels and socio-economic background may represent different recycling performance in designated regions. From the Stage 1 and 2 analyses, both residents of the different municipalities

recycled mainly because of environmental concerns. In addition, the final stage, in addressing RQ1, was extended to the relationship between sustainability issues and household recycling waste management. Discussion of sustainable issues in waste management focused on the initiatives towards public acceptance of the sustainable activities (recycling and waste to energy) by the municipalities. Moreover, these sustainable activities required intensive public engagement and education, with direct involvement by policymakers and central authorities. This was to ensure the seamless progression of the overall sustainable movement of HRWM or reverse logistics in waste management.

6.3.2 RQ2: What are the different factors associated with household recycling systems which may affect HRB, and how do they affect household recycling behaviour?

The underlying goal for RQ2 was to reveal the factors associated with HBR and HRWS. Therefore, Stage 1 used thematic analysis network to address the RQ, whereby the factors revealed were confirmed (C) and emerged (E) in the first stage as: engagement (E); convenience (C); accessibility (C) and availability (C). The personal factors were confirmed and emerged in the first stage as: self-awareness (C); self-efficacy (E); social norms (C); household dynamics (E); knowledge and experience (C). The degree of significance was limited to infer the factors revealed in Stage 1. Therefore, the second stage of quantitative phase analysis was to further verify quantitatively using statistical inferential techniques to address the RQ. In order to have a greater generalization and robustness in the analytical procedure, a larger sample size (n=412) was used. The larger sample was used to validate the representation of the smaller sample size (n=14) from Stage 1.

The factors revealed from this stage verified certain demographic factors manipulated by other personal factors as it interacted with situational factors. The manipulation of the demographic factors by other aspects of personal factors (self-awareness, self-efficacy and social norms) and overall aspects of situational factors (engagement, convenience, accessibility and availability) had been found in Stage 2 analyses as the 'confounding factor'. The assumption of the confounding factor in HRB initiation was not possible to infer within Stage 1.

The Stage 2 findings concurred that the different municipalities, with different socio-demographical and geographical settings, had shown minimal significant differences with regards to HRB manipulation.

The findings found in Stage 2 juxtaposed the situational factors as significant predictors and pre-conditions in progressing HRB. In addition, personal factors from the aspect of demographic factors as the confounding variables in the quantitative phase findings were equally significant in the progression of the HRB, without the abandonment of the pre-condition factors (engagement, convenience, accessibility and availability), i.e. both had to be interacted for the HRB to progress. Thus, the overall analyses in Stage 2 successfully addressed the RQ2, consistently reflecting the Stage 1 arguments and assumptions.

In Stage 3, with regards to personal factors, many responses that were considered diverse and inter-related factors emerged that coincided with the demographical aspects. For example, the socio-economic background of a householder could not be translated as the denominator of HRB. However, most respondents believed that it was interdependently related to other personal factors, such as self-awareness, self-efficacy and household dynamics. Interestingly, the responses from the householders focused on individual self-awareness and self-efficacy with demographic aspects in the progression of HRB. However, the municipalities were more concerned about the socio-economic background of individuals and agreed that the household dynamics, and knowledge and experience of individuals strongly influenced the progression of HRB. On the other hand, for situational factors, Stage 3 addressed RQ2 by confirmation that convenience played a vital role in HRWS implementation, but not excluding engagement, accessibility and availability.

Both householders and municipalities agreed on the interplay of self-awareness and self-efficacy with the aspects of situational factors. This agreement warranted the existence of a symbiosis effect without initiating the notation of symbiosis effect in the discussion.

In conclusion, in addressing RQ2, Stage 3 confirmed that both the situational and personal factors emerging in Stages 1 and 2 were mutually interdependent and equally important in affecting HRB.

6.3.3 RQ3: What are the interaction and symbiosis effects and what are the conditions which support the symbiosis between household recycling systems and household recycling behaviour?

The final research question was to reveal and explain the pre-condition phase between HRWS and HRB. The provisional 'symbiosis effect' assumption was derived from semantic relationship analyses of Spradley's method. Using Spradley's method in the analysis allowed us to comprehend the type of relation between HRWS and HRB ('cause and effect' and 'rationale'). The outcome of the deductive approach from Stage 1 developed a baseline for the quantitative inquiry of the survey design for the second stage. Essentially, this stage provided a broad understanding of the three research questions, which could inform and refine the second stage of sequential explanatory design (SED). Hence, Stage 1 had provisionally addressed the overall RQs on the basis of $n = 14$.

Stage 2 addressed RQ3 by further validating the provisional assumption of symbiosis effect in Stage 1. In the deployment of multiple regressions analyses (multi regressions, logistics regression and multivariate analysis), the symbiosis effect was represented by the interaction between the revealed factors from RQ2 that corresponded with the situational and personal factors consecutively. From the analyses, the critical factors from the situational attributes (engagement, convenience, accessibility and availability) were considered as pre-condition or pre-cursor factors. Furthermore, the personal factors (all attributes) were considered equally important, with the exception of demographic factors (age, marital status, employment and number of years of recycling) that had been considered as confounding factors.

The addressing of RQ3 in Stage 3 was confirmation that the symbiosis effect between personal and situational factors does exist in the progression of HRB. The discussion expanded on the attributes of personal factors with the level of situational factors as a stimulus.

The respondents were more concerned with self-efficacy and self-awareness levels in individuals in relation to the situational factors as stimulus, and agreed on the relevance of the symbiotic relation between HRWS and HRB. However, this concept has to be perceptively modelled by the policymakers and legislators. Engagement and awareness were considered the backbone of indirectly creating the symbiosis effect between these two factors.

In addition, Stage 3 was definitive in addressing RQ3, whereby the process was to investigate the means of the statistical findings (Stage 2) and thematic outcomes from Stage 1 respectively. The passive reflections from the focus group were that most of the householders had different opinions on 'sustainability' concept, and that the concept of 'symbiosis' was 'foreign' to most of them. However, when symbiosis and its relation to sustainability was explained during the discourses, almost every householder agreed on the symbiotic relation between HRB and HRWS. In conclusions derived from Stage 3, the overall findings from the previous stages were successfully triangulated. The inference can thus be made that it is necessary to pursue sustainability via reverse logistics to understand the symbiosis effect between municipalities and household recycling behaviour.

6.4 Validity and Reliability of Overall Design

This section is presented to summarise the overall validity and reliability issues with respect to SED. Reliability and validity in a mixed methodology approach are as important as in mono-method approaches. The distinct character of the different findings necessitates cohesiveness and credibility of the whole design. Particularly in the SED for this study, the usage of qualitative approach as the basis of incoming stages was vital to ensure warrantability within the deductive phase, as presented in Chapter 4. Thus, the application of mixing (interplaying) the different findings (data) was a form of inter-subject validity or triangulation, as presented in Chapter 5 (Creswell, 2008; Teddlie & Tashakkori, 2009; Jick, 1979). As presented in Chapter 4, Stage 2 underwent several tests to address reliability and validity in order to ensure the empirical values of the SED. Essentially, validity is to ensure that overall findings are cohesive and authentic.

When overall findings are cohesive and authentic, they have the potential(s) to give a meaningful and truthful interpretation without exposition to 'doubtfulness' (Newman et al., 2013; Johnson, 1997; Clark & Watson, 1995).

On the other hand, the essence of reliability is the verification of measurement consistency which can be replicated without relinquishing the same result over time (Peterson & Merunka, 2013; Bryman, 2008). For example in Chapters 4 and 5, qualitative analyses from Stages 1 and 3 used a 'concept of saturation' (Lincoln & Guba, 2013; Polit & Beck, 2010) to sustain rigour and transferability within the research inquiry and analysis. For Stage 2, as described in Chapter 4, the quantitative analyses used were very structured in the application of reliability and validity tests (i.e. Cronbach alpha, Factor analysis, Power analysis and Monte Carlo simulation) which encapsulated the rigour and robustness of the quantitative phase. However, the application of multiple analyses in this study had to accept that some measurements were exposed to justifiable errors (multicollinearity and non-normality distribution) (Cohen, 1992).

These justifiable errors have been addressed by the proximity of sample size and per item size in much social science research (Zumbo, 2014; Field, 2009; Cohen, 1992), as described in Chapters 4 and 5. This study design followed a mixed methodology approach which was able to address all three of the research questions. Here the 'mixing' of quantitative findings and qualitative findings from the sequential explanatory design standpoint promoted the validity and reliability processes that were essential to sustain that the original account's 'meaning' or 'numbers' were true and plausible. In conclusion, this study has addressed the reliability and validity issues by ensuring a systematic approach in dealing with the warrantability and generalizability of the SED.

The following sections offer discussion on the theoretical, practical and future implications of this study, together with its limitations.

6.5 Theoretical Implications

This study has an interdisciplinary grounding, the stated intent being to blend theories into, and thus contribute to, a received discipline of Supply Chain Management (SCM). SCM literature has had a significant interest in matters of sustainability (Carter & Easton, 2011; Grant et al., 2015) and green SCM (Murphy & Poist, 2003; Mishra et al., 2012). However, the thrust of this work has substantively examined situational factors rather than personal factors. In pursuit of sustainable and green SCM credentials, there seems to have been only limited interest in recycling, and the current study has addressed that neglect. Recycling and RL have been co-examined in a small number of studies. To date, studies in core SCM journals have examined RL in the context of recovering and recycling plastics, (Bing et al., 2014); household medicines (Xie & Breen, 2014) and hospital waste (Ritchie et al., 2000). This study has therefore provided a contribution to the previously under-explored context of RL and recycling, and, more specifically, to the context of municipality RL channels and HRWS. This study should hence be of interdisciplinary interest to both SCM and waste management scholars.

Furthermore, there has been limited attention to the perception of symbiosis in investigating the HRWS and HRB relationship, especially in logistics and waste management literature. This study has focused on the symbiotic relation (to date there has been no similar approach) of these two key actors in HRWM, rather than investigating the key actors separately, as in previous research (Martin & Bateman, 2014; Kalamas et al., 2014; Tonglet et al., 2004; Barr et al., 2003; Tucker & Speirs, 2003). The current study represents the integration of many disciplines within the revised theoretical framework, specifically in understanding the nexus between behavioural and operational assumptions. Furthermore, this study provides empirical support for the inclusion of an interaction as a predecessor that represents symbiosis effect between key factors, i.e. situational and personal factors in understanding actual recycling behaviour. The revised theoretical framework initiated in the first stage allowed the iteration process between each stage to confirm and validate the initial findings.

The element of articulation on the observation was essential in order to support the robustness of the framework. Hence, the analyses of smaller samples through larger samples and back to smaller samples were consistently iterated in order to ensure refinement of the framework elements, and, in the final stage, adoption of the triangulation phase was to address rigour and warrantability.

One of the major implications from this study was the convergence of all the relevant models and theories, revised into a robust framework or theoretical model. The theoretical framework served the purpose of accessibility to study a multifaceted area such as recycling behaviour which portrayed a symbiotic relation with HRWS. Essentially, to ensure this study inferred the interdependency between HRWS and HRB relationship, the use of multiple lenses was detrimental. Thus, theoretical underpinning should not be confined to one or two theories (models or frameworks), but researchers are encouraged to apply multiple theories that are interrelated (Stock, 1997; Sweeney et al., 2015; Chen & Kiser, 2015; Toubolic & Walker, 2015).

That is why the application of multiple theories (models or frameworks) in a study promotes a robust understanding of certain phenomena i.e. the interaction between systems (organisational or system/operational theories) and people (behavioural/consumer theories). Furthermore, the symbiosis perspective used in this study is consistent with the concept of reverse logistics framework (Carter & Ellram, 1998) whereby the antecedents of RL (HRWS and HRB) were studied in an interdisciplinary approach. The conceptualization process (Chapter 2) of the framework in this study was the basis of the research design. This conceptual framework was then revised to a theoretical framework in the first stage of the research design, where the detailed aspects were grouped in accordance to the designated factors. For example, the aspects of personal factors (self-awareness, self-efficacy, social norms, household dynamics, and knowledge and experience) were grouped with the aspects of situational factors (engagement, convenience, accessibility and availability).

The usefulness of the initial conceptual framework derived from multiple lenses of theoretical reviews allowed a generic (basic) framework as a standpoint for a study.

This generic framework could be moulded to the theoretical framework in accordance with the research designs and research question outlined. For example, this study used the assumption made by Carter and Ellram (1998) that study of the backwards movement should have an interdisciplinary approach, and the antecedents (factors) are clear in the reviews of the literature. In this study, the approach was underpinned by behavioural theories such as norm activation, theory of planned behaviour, a model of recycling behaviour and consumer behaviour setting, which were found to be important in encapsulating the symbiosis perspective model (Chapter 2). These theories tested certain scopes of study which were either behavioural or operational. Therefore, to single out one theory from another in accordance with the importance would have been implausible. This was due to the antecedents and determinants (conditions and/or factors) found from the aforementioned theories or models being either situational or personal factors (some overlapping conditions). Hence, the concept of convergence had to be used in order to sustain all the elements that represented situational and personal factors in portraying HRB and HRWS.

The application of multiple theories (models or frameworks) can promote a better or more accessible model and framework that contributes to seamless research design and strategies. The symbiosis perspective framework derived from the overall study was deemed appropriate for an interdisciplinary study that constitutes interaction between system and behaviour (Fig. 6.2 is modified from this study for future research).

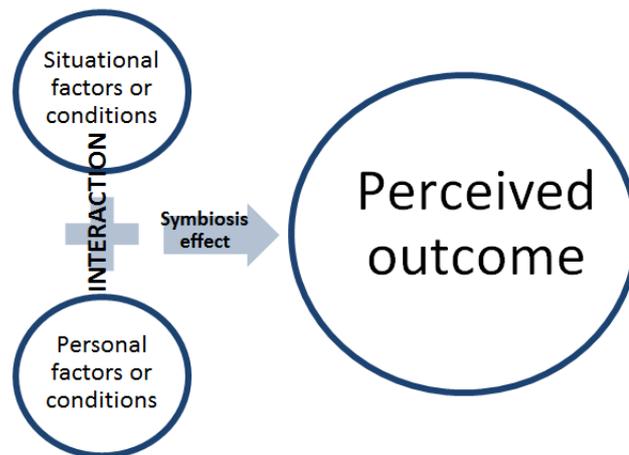


FIGURE 6.2: The Symbiosis Perspective

The sequential explanatory design (SED) (Trochim et al., 2008; Creswell, 2008) used in this study was accessible to seek assumptions from the ‘soft’ and ‘hard’ subjects in social sciences, especially for an interdisciplinary study (Carter & Ellram, 1998). The SED posited the interplay of qualitative and quantitative findings to promote rigour in the overall design (Teddlie & Tashakkori, 2009). The interdisciplinary approach taken by this study showed how logistics discipline is interwoven with other disciplines (Chicksand et al., 2012; Stock, 1997). The constructs used derived from multiple lenses of major bodies of knowledge. The interdisciplinary approach with mixed methodology design undertaken in this study supported the robustness in understanding the ‘soft’ and ‘hard’ subjects in HRWM scope. Methodologically, this study contributes to SCM and logistics disciplines by increasing the number of empirical studies applying mixed methodology approach (Golicic & Davis, 2012).

This study used both inductive and deductive techniques to promote the use of interdisciplinary approach with mixed methodology (Barr et al., 2013; Mertens & Hesse-Biber, 2013; Mangan et al., 2004; Barr et al., 2003). The use of SED is not particularly common within the boundary of SCM and logistics literatures, many experts in this particular area supporting a variation in methodology approach (Golicic & Davis, 2012; Spens & Kovacs, 2012; Mangan et al., 2004). By using this mixed–methodology approach, a targeted analysis procedure could be adopted to address the objectiveness and subjectivity in one research design. Hence, as explained in Chapter 3, the accessibility of

mixed methodology in addressing interdisciplinary study was considered effective and practical. In conclusion, the theoretical implications from this study have clearly created a new landscape in tackling interdisciplinary research, and therefore the models or frameworks developed can be practically implicated to real world case study.

6.6 Practical Implications

Past research has found a growing interest in household waste reduction, and solutions have been proposed in order to unravel the problem, and instil effective HRB. However, there is a limited amount of empirical work that addresses practicality within HRWM (Barr et al., 2013). EU waste directives have pushed all local authorities in the United Kingdom to have a strategic and sustainable waste management system. Both the East Riding and Yorkshire and the City of Hull have performed well beyond (above 45%) the EU waste directive average (DEFRA, 2011) from a recently low base. These two focal regions therefore represented appropriate contexts from which to study the impact of local authority initiatives, and the findings may inform practice across lagging OECD countries.

From a practical perspective, the findings should inform HRWS design by municipalities looking to more effectively manage MSW and enhance recycling and sustainability. Waste collection is one of the most visible and universal of local authority services, and improving the relationship between service user and service provider is to the mutual satisfaction of both. RL practitioners should introduce systems to support recovery of MSW in sympathy with communication and education initiatives to affect HRB, and should also appreciate symbiosis effect in the design of HRWSs.

The findings also suggest that there can be profound social implications for improved recycling performance in municipal areas. Even incremental improvements in HRWS performance can lead to enhanced sustainability through higher recycling rates, reduced MSW diversion to landfill, decreased pollution levels, reduced carbon footprints and reduced depletion of scarce natural resources. Consideration of the symbiosis effect and the situational and personal factors proposed in this thesis would be of particular value to practitioners when attempting to move from one mode of waste collection (i.e. co-mingled)

to another which requires greater commitment by households at the pivot point (i.e. source separation). For RL channel design, this study has provided a strong foundation for the consideration of symbiosis effect by channel designers. The principle of a symbiosis effect should also be examined with respect to other policy areas (e.g., transportation) where public engagement with policy is important.

Therefore, it is useful to design a sustainable reverse logistics system in waste management by considering the precursive factors with an appropriate engagement that represent the public needs. For instance, possible engagement strategies include public education and recycling awareness programmes that reinforce the positive outcomes of recycling initiatives, as well as the possibility of community investment on recovering energy from waste channels. The symbiosis perspective allowed the usage of multiple lenses to understand two major enablers (HRWS and HRB) in HRWM.

The overall findings verified that HRWS and householders behave symbiotically. It was also found that both municipalities believed behavioural changes were due to better engagement and closing the loop by offering better facilities, effective schedules and consumer centric services. However, better engagement and effective aspects of HRWS will not be substantiated if there is insufficient support from policymakers. Therefore, effective policy is an integral part of the circular economy (green economy), the application which cannot be held as the responsibility of local authorities alone; rather, it has to be an integrative approach (Kinzig et al., 2013; Barr et al., 2013; Tudor et al., 2011; Abbott et al., 2011). As one representative of a municipality quoted *“If we don’t have some back-up from central government as well as statutory duties for such a big green effort like this, it is unlikely to achieve”*. Therefore, sustainable development focusing on HRWSs should be collective concerns from stakeholders and policymakers.

The outcome from this study indicates that the nexus between HRWS and HRB should be focused on their symbiotic relationship, as well as looking at current HRWM from a symbiosis perspective. The caveat may be for policymakers and local authorities to come up

with a sustainable backward movement that addresses 'awareness, acknowledgement and action' from the households. The framework produced from this study allows practitioners to have the freedom to refine the structure as they see fit.

6.7 Limitations and Future Implications

The overall findings empirically shown in this study have posited the interaction between two distinct factors. However, a key limitation of the study was the duration of the data collection process (6-12 months), which is short. The findings would benefit from pseudo-longitudinal replication of the study at multiple intervals over a longer period of time. Equally, robustness would be enhanced by replication in other municipalities in the UK, and within the OECD. The population sample used a purposive and geographic sampling approach, and thus was non-randomized. Therefore, future sampling strategies could be formed from randomized technique. The current research was bounded by particular bodies of knowledge, and other theories or frameworks from another school of thought have not been considered, due to certain keywords that were applied in dealing with the literature. The body of work for this study was an interplay of many models and theories that contributed to a theoretical framework (Fig. 5.1).

The theoretical framework can be applicable for further replication or extension to many bodies of knowledge, and this framework was a stepping stone to converge multiple lenses of assumptions. Hence, the theoretical framework contributed by this doctoral study can be tested to promote its robustness and flexibility in addressing interdisciplinary research problems. The framework development in this study was to address the interdisciplinary issues; the application of a similar framework to address a single discipline is yet to materialize. Furthermore, the qualitative phase (I and II) inquiries deployed in the two stages (1 and 3) were undertaken by the author. The author's values and beliefs implicated during the discourses were not to manipulate the views of respondents, but as a medium to ensure the information was value-laden and to sustain 'trust' among the respondents.

This interdisciplinary study has provided a holistic view of the overarching issues of the domestic waste problem. In addition, the application of mixed methodology approach in an interdisciplinary study has provided generalizability over a sample of two distinct municipalities that underwent identical interview protocols within identical contexts, from which the initial conceptual model was developed. The revised theoretical framework was developed as the stages in the SED progressed. A good theoretical model, however, should also provide theoretical generalizability.

Theoretically, generalizable explanatory models can be applied using different methodologies under a different context, and across larger populations to successfully yield similar results. Therefore, to determine the theoretical generalizability of a similar model or framework, other studies need to be conducted (i.e. longitudinal or cross-cultural study). There are many other parts in the symbiosis model that could be refined and expanded.

The ultimate goal of this study was the development of a holistic model on the nexus between system and behaviour. Hence, future studies suggested here could provide a means for that development. The findings emerging from such studies could conceivably make available a refined model with theoretical generalizability, and thus provide the domestic waste research community with a framework with which to conduct studies of a similar kind in other areas. Furthermore, there is an opportunity to explore further the HRWM domain or scope based on countries and cultural differences, using the same symbiosis perspective. A future empirical study could be extended to explore in depth the major enablers (predictors) of symbiosis effect. Longitudinal studies could be executed to extend the investigation of HRB between transitional and permanent households, based on residency profiles and the extension of other aspects of personal factors, such as cultural factors between HRWS and HRB.

6.8 Conclusion

Thompson quoted: “the world is... a structure of unconscious relations and symbiotic processes” (1990).

Industry ecology theorists and ecologists support the notion that humans and the environment (including animals) are co-existent actors that behave symbiotically. Thus to understand human behaviour is to understand its relation with other co-existent actors (Allen et al., 2013). This study was an initial step to explain the symbiotic relation among the concomitant individuals (municipalities and householders) in pursuing a sustainable outcome.

The study supported the symbiosis effect that emerged as two major enablers of HRWM (municipalities and householders, represented by situational and personal factors respectively) symbiotically interacted, and a perceived outcome of sustainable behaviour finally materialized. As one member of the focus group implied, *“If more people understand their direct influence on the surroundings, it is less likely they will be disconnected to the environment and they tend to be perceptive of their daily consumption and waste generation. We will be sustainable beings”*. In a nutshell, pursuing sustainability via reverse logistics in HRWM shows an understanding of a ‘symbiosis effect’ between HRWS and householders.

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Appendix A

Part I: Literature studying the effects of recycling system

References	Topic/Sample	Key findings	Situational factors considered
Woodard et al. (2005)	The development of a UK kerbside scheme using known practice. Samples of over 1400 households	Higher participation rates are linked to a larger number of materials collected. The schemes that collect more materials show more participation.	Improved kerbside schemes (co-mingled for dry recyclates) Collection frequency
Woodard et al. (2006)	Participation in kerbside recycling schemes and its variation with material types. 1000 homes including a control group	It used fortnightly collection of residual waste with sets of recyclables collected on alternate weeks. The new scheme resulted in improvements of participation rates from 72 to 84%, and set-out rates from 45 to 59% (falling to 76 and 50% respectively, some months later).	Kerbside schemes (new) Collection frequency
Woodard et al. (2004)	The optimisation of household waste recycling centres for increased recycling—a case study in Sussex, UK sampling 969 site users were monitored	Two main categories of waste dominated. The first, identified as garden waste, was deposited by 37% of the target group and represents approximately 20% of arising by observed volume. The second was miscellaneous bagged waste, present in 34% of loads and equating to approximately 21% of arising by observed volume. Despite the availability of containers for segregating recyclable and compostable materials, 29% of users deposited these onto the mixed waste pile. The site was clearly not able to operate at its optimum.	Facility lay out Type of disposal Infrastructure Information
Woodard et al. (2001)	Evaluating the performance of a fortnightly collection of household waste separated into compostable, recyclates and refuse in the south of England	A new system of waste collection and source separation is reported. Its introduction has precipitated immediate reductions of 55% of waste going to landfill (from 18.1 kg per household per week to 8.2 kg per household per week). The CROWN scheme, set up by	New Scheme Introduced (3 different bins) Collection frequency Education Policy Recycling Facilities Recycling

	247 houses were surveyed	Wealden District Council, uses a 'green' wheelie bin for compostable materials and a 'black' wheelie bin for other wastes which are collected on alternate weeks only. A kerbside recycles box is also provided for papers and metals. This replaces a simple kerbside scheme and analysis of the waste before and after the change also shows that the amounts of waste in the recycles boxes and participation rates for its use have increased.	Infrastructure
Abbot et al. (2011)	Explaining the variation in household recycling rates across the UK UK's 434 local authorities over the period 2006Q2 to 2008Q4	<ul style="list-style-type: none"> • No monetary charges for recycling. The funding from the property tax • Non-monetary initiatives are kerbside schemes • The improvement of recycling rate in UK is the improvement of RL (recycling system provision) • Frequency of collection could incentivise households to separate their recycles. (driver to increase recycling rate) • The financial constraints could deter the efficiency of kerbside schemes • Central government important in supporting the initiatives • The provision of container also significant to dry recycling only. The type/size consider as potential to improve recycling services • The design of recycling provision will be crucial for composting material and lower frequency becomes relevant when composting volume is a higher contributor than waste volumes • LCs disinterested in the provision of the recycling container • Variation between regional 	Recycling System Frequency for collection Non-monetary Initiatives Bins

		(support methodology part).	
Harder and Woodard (2007)	Systematic studies of shop and leisure voucher incentives for household recycling (Households)	No changes between affluent and deprived area. Positive reaction from households. Preferred individual rewards. High participation from the retailer (leisure voucher provider).	Economic incentives
Bench et al. (2005)	Waste minimisation: Home digestion trials of biodegradable waste	The main reason for people buying the Green Cone had been concerns about waste (88%), with 78% and 67% of respondents, respectively, claiming to have participated in recycling and home composting in the last 30 days. The waste material most frequently put in the digester was cooked food (91%), followed by fruit waste, vegetable matter and bones/meat. Some respondents were using it for garden and animal waste from pets. Most users found the Green Cone performed satisfactorily. Approximately, 60% of respondents had seen a reduction of 25–50% in the amount of waste they normally put out for collection, with analysis showing reported levels of reduction to be significant ($p < 0.05$). Additional weight surveys by householders recorded an average of 2.7 kg/(h week) diverted to the food digester.	New Bin
Kipperberg (2007)	A comparison of household recycling behaviour in Norway and the United States (Households)	Norwegians positively affected by monetary policy. US variation responds on incentives. Personal factors contributed to the incentives <ul style="list-style-type: none"> • Perceived behaviour • Social norms 	Economic incentives
Birtwistle (2007)	Fashion clothing – where does it all end up? (Consumer and Charity Shops)	Identifies consumers' lack of understanding of how purchasing behaviour affects the environment and key informant interviews explore how clothing can be re-used and recycled.	Marketing Education

Breen (2006)	Give me back my empties or else! A preliminary analysis of customer compliance in reverse logistics practices (UK) (Retailers)	In both B2B and B2C relationships, there is evidence of suppliers suffering financial loss due to customer non-compliance.	Marketing
Jahre (1995)	Household waste collection as a reverse channel: a theoretical perspective (Municipalities)	Integrated logistics and marketing theory in channel structure.	Collection Frequencies Kerbside schemes
Guiltinan and Nwokoye (1975)	Developing distribution channels and systems in the emerging recycling industries	Conceptualization of reverse channel structures and channel members.	Recycling Infrastructure Recycling Facilities Marketing Incentives
Pohlen and Farris (1992)	Reverse logistics In plastics recycling	Conceptualization of channel structure of recycling.	Facilities and Infrastructure Distances and Accessibility
Hibbert et al. (2005)	Charity retailers in competition for merchandise: examining how consumers dispose of used goods (210 households)	The results show that disposal is significantly influenced by the events that prompt disposition (decorating, purchase, and bereavement), and households use a varied portfolio of disposal channels within and across categories of goods. Five types of households are differentiated with respect to the combination of channels used and the mixture of goods discarded.	Disposal channels Marketing

Part II: Literature studying the behaviour of households

References	Objectives / study objects (samples)	Key findings	Situational/Personal factors considered
Stern (1999)	A value-belief-norm theory of support for social movements; the case for environmentalism (420 Public)	Individuals who accept a movement's basic values, believe that valued objects are threatened, and believe that their actions can help restore those values experience an obligation (personal norm) for pro-movement action that creates a predisposition to provide support; the particular type of support that results is dependent on the individual's capabilities and constraints.	Attitudinal Personal Capabilities Personal Norm Contextual factors Habit and Routine
Barr et al. (2003)	Attitudes towards recycling household waste in Exeter, Devon: quantitative and qualitative approaches (Households)	Respondents were much more likely to recycle if they had access to a structured kerbside recycling scheme. Many other factors influenced their attitudes and behaviours towards recycling, including their acceptance of the activity and their perception of the benefits and problems of recycling as a whole.	Marketing Improved Facilities Kerbside schemes Education Conveniences
Boldero (1995),	The prediction of household recycling of newspapers: The role of attitudes, intentions, and situational factors (Households)	It was found that, although attitudes and intentions to recycle household newspapers were significant predictors of recycling behaviour, factors associated with the inconvenience of recycling and the programmes provided by borough councils, as well as respondents' past recycling behaviour, were also significant predictors.	Attitudinal Personal Capabilities Marketing Improved Facilities Kerbside schemes Education Conveniences
Tucker (1996)	Normative influences in household waste recycling (Households)	The existence of social norms in triggering the recycling behaviour among	All situational factors All personal factors Interaction

		community is important when the normative behaviour of the local constituents are pro environmental and projecting recycling as societal responsibility, however it could be diminished by higher ignorance level on societal and environmental issues in one locality.	
Bhate (2005)	An examination of the relative roles played by consumer behaviour settings and levels of involvement in determining environmental behaviour (Households)	Indicates that consumers may have either inadequate or inappropriate knowledge about environmental issues which may have led to low involvement levels and consequently limited behaviour. It may therefore be necessary to distinguish between cognitions that are affected under high or low involvement situations	Marketing Improved Facilities Education Conveniences Pro-Environmental behaviour
Bevin (2007)	Beyond recycling: 'commons-friendly' waste reduction at new consumption communities (Community Residents)	15 salient goals relevant to consumers for recycling, their interrelations and hierarchical structure. The provision of specific goals and procedures for recycling to consumers would likely increase the practice of recycling.	Marketing Improved Facilities Education Conveniences Pro-Environmental behaviour
Tonglet et al. (2004)	Using the Theory of Planned Behaviour to investigate the determinants of recycling behaviour: a case study from Brixworth, UK	The findings suggest that pro-recycling attitudes are the major contributor to recycling behaviour, and that these attitudes are influenced firstly, by having the appropriate opportunities, facilities and knowledge to recycle, and secondly by not being deterred by the issues of physically recycling (for example time, space and inconvenience). Previous recycling	Attitudinal Personal Capabilities Conveniences

		experience, and a concern for the community and the consequences of recycling are also significant predictors of recycling behaviour.	
Nixon and Saphores (2007)	Financing electronic waste recycling - Californian Households' willingness to pay advanced recycling fees (3000 diversified households)	Age, income, beliefs about government and business roles, proximity to existing recycling facilities, community density, education, and environmental attitudes are significant factors for explaining people's willingness to pay an advanced recycling fee (ARF) for electronics. Most respondents are willing to support a 1% ARF.	Proximity to recycling system Education Business roles
Ristic (1999)	Analysing dome motivational factors of recycling behaviour in Zagreb Croatia (104 households)	Two factors were significant predictors of recycling behaviour: perception of collection containers distance and perception of individual responsibility and effectiveness of individual action.	Collection Bin Distances
Thorgesen (1994)	A model of recycling behaviour, with evidence from Danish source separation programmes. (Households)	Positive reaction on source separation programme.	Education Marketing
Biel and Thorgesen (2007)	Activation of social norms in social dilemmas: a review of the evidence and reflections on the implications for environmental behaviour (Public)	Social norms imply that people should manifest a prescribed behaviour or not manifest a proscribed behaviour.	All situational factors All personal factors Interaction

Appendix B

Part I: Email invitation for participation and Consent Form

Dear Sir/Madam

The Logistics Institute at the University of Hull is conducting a research project studying sustainability and the effectiveness of household recycling systems and household recycling behaviour. You are invited to participate in an interview session (max. 90 minutes per session). The purpose of this interview is to understand the relationship between current household recycling waste systems and householders.

We would appreciate your views on the issues and your assistance is critical for a better understanding of recycling behaviour in the East Riding of Yorkshire and the City of Hull.

Respondents' responses are voluntary and will be confidential. All responses will be kept strictly anonymous. Only the research team will view any of the responses.

If you have any questions or concerns, please contact Emy E. A.Jalil, Researcher for this project under the supervision of Professor David Grant at tel. (mob) 07703 826951 or email ezura@uum.edu.my or e.e.a-jalil@2010.hull.ac.uk.

Thank you for your kind consideration and attention.

Best Regards

Mrs. Emy E.A.Jalil, MLogistics

PhD Candidate
University of Hull Logistics Institute
Hull University Business School
Cottingham Road, Hull, UK HU6 7RX
Email: e.e.a-jalil@2010.hull.ac.uk

Tel. +44 (0) 7703 826951

Consent Form

Business School

RESEARCH ETHICS COMMITTEE

CONSENT FORM:

I, _____ of

Hereby agree to be a participant in this study to be undertaken

By *Emy E. A . Jalil*

And I understand that the purpose of the research is ***to understand relationship between current household recycling waste system and householders.***

I understand that

1. The aims, methods, and anticipated benefits, and possible risks/hazards of the research study, have been explained to me.
2. I voluntarily and freely give my consent to my participation in such research study.
3. I understand that aggregated results will be used for research purposes and may be reported in scientific and academic journals.
4. Individual results will not be released to any person except at my request and on my authorisation.
5. I am free to withdraw my consent at any time during the study, in which event my participation in the research study will immediately cease and any information obtained from me will not be used.

Signed:

Date:

The contact details of the researcher are:

Tel. (mob) 07703 826951 or email ezura1601@gmail.com or e.e.a-jalil@2010.hull.ac.uk.

The contact details of the secretary to the HUBS Research Ethics Committee are Amy Cowling, Hull University Business School, University of Hull Cottingham Road, Hull, HU6 7RX.

Email: a.cowling@hull.ac.uk tel. 01482-463410.

Part II: Interviews Protocol – Households and Councils

INTERVIEW PROTOCOL

Sustainability via Reverse Logistics: An Examination of Symbiosis Effect between Recycling System and Household Behaviour

Households: *(area)*

Date:

In this research, we assess the sustainability (and effectiveness) of household recycling systems and household recycling behaviour, reveal how factors associated with household recycling systems affect household recycling behaviour, and how household recycling behaviour affects the provision of household recycling systems by the municipalities. The information you provide in this interview will be used to reveal and explain the interaction and the possibility of symbiosis effects between household recycling systems and household recycling behaviour.

All your answers will be kept confidential; no-one will be able to identify you from your responses. The interview takes less than 20 minutes. The interview will tend to focus on the organization when it is operating at its best in several different topic areas:

RQ5. What are the interaction and symbiosis effects and what are the conditions which support the symbiosis between household recycling systems and household recycling behaviour?

When I say “Recycling” what is the first thing that comes to mind (probe on council roles)

How do you feel when you are sorting and separating your rubbish for recycling?

Is it convenience for you to do this on a daily basis?

What will make it easier?

When I say “Sustainability” what does this term mean to you, your neighbourhood and environment?

What is it about the environment that you value?

Do you think that you are recycling enough, and is the pamphlet that the council gives you every year clear and easy to understand?

Recycling Initiatives

RQ2. How to assess household recycling behaviour? What are the recycling behaviours of households using different household recycling systems provided by UK municipalities?

Show the picture and probe about these changes in themselves and environment.

Do you feel this is a convenience way of recycling? Why or why not?

Show/talk about the pamphlet. Do you find it important for you to be able to recycle?

RQ3. What are the different factors associated with household recycling systems which may affect household recycling behaviour, and how do they affect household recycling behaviour?

RQ5. What are the interaction and symbiosis effects and what are the conditions which support the symbiosis between household recycling systems and household recycling behaviour?

I'd like to ask you if, before the 3 wheelie bins were introduced in 2009, and looking at your current address, can you recall a time when you felt the need for changes in how the council manage your waste?

Why were the changes made an important move?

Who were the most significant contributors to ensure these changes?

Why were they significant?

RQ1. How to assess the sustainability (effectiveness) of a household recycling system? What are the sustainability levels of different household recycling systems provided by UK municipalities?

RQ2. How to assess household recycling behaviour? What are the recycling behaviours of households using different household recycling systems provided by UK municipalities?

RQ5. What are the interaction and symbiosis effects and what are the conditions which support the symbiosis between household recycling systems and household recycling behaviour?

Let's talk for a moment about when the 3 wheelie bins were introduced.

What made it an important change?

What was it about you that made it an effective way for disposing of your waste?

What were the most important factors from councils that helped to make it an effective process? (Probe: conveniences, communications, strategy and relationships).

What made such relationships/cooperation possible? (Explore: recycling methods used, recycling provisions, marketing and education, communication systems or process, incentives for cooperation).

INFORMATION REQUESTED FROM THE INTERVIEWER

A. What was the best quote that came out of the interview?

B. What was the best experience that came out of the interview?

Interviewer Name _____

Date of Interview _____

DEMOGRAPHIC BACKGROUND (FOR INTERVIEWEE)

This section is for respondent background information. Please tick in the boxes provided.

Choose the BEST suitable option.

1. Age : 20 or under
 21 – 30
 31 – 40
 41 – 50
 51 or older

2. Gender : Male Female

3. Marital Status: Single
 Married
 Others _____

4. Number in household : single occupant
 double occupant
 3 – 4
 Others _____

5. I am currently : Studying
 Working
 Neither Working nor Studying

6. I started living in Hull/East Riding of Yorkshire for Less than 4 years More than 4 years

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Appendix C

Template used for call for participation either online or postal

Business School

December 12, 2012

The Logistics Institute at the University of Hull is conducting a research project studying sustainability and the effectiveness of household recycling systems and household recycling behaviour. We would appreciate your views on the issues and therefore request you to complete this questionnaire.

Please complete the questionnaire and return it at your earliest convenience or complete it in online at https://docs.google.com/forms/d/1JYleBB0ylzM43u5TB15F8r-V0-ukQ0E9-g_h-NDaCuU/viewform. If you are unable to complete the questionnaire, please recycle the booklet. Your assistance is critical for a better understanding of recycling behaviour in the East Riding of Yorkshire and the city of Hull.

Your responses are voluntary and will be confidential. All responses will be kept strictly anonymous. Only the research team will view any of the responses.

If you have any questions or concerns, please contact Emy E. A.Jalil, Researcher for this project under the supervision of Professor David Grant at tel. (mob) 07703 826951 or email ezura@uum.edu.my or e.e.a-jalil@2010.hull.ac.uk.

If you have any questions about your rights as a research subject, you may contact the secretary of the Hull University Business School Research Ethics Committee to discuss them: Mrs. Amy Cowling, Hull University Business School, University of Hull, and Cottingham Road, Hull, HU6 7RX. Alternatively you may forward any concerns by e-mail to: a.cowling@hull.ac.uk or telephone: 01482-463410.

We appreciate you taking the time to complete the survey and thank you for your consideration.

Yours sincerely,

Emy E. A.Jalil

Appendix D

Questionnaire used for online and postal distribution.

RECYCLING is defined as the reprocessing of waste, either with the same materials/products (closed-loop recycling) or with different materials (open-loop recycling).

Consider the following set of statements related to your views on recycling and the environment. Please circle the number under the initials that applies.

- SA = STRONGLY AGREE
- A = AGREE
- N = NEUTRAL
- D = DISAGREE
- SD = STRONGLY DISAGREE

QUESTIONS	SA	A	N	D	SD
I am aware that environmental issues are becoming more urgent than before.	5	4	3	2	1
I know recycling is helping the environment.	5	4	3	2	1
I check product labels for disposal information when I go shopping.	5	4	3	2	1
Given a choice, I would definitely purchase a product that is easier to dispose of than similar alternatives.	1	2	3	4	5
Given a choice, I select products with the recycling symbol. 	5	4	3	2	1
I recycle most of my recyclable items.	5	4	3	2	1
I would definitely recycle If I received information that recycling has become MORE IMPORTANT to the environment than previously believed.	5	4	3	2	1
I would still recycle if I received information that recycling is LESS IMPORTANT to the environment than previously believed.	5	4	3	2	1

Which goods/materials are you currently recycling? Please tick <input checked="" type="checkbox"/> all that apply.	
Aluminium (packaging materials)	
Glass (bottles, jars and containers)	
Newspaper/Magazines/Pamphlets	
White A4 Paper	

Cardboard boxes (packaging materials)	
Plastic (bottles, tubs and containers)	
Plastic Bags	
Tin Cans	
Clothing and textiles	
Others (Please state the items)_____	
I recycle because (Tick <input checked="" type="checkbox"/> all that apply)	
To comply with regulations	
Improve the environment	
To represent a good image	
To serve an environmentally conscious society	
Financial gains from the sale of recyclable products	
Do not know	
Others:_____	
Separation and Sorting the waste is usually done by	a. Myself b. Other members of the household _____ c. The whole household

Consider the following set of questions related to situational factors that affect recycling activities at home. Please circle the number under the initials that applies.

- A = ALWAYS
O = OFTEN
S = SOMETIMES
R = RARELY
N = NEVER

QUESTIONS	A	O	S	R	N
Most of the recyclables are being disposed by					
Putting them in with the rest of my rubbish (i.e. they are not separated).	5	4	3	2	1
Putting them separately from the rest of my rubbish.	5	4	3	2	1
Informing the right operator for collection (especially for larger items - furniture, electrical appliances or garden wastes).	5	4	3	2	1
Dropping them off to recycling centres (e.g. at a supermarket or household waste and recycling centre).	5	4	3	2	1
Would you be willing to drop off recycling items if given convenience	5	4	3	2	1

(closer to residential and accessible) location?					
It is good that the environment is taken more into account, and for me personally it is a disadvantage that more effort is expected to protect the environment.	1	2	3	4	5
It is good that the environment is taken more into account, but for me personally it is an advantage that I can now increase my effort to protect the environment.	5	4	3	2	1
If necessary, I would be willing to pay extra for recycling services to be provided.	5	4	3	2	1
My recycling bins are usually fuller than my general bins.	5	4	3	2	1
The bins' collection times really affect my recycling routines.	5	4	3	2	1
The size and ease of use of the wheelie bins affect how I manage my waste and recycling routines.	5	4	3	2	1
The liners or bags provided affect how I manage my waste and recycling routines.	5	4	3	2	1
I have my own separation system in my house to make me and other occupants participate more in recycling at home.	5	4	3	2	1
I often find it difficult to dispose of larger items (mattresses, old furniture, electrical appliances).	5	4	3	2	1
I would definitely dispose of my larger items properly if there were collection services periodically in my residential area.	5	4	3	2	1
I would definitely improve my recycling routines if there were more recycling bins in public areas (shopping complexes, leisure centres, recreational centres, main streets).	5	4	3	2	1

Consider the following set of statements related to your thoughts on the relationships between recycling systems and household recycling behaviour. Please circle the number under the initials that applies.

- SA = STRONGLY AGREE
- A = AGREE
- N = NEUTRAL
- D = DISAGREE
- SD = STRONGLY DISAGREE

QUESTIONS	SA	A	N	D	SD
Reasons People Are Not Recycling:					
They do not use goods/materials that can be recycled.	5	4	3	2	1
They are not aware which goods and materials could be recycled.	5	4	3	2	1

The cost associated with recycling.	5	4	3	2	1
The accessibility to recycling facilities.	5	4	3	2	1
The time required to prepare goods for recycling.	5	4	3	2	1
Their lack of knowledge about recycling programmes.	5	4	3	2	1
My major sources of information about recycling include:					
Magazines and newspaper.	5	4	3	2	1
The Internet.	5	4	3	2	1
Television.	5	4	3	2	1
Local Councils.	5	4	3	2	1
Environmental Community Group (of Non-Governmental Organizations).	5	4	3	2	1
I would like a pick-up facility for my larger recyclable items.	5	4	3	2	1
What services would you expect from local council disposal facilities?					
Dependable scheduled pick-ups.	5	4	3	2	1
Council employees separate goods/materials (i.e., glass, aluminium, etc.)	5	4	3	2	1
Provision of storage unit recyclables (i.e., trash cans, bins, etc.)	5	4	3	2	1
I am aware of a facility where I can take recyclable items that I may wish to dispose of.	5	4	3	2	1
I find out about recycling centres by					
Council's webpage.	5	4	3	2	1
Friends / family tell me.	5	4	3	2	1
I read about it in the local paper.	5	4	3	2	1
Information mailed to me by my local council.	5	4	3	2	1
I enquired at my local council.	5	4	3	2	1
I use the bulk rubbish collection service provided by my local council.	5	4	3	2	1
If the council provides all the necessary facilities (in public areas and near the residential areas) for recycling, I would definitely use them.	5	4	3	2	1
The distances from my residence to the recycling centres have a major impact on my recycling habits.	5	4	3	2	1
What would be the best way to communicate information regarding recycling facilities and services to you and your residence?					
Television advertising / promotion.	5	4	3	2	1
Information in the local community paper.	5	4	3	2	1
A letter from the council providing details of the facility.	5	4	3	2	1
Awareness programmes held by government agencies or non-governmental organisations.	5	4	3	2	1

Some Information about Yourself

This section is for respondent background information. Please tick in the boxes and/or fill in the blank provided.

1. Age : 20 under 21 – 30
 31 – 40 4 0
 51 or older

2. Gender : M Fe

3. Marital Status: Sin Married Other

4. Number in household : single occ t
 double occupants
 3 – 4 Others _____

5. I am currently : Stu g Others
 Working red

For question 6, please fill in number of years/months on the required boxes.

6. I have lived in Hull/East Riding of Yorkshire for _____ years and have recycling for _____ years.

7. The following best describes the area I live in:

Urban suburban Rural

Type of property : Fl apartment/Studio

House with garden

House without garden

Country of Birth UK er Country of Resident UK
Other

Thank you for your time and patience in answering this questionnaire. Be assured that your answers will be held in strict confidence.



THANK YOU

We sincerely appreciate your help in filling out this questionnaire. Your rapid response is critical to completing this research and will help develop a better understanding of Recycling System and Recycling Behaviour.

Reverse Logistics Research

Conducted by:
Hull University Business School
Cottingham Road, Hull, UK HU6 7RX

Appendix E

Part I: Template used for invitation for participants with consent form

The Logistics Institute at the University of Hull is conducting a research project studying sustainability and the effectiveness of household recycling systems and household recycling behaviour. You are invited to participate in a focus group. The purpose of this focus group is to understand relationship between current household

recycling waste system and householders. We would appreciate your views on the issues and your assistance is critical for a better understanding of recycling behaviour in the East Riding of Yorkshire and the city of Hull.

You will receive compensation of GBP5 per session (120minutes) for participating in the research study. Your responses are voluntary and will be confidential. All responses will be kept strictly anonymous. Only the research team will view any of the responses.

If you are interested, please contact Emy E. A.Jalil, Researcher for this project under the supervision of Professor David Grant at tel. (mob) 07703 826951 or email ezura1601@gmail.com or e.e.a-jalil@2010.hull.ac.uk.

If you have any questions about your rights as a research subject, you may contact the secretary of the Hull University Business School Research Ethics Committee to discuss them: Mrs. Amy Cowling, Hull University Business School, University of Hull, and Cottingham Road, Hull, HU6 7RX. Alternatively you may forward any concerns by e-mail to: a.cowling@hull.ac.uk or telephone: 01482-463410.

Yours sincerely,

Emy E. A.Jalil

Business School

RESEARCH ETHICS COMMITTEE

CONSENT FORM:

I, _____ of

Hereby agree to be a participant in this study to be undertaken

By *Emy E. A . Jalil*

And I understand that the purpose of the research is ***to understand relationship between current household recycling waste system and householders.***

I understand that

1. The aims, methods, anticipated benefits and possible risks/hazards of the research study have been explained to me.
2. I voluntarily and freely give my consent to my participation in such a research study.
3. I understand that aggregated results will be used for research purposes and may be reported in scientific and academic journals.
4. Individual results will not be released to any person except at my request and on my authorisation.
5. I am free to withdraw my consent at any time during the study, in which event my participation in the research study will immediately cease and any information obtained from me will not be used.

Signed:

Date:

The contact details of the researcher are:

Tel. (mob) 07703 826951 or email ezura1601@gmail.com or e.e.a-jalil@2010.hull.ac.uk.

The contact details of the secretary to the HUBS Research Ethics Committee are Amy Cowling, Hull University Business School, University of Hull Cottingham Road, Hull, HU6 7RX.

Email: a.cowling@hull.ac.uk tel. 01482-463410.

Part II: The Discussion Guide used for focus group and interviews

Semi-structured Interview Questions

For Councils

Explanation	
A. Introduction	<ul style="list-style-type: none"> i. My name is Emy E A Jalil. On behalf of the Logistics Institute, HUBs and myself, I would like to thank you for participation on the final stage of the research process. ii. This email interview is a part of project that is being conducted for doctoral research to justify or support prior phases of data collections. By finding out the councils' understanding with regards to the research outcomes, we will be able to develop a cohesive framework for practitioners as well as academia. iii. A series of questions or statements are related to the Household Recycling Behaviour (HRB) and Household Recycling Waste Services (HRWS). When you answer, please express your thoughts and concerns about each of the questions or statements or any other related issues. Your opinions and ideas are very important to us.
B. Preliminary Procedures	<ul style="list-style-type: none"> i. Please remember that there are no right or wrong answers to any of these questions. Also feel free to state your own viewpoints, feelings and personal experiences. ii. The more information we get from you, the more it will help us to develop a better framework that is accessible for real life cases. iii. All comments are welcomed, both positive and negative. If you don't have an answer or do not understand the question, it is okay to tell me so. It helps us even when you don't have an answer to a question. So please don't be ashamed to put, "I don't know" or "I'm not sure what you're asking."
C. Procedure	<ul style="list-style-type: none"> i. I will take the information I obtain from the emails and write a report. Please remember that you will not be identified in any way. ii. This email interview is strictly confidential. iii. The task will last less than 30 minutes.
Discussion Questions	
The first set of questions are about councils Household Recycling Waste System (HRWS)	
A. Engagement	i. Engagement from councils has been found as important factor in motivating householders to recycle. For this question, what is your thought on behalf of the council?
Response	
	ii. What activities describe engagement by councils?
Response	
	iii. Who do you think this engagement will benefit most?
	iv. Why?
Response	
B. Sustainability	i. Have you heard the word "sustainability"? If yes, what does sustainability mean to you in regard to waste management? Do you think that sustainability can be achieved? Why or why not?

Response	
C. Convenience	i. Do you think that convenience influences your HRB? How?
Response	
	ii. What would you say is more likely to be convenient, the services or facilities (show pictures on various bin type)?
Response	
	iii. If the services or facilities are not convenient, what would you do? Why?
Response	
D. Accessibility and availability	i. Do you think that accessibility and availability influences householders? How?
Response	
	ii. How does HRWS accessibility and availability effect households? How are the householders affected by these factors? Why?
Response	
E. Waste-to-energy	i. Have you heard the word “waste-to-energy”? If yes, what does waste-to-energy mean to you in regard to household waste?
Response	
The second set of questions are about personal factors: <i>the personal factors (marital status, employment, country of birth, recycling knowledge) have been found as main factors influencing HRB from previous phases of findings.</i>	
A. Knowledge	i. Do you think that householders’ knowledge of recycling influences their HRB? How?
Response	
	ii. Who would you say are more likely to be effective recyclers, those are situated in affluent areas or not? Why?
Response	
	iii. Do you think knowledge is gained through family norms?
Response	
B. Country of Birth	i. Do you think that where you are from influences your HRB? Why?
Response	
	ii. Have you heard the word “transient” population? <i>Transient means temporary residents such as university students.</i>
Response	
	iii. Do you think that those who are considered transient are more likely to be oblivious (ignorant) of the HRB norms?
Response	
C. Employment	i. Do you think that the working environment somehow influences HRB? Why? What factors from the working environment trigger HRB?
Response	
	ii. Do you think that the study environment somehow influences HRB? Why? What factors from the study environment trigger HRB?
Response	
D. Marital status	i. Do you think marital status/cohabitation has influence on HRB? How? Why?
Response	
	ii. Do you think your family members or housemates have influence on your HRB? How? Why?

Response	
E. Symbiosis	i. Have you heard the word “symbiosis”? If yes, what does symbiosis mean to you in regard to waste management? <i>Symbiosis is mutual interdependency between two or more factors.</i>
Response	
F.	i. Do you think in order for the symbiosis effect to take place, this means an effective HRB, when the council’s HRWSs and householders are mutually benefitting each other? Why?
Response	
	ii. Do you think in order for HRB to progress effectively, certain situational factors must be available first, which will motivate a person to recycle? Why or why not?
Response	
G. Awareness-related questions	i. Do you think pamphlets given by the councils are the main reference for householders? Why or why not?
Response	
	ii. Where do you get other recycling information? Why or why not? Why do you go there? <i>Probe to find out what participants think of the council recycling programmes.</i>
	iii. <i>What kinds of recycling information would be most helpful to you? Probe for communication tools flyers, TV programmes etc.</i>
Response	
	iv. Do you think education (tertiary as well as primary and high school) is the platform to convey recycling awareness? Why or why not?
Response	
Closing	
<p>A. These are all the questions we have for you.</p> <p>B. Once again, I want to reassure you that everything you mention is strictly confidential and anonymous. Your names will not be connected to the information given today.</p> <p>C. Thank you for the assistance. The information that you have provided is very important. You have been very helpful to us.</p>	

Semi-structured Interview Questions

For Householders

Explanation	
D. Introduction	<p>iv. My name is Emy E A Jalil. On behalf of (Logistics Institute, HUBs) and myself, I would like to thank you for participation on the final stage of the research process.</p> <p>v. This email interview is a part of project that is being conducted for doctoral research to justify or support from prior phases of data collections. By finding out the councils’ understanding in regards to the research outcomes. We will be able to develop a cohesive framework for practitioners as well as academia.</p> <p>vi. A series of questions or statements relate to Household Recycling Behaviour (HRB) and Household Recycling Waste Services</p>

	(HRWS). When you answer, please express your thoughts and concerns about each of the questions or statements or any other related issues. Your opinions and ideas are very important to us.
E. Preliminary Procedures	<ul style="list-style-type: none"> i. Please remember that there are no right or wrong answers to any of these questions. Also feel free to state your own viewpoints, feelings, and personal experiences. ii. The more information we get from you, the more it will help us to develop a better framework that is accessible for real life cases. iii. All comments are welcomed, both positive and negative. If you don't have an answer or do not understand the question, it is okay to tell me so. It helps us even when you don't have an answer to a question. So please don't be ashamed to put, "I don't know" or "I'm not sure what you're asking."
F. Procedure	<ul style="list-style-type: none"> i. I will take the information I obtain from the emails and write a report. Please remember that you will not be identified in any way. ii. This email interview is strictly confidential. iii. The task will last less than 30 minutes.
Discussion Questions	
The first set of questions are about councils Household Recycling Waste System (HRWS)	
F. Engagement	<ul style="list-style-type: none"> i. Engagement from councils had been found as important factor in motivating householders to recycle. For this question, what is your thought on the council?
Response	
	<ul style="list-style-type: none"> ii. What activities describe engagement by councils?
Response	
	<ul style="list-style-type: none"> iii. Who do you think this engagement will benefit most? iv. Why?
Response	
G. Sustainability	<ul style="list-style-type: none"> i. Have you heard the word "sustainability"? If yes, what does sustainability mean to you in regard to waste management? Do you think that sustainability can be achieved? Why or why not?
Response	
H. Convenience	<ul style="list-style-type: none"> i. Do you think that convenience influences your HRB? How?
Response	
	<ul style="list-style-type: none"> ii. Which would you say are more likely to be convenient, the services or facilities?
Response	
	<ul style="list-style-type: none"> iii. If the services or facilities are not convenient, what would you do? Why?
Response	
I. Accessibility and availability	<ul style="list-style-type: none"> i. Do you think that accessibility and availability influences householders? How?
Response	
	<ul style="list-style-type: none"> ii. How does HRWS accessibility and availability effect households? How are the householders' affected by these factors? Why?
Response	
J. Waste-to-energy	<ul style="list-style-type: none"> i. Have you heard the word "waste-to-energy"? If yes, what does waste-to-energy mean to you in regard to household waste?

Response	
The second set of questions is about personal factors: <i>the personal factors (marital status, employment, country of birth, recycling knowledge) have been found as main factors influencing HRB from previous phases of findings.</i>	
H. Knowledge	i. Do you think that householders' knowledge of recycling influences their HRB? How?
Response	
	ii. Who would you say are more likely to be effective recyclers, those situated in affluent areas or less affluent areas? Why?
Response	
	iii. Do you think knowledge is gained through family norms?
Response	
I. Country of Birth	i. Do you think that where you are from influences your HRB? Why?
Response	
	ii. Have you heard the word "transient" population? <i>Transient means temporary residents such as university students.</i>
Response	
	iii. Do you think that someone who is considering transient is more likely to be oblivious (ignorant) of the HRB norms?
Response	
J. Employment	i. Do you think that the working environment somehow influences HRB? Why? What factors from the working environment trigger HRB?
Response	
	ii. Do you think that the study environment somehow influences HRB? Why? What factors from the study environment trigger HRB?
Response	
K. Marital status	i. Do you think marital status/cohabitation has influence on HRB? How? Why?
Response	
	ii. Do you think your family members or housemates influence your HRB? How? Why?
Response	
L. Symbiosis	i. Have you heard the word "symbiosis"? If yes, what does symbiosis mean to you in regard to waste management? <i>Symbiosis is mutual interdependency between two or more factors.</i>
Response	
M.	i. Do you think in order for the symbiosis effect to take place, and have effective HRB this is when the council's HRWS and householders are mutually benefitting each other? Why?
Response	
	ii. Do you think in order for HRB to progress effectively, certain situational factors must be available first, which will motivate a person to recycle? Why or why not?
Response	
N. Awareness-related questions	i. Do you think pamphlets given by the councils are the main reference for householders? Why or why not?
Response	

	ii. Where do you get other recycling information? Why or why not? Why do you go there? <i>Probe to find out what participants think of the council recycling programmes.</i>
	iii. <i>What kinds of recycling information would be most helpful to you? Probe for communication tools flyers, TV programmes etc.</i>
Response	
	iv. Do you think education (tertiary as well as primary and high school) is the platform to convey recycling awareness? Why or why not?
Response	
Closing	
<p>D. These are all the questions we have for you.</p> <p>E. Once again, I want to reassure you that everything you mention is strictly confidential and anonymous. Your names will not be connected to the information given today.</p> <p>F. Thank you for the assistance. The information that you have provided is very important. You have been very helpful to us.</p>	

Some Information about Yourself

This section is for respondent background information. Please tick in the boxes and/or fill in the blank provided.

1.	Age	20 or under.	21 – 30	31 – 40	41 – 50	51 or older
2.	Gender	Male			Female	
3.	Marital Status	Single	Married	Other		
4.	Number in household (occupants)	Single	Double	3 or more		
5.	I am currently	Studying	Working	Other		
6.	My residential area is situated in	Hull		East Riding of Yorkshire	Other	
7.	How long have you lived in the current area?	Less than 4 years (1-4)	More than 4 years (> 4)	Other		
8.	I have been recycling (years)	Less than 4 years (1-4)	More than 4 years (> 4)	Other		
9.	My area is best described as	Urban	Rural	Suburban		
10.	My property is best described as	House without garden	House with garden	Flat/Apartment/Studio		
11.	Country of Birth	UK		Other		

Thank you for your time and patience in answering this questionnaire. Be assured that your answers will be held in strict confidence.

Appendix F

The Summary of Interviews between the Respondents and Researcher

Interviews Notes and Summary	
<p>RQ2: What are the different factors associated with HRWS that may affect HRB, and how do they affect HRB?</p> <p>Why were the changes made is an important move? Who were the most significant contributors to ensure these changes? Why were they significant?</p>	
Concepts Investigated	Interviews summary: Municipality
<ul style="list-style-type: none"> ● Sustainability ● Household recycling – frequency, bin, scheme, etc. ● Recycling performance 	<p>Corresponding with this questions are the municipalities.</p> <p>Hull City municipality uses weightage of the collection based on the scheme. The sustainable options were to improve current schemes to much more relevant constituents. They use feedbacks approach on the current scheme and changes had been made prior to the feedback. The changes that had been made were scheduling and engagement with problematic areas. The approach for the problematic areas was likely to be door-to-door approach which had been outsourced to an external consultant. They recorded the pattern of the usage of bins, call for collections and recycling rate and with these inputs they decided what would be the best options.</p> <p>In discussion on sustainability options: they were more concerned on how to divert the black bin refuse from the landfill. In regard to carbon footprints: they recorded collection frequency and how it reflected their financial constraints.</p> <p>The most complex area was the internal integration between departments with regards to conveying the sustainable methods of refuse. It seems that when they proposed the best option it would be backfired by other depts. (incineration case). <i>Stock and Ellram (1998) mentioned in a seminal paper that reverse logistics could be effective if the internal management supported environmental awareness in their strategic management plans.</i></p> <p>The limitation of control over the MRF if it was outsourced to independent parties. They had changed the time-period from 20 years’ contract to 10 years’ contract. The operators had sole authority in managing the waste.</p> <p>LCA analyses are not a common practice of the municipality but they are aware of the operators that use it to do the environmental assessment.</p> <p>They are very optimistic on the household recycling behaviour change and they do not believe that laziness and “don’t care attitude” are the causes. They stated that problematic areas are mostly student accommodation areas and immigrants from Eastern Europe. They said that it was due to the feeling of non-self-belonging or being transitional tenants (May, 2011; Inzlicht & Good, 2006) discussing the role of the dominant society influencing their livelihood in the new environment. The importance of education and central government in conveying the sustainable messages and municipalities reflected that if the main government does not have an integrated approach to solving waste and recycling issues, it will be difficult to be among the top EU members in supporting sustainable approach in managing waste.</p> <p>East of Riding of Yorkshire</p> <p>Mainly discussed the importance of internal integration in waste and recycling management (similar to Hull); the problem with long term contracts and the inefficiency of trial approaches on the introduction of new schemes (similar to Hull). Their assessment of sustainability was quite similar to Hull but how they correspond or engage with the households was quite different.</p> <p>Currently, the East Riding had a higher recycling rate (64%) compared to Hull (60%).</p>

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RQ1 and RQ3 were addressed to Householders. To maintain anonymity of the identity of all householders, codes (P1-P12) were used to refer to the individuals with the themes associated from the literature. RQ1: What is the reasoning behind HRB between different municipalities?

When I say “Recycling” what is the first thing that comes to mind? (probe on municipality roles)

- How do you feel while sorting and separating your rubbish for recycling?
- Is it convenient for you to do this on a daily basis?
- What will make it easier?

RQ3: What are the interaction and symbiosis effects and the conditions that support the symbiosis between HRWS and HRB? Show the picture and probe about these changes in themselves and towards the environment.

I'd like to ask you... Before the 3 wheelie bins were introduced in 2009 and looking at your current address, can you recall the time when you felt the need to change, and how the municipality managed your waste?

Do you feel this is a convenient way of recycling? If, yes, why and if no, why not?

Show/talk about the pamphlet. Do you find it important to be able to recycle?

When I say “Sustainability”, what does this term mean to you, your neighbourhood and the environment?

What is it about the environment that you value?

Do you think that you have recycled enough, and, remembering the pamphlet that the municipality gives you each year, is it clear and easy to understand?

Note : 1= yes 2 =no 0= do not know This code shows the concepts were among key words and main topics that were brought up by the participants in the interviews	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12
Sustainability	1	1	1	1	1	1	1	1	1	1	1	1
Collection/Delivery Operator	1	1	1	1	1	1	1	1	1	1	1	1
Household Waste and Recycling Centres (HWRC)	1	2	1	2	2	1	1	1	1	2	1	1
Customer Services Centre	2	1	1	2	1	1	1	1	2	2	1	2
Kerbside-Sort	1	1	1	1	1	1	1	1	1	1	1	1
Co-mingled	1	1	1	1	1	1	1	1	1	1	1	1
Collection Frequency	2	1	2	1	2	1	1	2	2	0	2	2
Bins	1	1	1	1	1	1	1	1	1	1	1	1
Distances	1	1	2	1	1	1	1	1	1	2	1	1
Advertising	1	1	1	1	1	1	1	1	1	1	1	1
Information	1	1	1	2	1	1	2	2	0	0	2	2
Public Engagement	2	1	2	1	2	1	2	2	2	2	1	2
Education	2	1	2	1	2	1	2	2	2	2	2	2
Monetary Rewards	2	2	2	2	2	2	2	2	2	2	2	2
Non-monetary Rewards	1	1	1	1	1	1	1	1	1	1	1	1
Penalty Fee	2	1	1	1	2	1	1	1	1	0	1	1
Knowledge of issues	1	1	1	1	1	1	1	1	1	1	1	1
Awareness of	1	1	1	1	1	1	1	1	1	1	1	1

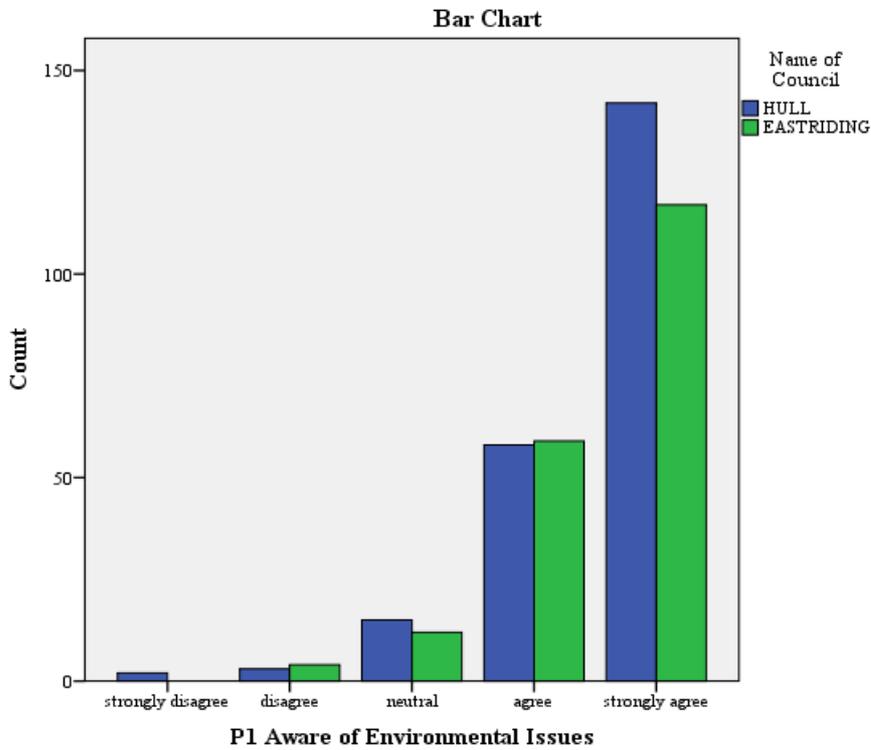
consequences (personal)												
Personal recycling attitudes and norms	1	1	1	1	1	1	1	1	1	1	1	1
Motivating factors	1	1	1	1	1	1	1	1	1	1	1	1
Intentions to act	1	1	1	1	1	1	1	1	1	1	1	1
Knowledge of strategies and action skills	1	1	1	1	1	1	1	1	1	1	1	1
Satisfaction with service provided	1	1	1	1	1	1	1	1	1	1	1	1
Scheme preferences	1	1	1	1	1	1	1	1	1	1	1	1
Recycling participation	1	1	1	1	1	1	1	1	1	1	1	1
Situational factors affect personal factors	2	2	2	2	2	2	2	2	2	2	2	2
Advertising	1	1	1	1	1	1	1	1	1	1	1	1
Information	1	1	1	1	1	1	1	1	1	1	1	1
Public Engagement	1	1	1	1	1	1	1	1	1	1	1	1
Education	1	1	1	1	1	1	1	1	1	1	1	1
Other new factors	1	1	1	1	1	1	1	1	1	1	1	1

Most of the discussions were heavier on the symbiosis factor where most of them strongly agreed on education as the main factor to manifest HRB in those unlikely to recycle. However, the municipality positions/roles in creating the stimuli were equally important. Incentives were mixed between those who declared themselves as environmentalist and those who did not. Increases of tax or fines was an unlikely proposal; however, positive incentives such as voucher systems or tax exemptions were favourable. Some of them agreed that national government should be more aggressive or supportive in order to have a holistic approach. Those who live with their nuclear family do recycling because their parents did it for them; however, for those living as a unit, such as a family or with partners, all members of the family or unit are involved in the recycling activities.

Appendix G

P1 Aware of Environmental Issues * Name of Council Cross tabulation

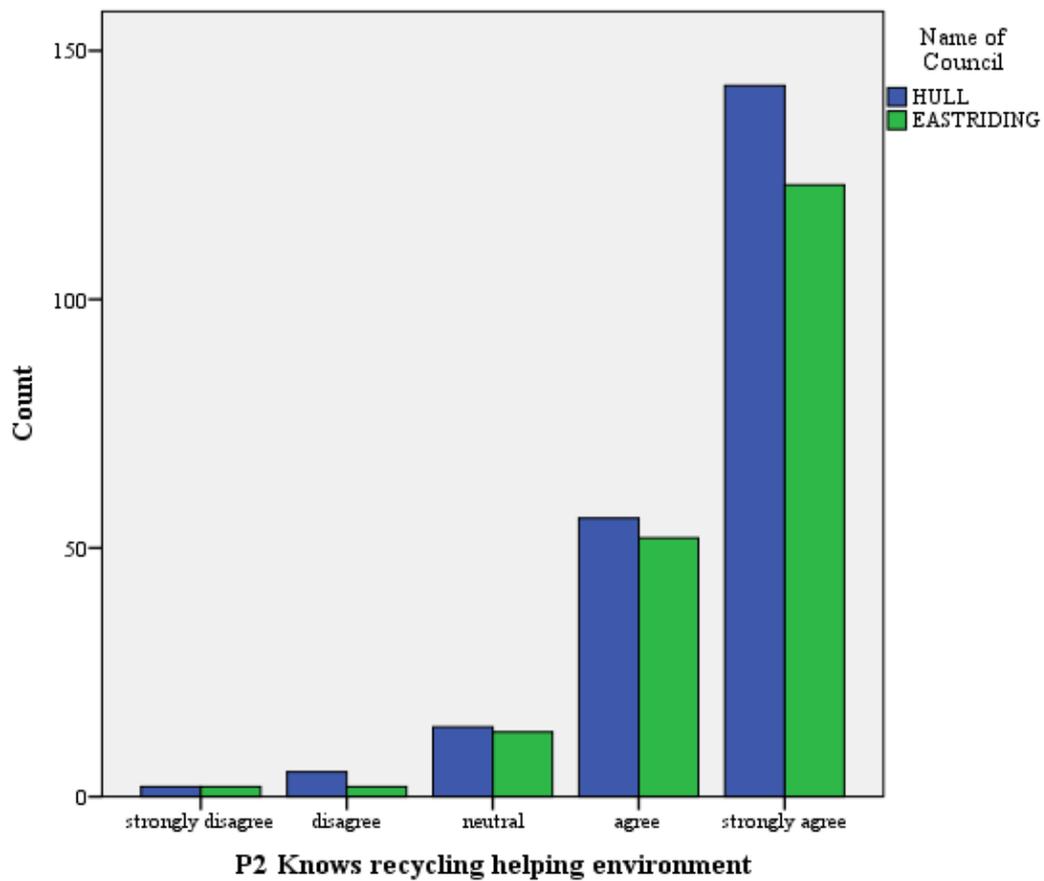
Count		Name of Council		Total
		HULL	EAST RIDING	
P1 Aware of Environmental Issues	strongly disagree	2	0	2
	disagree	3	4	7
	neutral	15	12	27
	agree	58	59	117
	strongly agree	142	117	259
Total		220	192	412



P2 Knows recycling is helping the environment * Name of Council Cross-tabulation

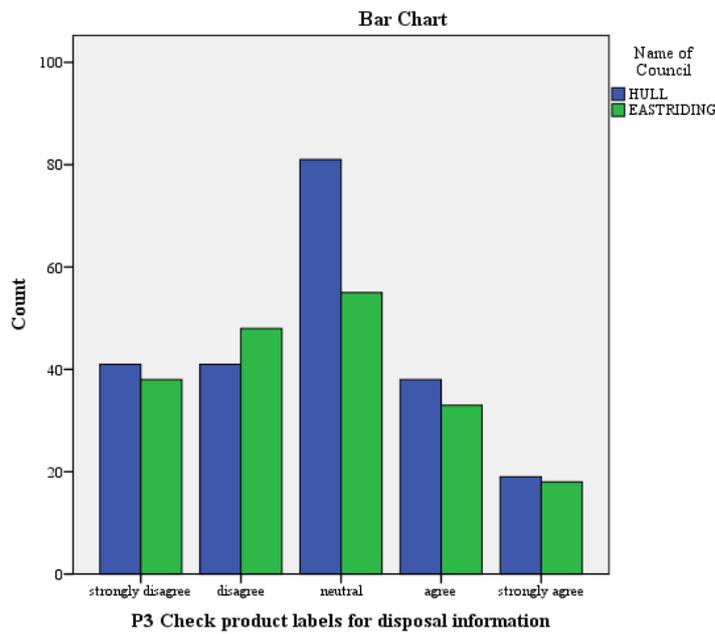
Count		Name of Council		Total
		HULL	EAST RIDING	
P2 Knows recycling is helping environment	strongly disagree	2	2	4
	disagree	5	2	7
	neutral	14	13	27
	agree	56	52	108
	strongly agree	143	123	266

Bar Chart



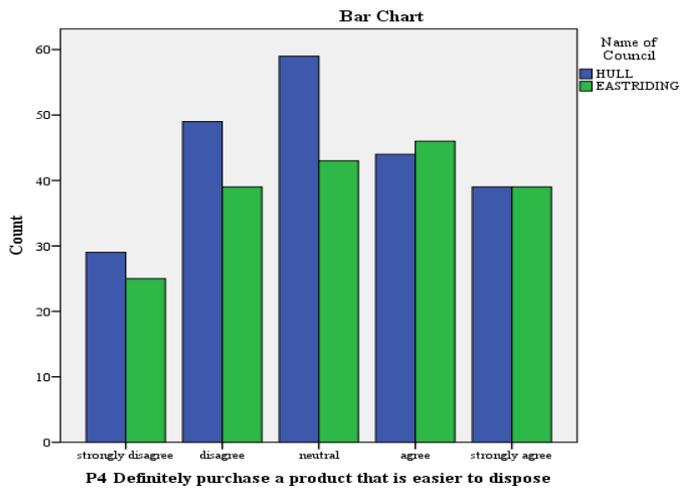
P3 Check product labels for disposal information * Name of Council Cross-tabulation

Count		Name of Council		Total
		HULL	EASTRIDING	
P3 Check product labels for disposal information	strongly disagree	41	38	79
	disagree	41	48	89
	neutral	81	55	136
	agree	38	33	71
	strongly agree	19	18	37
Total		220	192	412



P4 Definitely purchase a product that is easier to dispose * Name of Council Cross-tabulation

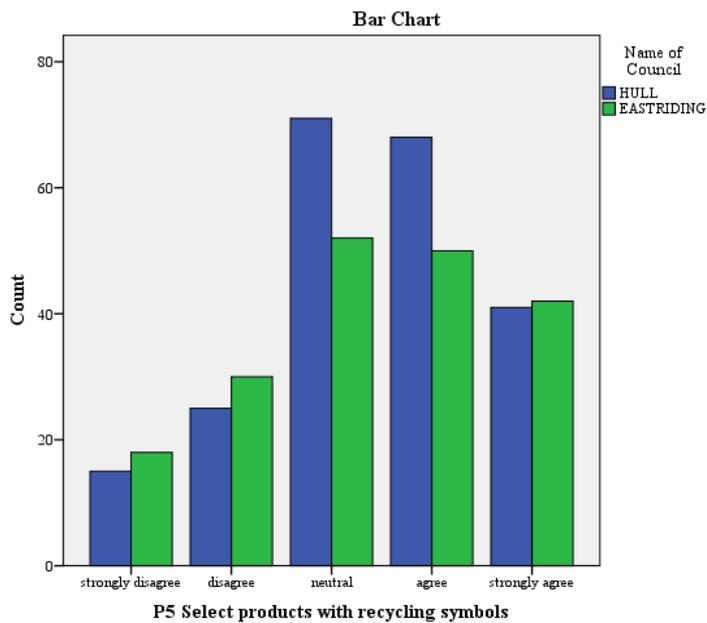
Count		Name of Council		Total
		HULL	EASTRIDING	
P4 Definitely purchase a product that is easier to dispose	strongly disagree	29	25	54
	disagree	49	39	88
	neutral	59	43	102
	agree	44	46	90
	strongly agree	39	39	78
Total		220	192	412



P5 Select products with recycling symbols * Name of Council Cross-tabulation

Count

		Name of Council		Total
		HULL	EASTRIDING	
P5 Select products with recycling symbols	strongly disagree	15	18	33
	disagree	25	30	55
	neutral	71	52	123
	agree	68	50	118
	strongly agree	41	42	83
Total		220	192	412

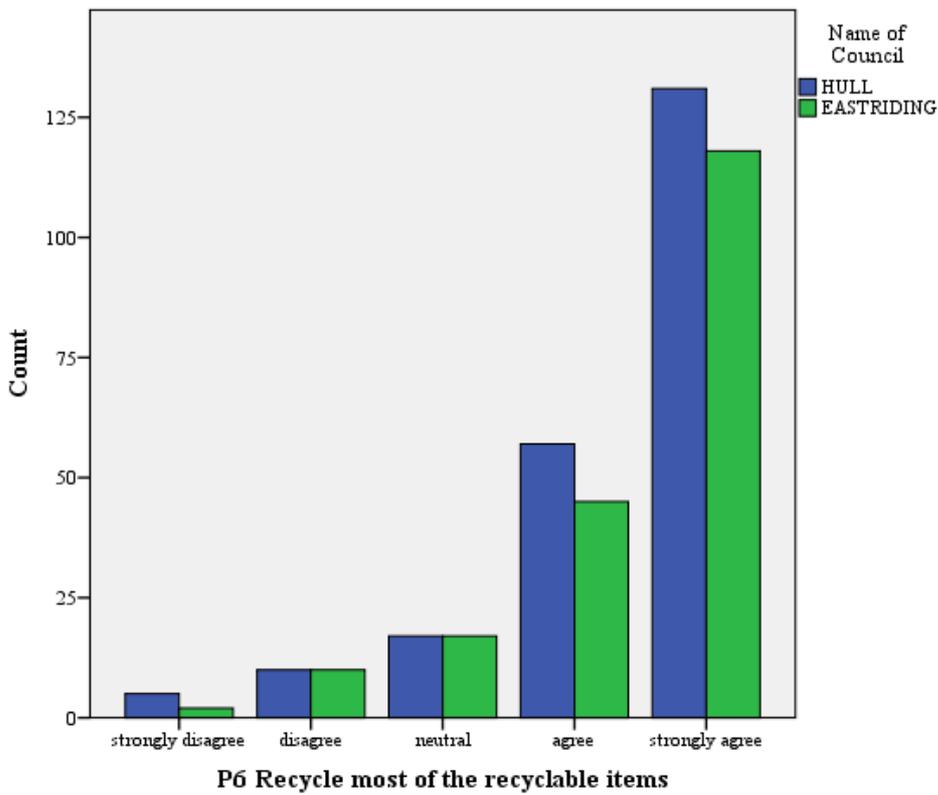


P6 Recycle most of the recyclable items * Name of Council Cross-tabulation

Count

		Name of Council		Total
		HULL	EASTRIDIN G	
P6 Recycle most of the recyclable items	strongly disagree	5	2	7
	disagree	10	10	20
	neutral	17	17	34
	agree	57	45	102
	strongly agree	131	118	249
Total		220	192	412

Bar Chart

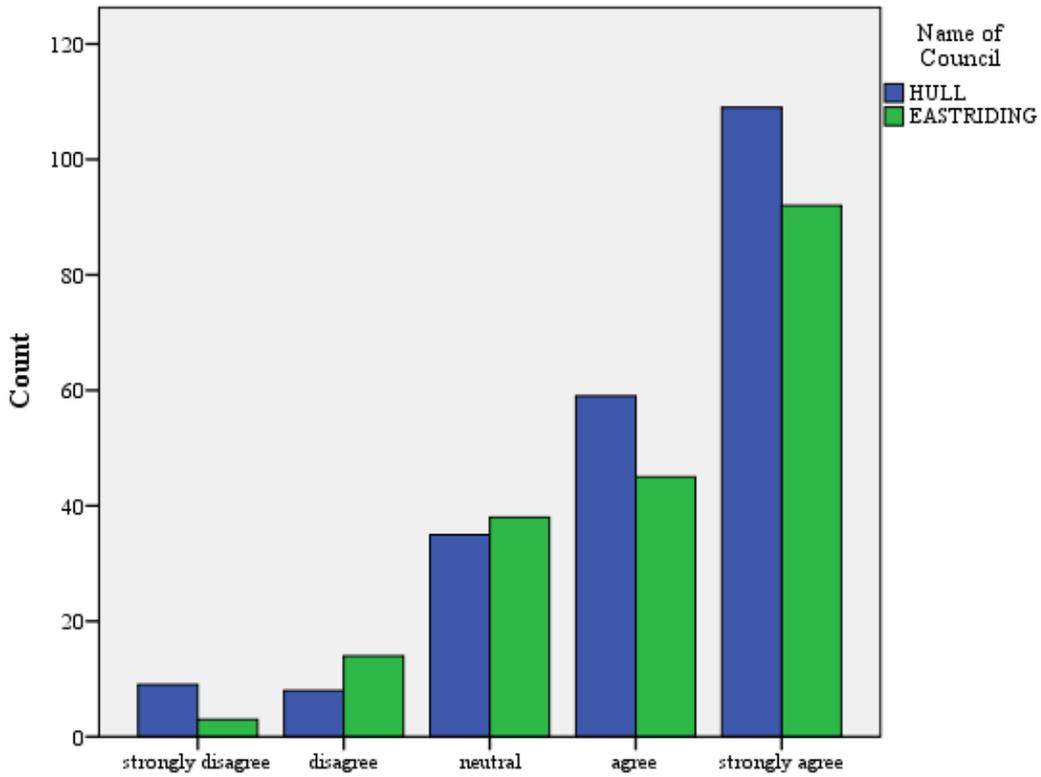


P7 Definitely recycle if received information that recycling has become more important to the environment than previously believed * Name of Council Cross-tabulation

Count

		Name of Council		Total
		HULL	EASTRIDING	
P7 Definitely recycle if received information that recycling has become more important to the environment than previously believed	strongly disagree	9	3	12
	disagree	8	14	22
	neutral	35	38	73
	agree	59	45	104
	strongly agree	109	92	201
Total		220	192	412

Bar Chart



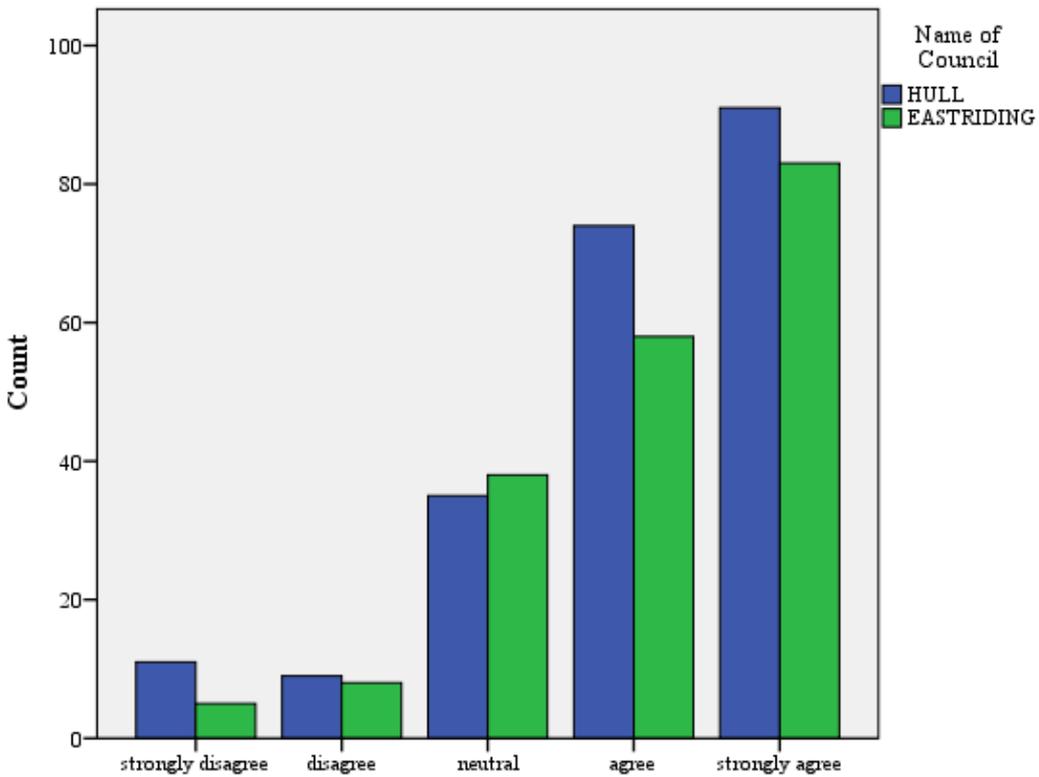
P7 Definitely recycle if received information that recycling has become more important to the environment than previously believed

P8 Still recycle if received information that recycling is less important to the environment than previously believed. * Name of Council Cross-tabulation

Count

		Name of Council		Total
		HULL	EASTRIDING	
P8 Still recycles if received information that recycling is less important to the environment than previously believed.	strongly disagree	11	5	16
	disagree	9	8	17
	neutral	35	38	73
	agree	74	58	132
	strongly agree	91	83	174
Total		220	192	412

Bar Chart



P8 Still recycle if received information that recycling is less important to the environment than previously believed.

The Chi-Square Tests based on Demographic and Personal Factors

Demographic Factor(s)	Recycling Experience (n=412)	
	Pearson Chi-Square (Sig.)	Spearman Correlation (value)
Age	0.000	0.291
Gender	0.998	0.000
Living in current property (years)	0.000	-0.017
Country of Birth	0.000	-0.304
Working Status	0.000	0.255
Type of Residential Area	0.016	0.116
Property Type	0.000	0.088
Number of Household	0.048	-0.003
Councils Area	0.487	-0.034

Personal Factor(s)	Council	
	Pearson Chi-Square (Sig.)	Spearman Correlation (value)
Self-Awareness	0.879	-0.031
Knowledge and experience	0.201	-0.050
Social Norms	0.553	0.009
Self-Efficacy	0.836	0.018
Household Dynamics	0.194	0.039

Appendix H

The tabulation of responses Using Micro-interlocutor Analysis (Onwuegbuzie et al., 2010)

Research Question with Discussion Item (D)	P 1	P 2	P 3	P 4	P 5	P 6	P 7	P 8	P 9	P 10	P 11	P 12	P 13	P 14	P 15	P 16	Average
RESEARCH QUESTION 1 (RQ1)																	
D1. Have you heard the word “sustainability”? If yes, what does sustainability mean to you with regards to waste management? Do you think that sustainability can be achieved? Why or why not?	5	4	4	2	2	4	4	4	4	4	4	4	4	4	5	5	3.9
D2. Have you heard the word “waste-to-energy”? If yes, what does waste-to-energy mean to you with regards to household waste?	4	2	2	2	2	2	2	4	4	4	2	2	2	5	5	5	2.9
RESEARCH QUESTION 2 (RQ2)																	
D1. Do you think that householders’ knowledge of recycling influences their HRB? How?	5	5	4	4	4	5	5	4	4	5	5	4	4	5	5	5	4.5
D2. Who would you say is more likely to be effective recyclers, those are situated in affluent area or less affluent areas? Why?	4	4	4	1	4	4	4	4	1	4	4	1	1	5	4	4	3.3
D3. Do you think knowledge is gained through family norms?	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5.0
D5. Do you think that “where you are from” influences your HRB? Why? Have you heard the word “transient” population? <i>Transient is temporary residents such as university students.</i> Do you think that those who are considered transient are more likely to be oblivious (ignorant) of the HRB norm?	4	2	2	4	2	2	2	4	2	2	4	2	2	5	5	5	2.9
D6. Do you think that the	5	4	4	4	5	5	4	4	4	4	4	5	4	4	5	5	4.4

working environment somehow influence HRB? Why? What factors from the working environment trigger HRB?																	
Do you think that this study environment somehow influences HRB? Why? What factors from this study environment trigger HRB?																	
D7. Do you think marital status/cohabitation has influence on HRB? How? Why? Do you think your family members or housemates have influenced your HRB? How? Why?	5	3	3	4	5	5	3	3	3	4	5	3	4	5	5	4.0	
D8. Do you think that convenience influences your HRB? How?	5	4	4	5	5	5	4	4	4	5	5	5	4	3	3	4.3	
D9. What would you say are more likely to be convenient, the services or facilities (show pictures on various bin types)?	5	4	4	4	5	5	4	4	4	4	5	5	4	5	5	4.5	
D10. If the services or facilities are not convenient, what would you do? Why?	5	4	4	4	5	5	4	4	4	4	5	5	4	4	4	4.3	
D11. Do you think that accessibility and availability influences householders? How?	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5.0	
D12. How does HRWS accessibility and availability effect households? How are the householders affected by these factors? Why?	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5.0	
RESEARCH QUESTION 3 (RQ3)																	
D1. Engagement from municipalities has been found as an important factor in motivating householders to recycle. For this question, what is your thought on behalf of the municipality? What activities describe engagement by municipalities? Who do you think this	5	4	4	4	4	4	5	5	5	4	4	4	4	5	5	4.4	

engagement will benefit most? Why?																	
D2. Have you heard the word “symbiosis”? If yes, what does symbiosis mean to you with regards to waste management? Symbiosis is <i>mutual interdependency between two or more factors</i> .	4	2	2	2	4	2	4	2	2	2	2	2	2	4	4	2.7	
D3. Do you think in order for the symbiosis effect to take place, and for an effective HRB it means that municipalities HRWS and householders are mutually benefitting each other? Why?	5	4	4	4	5	4	5	4	4	4	4	4	4	4	5	4.3	
D4. Do you think in order for HRB to progress effectively, certain situational factors must be available first which will motivate a person to recycle? Why or why not?	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5.0	
D5. Do you think pamphlets given by the municipalities are the main reference for householders? Why or why not?	5	5	4	4	4	5	5	5	4	4	4	4	4	5	5	4.3	
D6. Where do you get other recycling information? Why or why not? Why do you go there? <i>Probe to find out what participants think of the municipality recycling programmes.</i>	1	4	3	3	1	3	1	3	4	3	3	4	4	5	5	3.1	
D7. What kinds of recycling information would be most helpful to you? Probe for communication tools flyers, TV programmes, etc. Do you think education (tertiary as well as primary and high school) is the platform to convey recycling awareness? Why or why not?	1	4	4	4	4	5	4	4	5	4	4	4	4	1	1	3.5	
Overall Average																4.1	
Code																	
SE = provided significant statement or example suggesting agreement																5	
A = indicated agreement (i.e. verbal or non-verbal)																4	

NR = did not indicate agreement or disagreement (i.e. no response)	3
D = indicated disagreement (i.e. verbal or non-verbal)	2
SD = provided significant statement or example suggesting disagreement	1

Appendix I

Target 45+

Target **45+**

Hull and East Riding's solution to sustainable waste management

Joint Sustainable Waste Management Strategy

Review 2012



1. Background
 - 1.1 Waste Prevention and Reuse
 - 1.2 Recycling and Composting
 - 1.3 Other Recovery and Disposal
2. Current Position
 - 2.1 Current Waste Services
 - 2.2 Joint Waste Management Contract
 - 2.3 Waste Composition
 - 2.4 Waste Arising
 - 2.5 The Change in Waste Arisings
 - 2.6 Trends and Reporting
 - 2.7 Recycling and Composting
 - 2.8 Waste Reduction
3. Key Strategy Drivers
 - 3.1 Environmental Protection Act 1990
 - 3.2 EU Landfill Directive 1999
 - 3.3 National Waste Strategy
 - 3.4 Waste Framework Directive
 - 3.5 National Waste Policy Review for England 2011
 - 3.6 Landfill Tax and the Landfill Allowance Trading Scheme (LATS)
 - 3.7 Regional and Planning Context
4. Why do we need to review the Joint Sustainable Waste Management Strategy?
 - 4.1 Sustainability Appraisal
5. Proposed Aims, Targets and Actions of the Joint Sustainable Waste Management Strategy 2012
 - 5.1 Aim 1 - Deal with municipal waste in the most sustainable way by moving waste management practice up the waste hierarchy
 - 5.2 Aim 2 - Raise public awareness and responsibility for waste
 - 5.3 Aim 3 - Provide a network of local recycling facilities for residents and ensure that waste is processed through treatment facilities in accordance with relevant legislation and where appropriate with due recognition of the local planning process
 - 5.4 Aim 4 - Divert biodegradable waste from landfill
 - 5.5 Aim 5 - Provide leadership in dealing with the Councils' own internal waste
 - 5.6 Aim 6 - Provide a sustainable waste management service for households and businesses which achieves value for money and high levels of customer satisfaction which aims to achieve top 10% performance
 - 5.7 Aim 7 - Work with local and regional stakeholders to ensure delivery of the Councils' strategic objectives
 - 5.8 Aim 8 - To reduce the climate change impact of the Councils' waste services
6. Monitoring and Review

Appendices

Appendix 1	Waste Composition Analysis
Appendix 2	Sustainability Appraisal Objectives and Key Questions
Appendix 3	Sustainability Report
Appendix 4	Waste Collection Commitment
Appendix 5	Business Recycling Waste Services Commitment
Appendix 6	East Riding of Yorkshire Council Strategy Action Plan
Appendix 7	Hull City Council Strategy Action Plan

Glossary.

Abbreviations

BPEO	Best Practicable Environmental Option
BVPI	Best Value Performance Indicator
CIWM	Chartered Institution of Wastes Management
DEFRA	Department for Environment, Food and Rural Affairs
DPD	Development Plan Document
EfW	Energy from Waste
EMAS	Eco-Management and Audit Scheme
EPA	Environmental Protection Act
EU	European Union
HWRS	Household Waste Recycling Site
LARAC	Local Authority Recycling Advisory Committee
LATS	Landfill Allowance Trading Scheme
LGA	Local Government Association
MRF	Materials Recycling Facility
MSW	Municipal Solid Waste
NAWDO	National Association of Waste Disposal Officers
NI	National Indicator
PFI	Private Finance Initiative
RDF	Refuse Derived Fuel
RSS	Regional Spatial Strategy
SA	Sustainability Appraisal
SEA	Strategic Environmental Assessment
WEEE	Waste Electronic and Electrical Equipment
WET Act	Waste and Emissions Trading Act (2003)
WRAG	Waste and Recycling Advisory Group
WRG	Waste Recycling Group

1. Background

Target 45+ is the Joint Sustainable Waste Management Strategy (the Strategy) developed in partnership by Kingston upon Hull City Council and the East Riding of Yorkshire Council (the Councils). The document sets out how the Councils plan to manage Municipal Solid Waste (MSW) produced in the area. MSW includes waste from households, waste collected from businesses and other waste produced as a result of delivering environmental services such as street sweeping and gully cleaning.

The Strategy was jointly adopted by both Councils in 2006 and at that time clearly set out the strategic aims and targets for waste collection, recycling and disposal over a 15 year period from 2006-2020. The strategic aims of the strategy adopted in 2006 were as follows:

- Deal with waste in the most sustainable way by moving waste management practice up the waste hierarchy
- Raise public awareness and responsibility for waste
- Ensure the area is well served by an integrated network of waste management facilities
- Divert biodegradable waste from landfill
- Provide leadership in dealing with the Councils' own internal waste
- Provide a quality sustainable waste management service which achieves value for money
- Provide services which achieve top 10% performance in regional and national targets
- Work through the individual Councils' Local Strategic Partnerships to ensure engagement with partners, communities and ensure Target 45+ contributes to Sustainable Communities across Hull and the East Riding

Since adopting the Strategy in 2006, both Councils have made significant progress in delivering these aims. The purpose of this planned 5-yearly strategy review is to outline the progress made by the Councils, set out the current position and explain the proposed updated strategic aims and targets in the Strategy.

This Strategy has been developed using the principles of the waste hierarchy as set out in the National Waste Strategy for England 2007 shown at Figure 1 below:

Figure 1 - The Waste Hierarchy



The waste hierarchy prioritises prevention followed by reuse, recycling and composting. The recovery of energy is the next preference followed by disposal as the last resort. The aim is to prevent waste from being produced in the first place and where waste is produced, treat it as a resource to maximise its potential value.

1.1 Waste Prevention and Reuse

Since 2006 the amount of waste produced across Hull and the East Riding has decreased from 355,270 tonnes in 2006/07 to 331,893 in 2010/11, representing a reduction of 6%. The main reason for this decline has been the impact of the global recession on consumer habits. In addition work by the retail sector to minimise packaging and a move from paper to electronic media nationally have also contributed to the decrease in recent years.

There have been a range of local initiatives undertaken by the Councils to promote waste prevention and re-use. These include the promotion of the mail preferencing service to reduce junk mail, promotion of the national 'love food hate waste' campaign, development of web-based information for residents and businesses and provision of over 70,000 home compost bins to residents across the area.

As a consequence of the global recession and local promotions, the Strategy target to reduce waste growth to 0% by 2012 has been achieved. The level of public awareness of recycling and waste related issues and their local profile have also risen considerably as a result of the Councils' extensive communication and awareness raising campaigns. This has influenced a change in behaviour with residents now actively segregating waste and recyclables at the kerbside and thinking about waste prevention when purchasing goods. The success achieved to date will be built on in future years.

1.2 Recycling and Composting

The Councils have significantly increased recycling and composting performance and reduced the amount of waste sent to landfill over the last five years. Both Councils have invested millions of pounds in the development of new kerbside recycling collection strategies following a range of trials and extensive public consultation. The new blue and brown bin collection services make it easy for residents to recycle an expanded range of recyclables, garden and food waste. Public satisfaction levels with the new services are now extremely high, delivering significantly improved resident participation rates in all schemes. Both Councils have now achieved the National Waste Strategy for England 2007 target of recycling and composting 40% by 2010 as a result.

In addition, the Councils continue to extend the range of recyclables collected through the network of Household Waste Recycling Sites (HWRSs). Over twenty different commodities can now be recycled. With improved segregation, approximately 80% of all waste is now being recycled across all sites. All waste that can not be sorted at the HWRSs is now being sent for mechanical sorting to further increase our recycling rate.

The Councils currently provide commercial waste collections to over 4700 businesses across the area. Following the introduction of the household recycling collection services, the Councils are now offering recycling services to businesses. Over 750 businesses are now benefiting from recycling collections. Recycling services are also being delivered internally within Council offices and at schools, which is also helping to reduce the amount of waste sent to landfill.

To further enhance recycling performance the Councils are continuing to identify innovative ways to recycle more. Mechanical street sweepings and gully waste are now being mechanically sorted and bulky items segregated to maximise diversion from landfill.

1.3 Energy Recovery and Disposal

Despite a reduction in the overall amount of waste produced and huge improvements made through recycling and composting, over 50% of waste is still disposed of in landfill. A key element of the original Strategy was to develop an Energy from Waste (EfW) facility to manage the waste left over after recycling and composting. Although planning permission for an EfW facility at Saltend was received, the facility has not been developed under the current Joint Waste Contract with Waste Recycling Group (WRG).

The Councils have now agreed with WRG to terminate the current Contract in March 2013, although there is provision to extend for a further two years.

Although an EfW facility has not been developed, several key facilities have been established that have played a key part in improving waste management services.

A new waste transfer station has been developed at Carnaby to receive the recycling and composting waste streams that are now being collected. Two new HWRSs have been constructed at Wiltshire Road and Sutton Fields in Hull and ongoing improvements are being made at the HWRSs in the East Riding with planned improvements in place for Humberfield and Driffield.

Contracts secured to handle the extended range of materials now collected in the blue and brown bin schemes are operating effectively.

The Councils plan to commence the procurement process for new waste contracts in 2012. This is to ensure that facilities are provided to process the various waste streams and that alternative treatment facilities are in place to reduce reliance on landfill.

2. Current Position

A summary of the current waste management services provided across both Council areas is set out in Table 1 below:

2.1 Current Waste Services

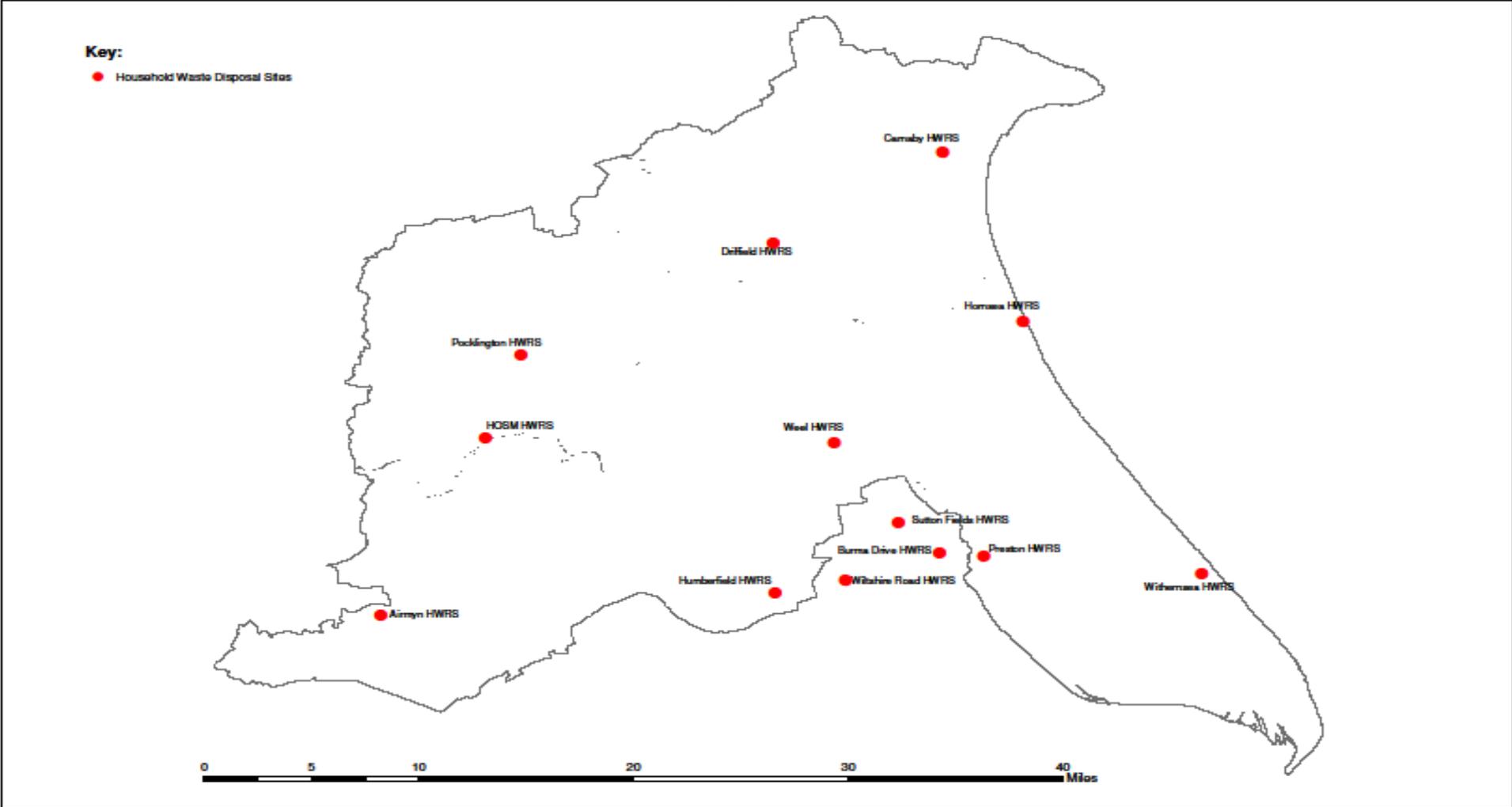
Table 1 - Services provided by the Councils

Service Type	Hull City Council	East Riding of Yorkshire Council
Household Waste	Weekly waste collection via a 240 litre wheeled bin	Weekly waste collection via 180 litre wheeled bins to approximately 110,000 households Weekly waste collection via 240 litre wheeled bins to approximately 35,000 households
Kerbside Dry Recycling	Fortnightly 240 litre blue bin for collection of paper, cardboard, books, cans, aerosols, foil, plastic bottles, plastic food and yoghurt pots, carrier bags, tetrapak, glass bottles and jars	Four weekly collection of 240 litre blue bin (with the option of a 140l bin if required) for paper, books, cans, aerosols, foil, plastic bottles, plastic food and yoghurt pots, carrier bags, tetrapak, glass bottles and jars
Kerbside Organic Recycling	240 litre brown bin for garden and cooked and uncooked food waste (Approximately 95,000 households) 23 litre outdoor caddy for cooked and uncooked food waste (Approximately 15,000 households)	Fortnightly collection of 240 litre brown bin for commingled garden, food waste and cardboard
Bulky Items	One free collection of 5 items per household per calendar year. £15 for up to 5 items thereafter. Certain items such as DIY waste are chargeable from the outset	Household waste: up to 5 items for £26 Commercial waste: £70.41 per hour, minimum charge of one hour
Bring Sites	20 Bring Sites for the collection of paper, cardboard, glass bottles and jars, plastics and cans	140 Bring Sites for the collection of paper, glass bottles and jars, plastics and cans
Household Waste Recycling Sites (HWRS)	3 HWRSs at: Burma Drive Amsterdam Road Wiltshire Road	10 HWRSs at: Humberfield, Hessle Weel, Beverley Preston Withernsea Hornsea Driffield Carnaby Pocklington Holme Upon Spalding Moor Airmyn

Service Type	Hull City Council	East Riding of Yorkshire Council
Household Waste Recycling Sites (cont.)	Materials accepted at the sites include: <ul style="list-style-type: none"> • Aerosols • Aluminium Foil • Asbestos • Books • Cans • Car and Household Batteries • CDs and DVDs • Chemicals • Cooking Oil • Garden Waste • General Waste • Glass • Mobile Phones • Oil • Paper • Plasterboard • Plastic Bottles • Printer Cartridges • Scrap Metal • Soil and Rubble • Spectacles • Textiles • Tyres • WEEE (Waste Electronic and Electrical Equipment) • WEEE (a) Large Domestic Appliances • WEEE (b) Fridges & Freezers • WEEE (c) Televisions • WEEE (d) Fluorescent Tubes • WEEE (e) Small Domestic Appliances • Wood 	
Commercial Waste	A chargeable commercial waste collection service is provided for: <ul style="list-style-type: none"> • General Waste • Paper • Glass • Mixed Dry Recycling 	A chargeable commercial waste collection service is provided for: <ul style="list-style-type: none"> • General Waste • Mixed Dry Recyclables
Clinical Waste	Free collection to residents; chargeable collection to commercial customers	

Detailed overleaf is a map showing the location of the Household Waste Recycling Sites within the Councils' areas.

Household Waste Recycling Sites East Riding & Hull



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East Riding of Yorkshire Council 10/000000
A. August 2011

The Councils collect and manage a wide variety of waste streams through the services provided. Whilst the HWRs and Bring Sites are provided for residents to use, the Councils need to ensure that a strategic network of Waste Transfer Stations is also provided to receive delivery of waste from all other collection and cleansing services. These different waste streams must then be transported either to end market for recycling or composting, processed through further waste treatment facilities or delivered to a final disposal point.

Management of the HWRs, provision of Waste Transfer Stations, waste processing and disposal facilities are provided through a Joint Waste Management Contract delivered by an external contractor, Waste Recycling Group (WRG).

2.2 Joint Waste Management Contract

The Councils signed a Contract with WRG in 1999 to manage the Councils' waste for a 25 year period. As part of the contract WRG were required to provide a mix of waste management facilities including the development of an Energy from Waste (EfW) facility, to help divert waste away from landfill.

WRG secured planning permission for the development of an EfW facility in December 2006 and January 2007 from Hull City Council and East Riding of Yorkshire Council respectively. A series of contractual negotiations took place between 2007 and 2010 with regard to the funding and delivery of the waste infrastructure. Although various funding options were considered the funding mechanism could not be agreed.

Following discussions between WRG and the Councils it was agreed that the current Contract be terminated on 31 March 2013 with the option to extend by up to two years. The Councils and WRG will continue to work effectively together to deliver the Contract's requirements until the contract end date.

The procurement of new waste management contracts required to deliver value for money, sustainable waste management solutions for Hull and East Riding is planned to commence in 2012.

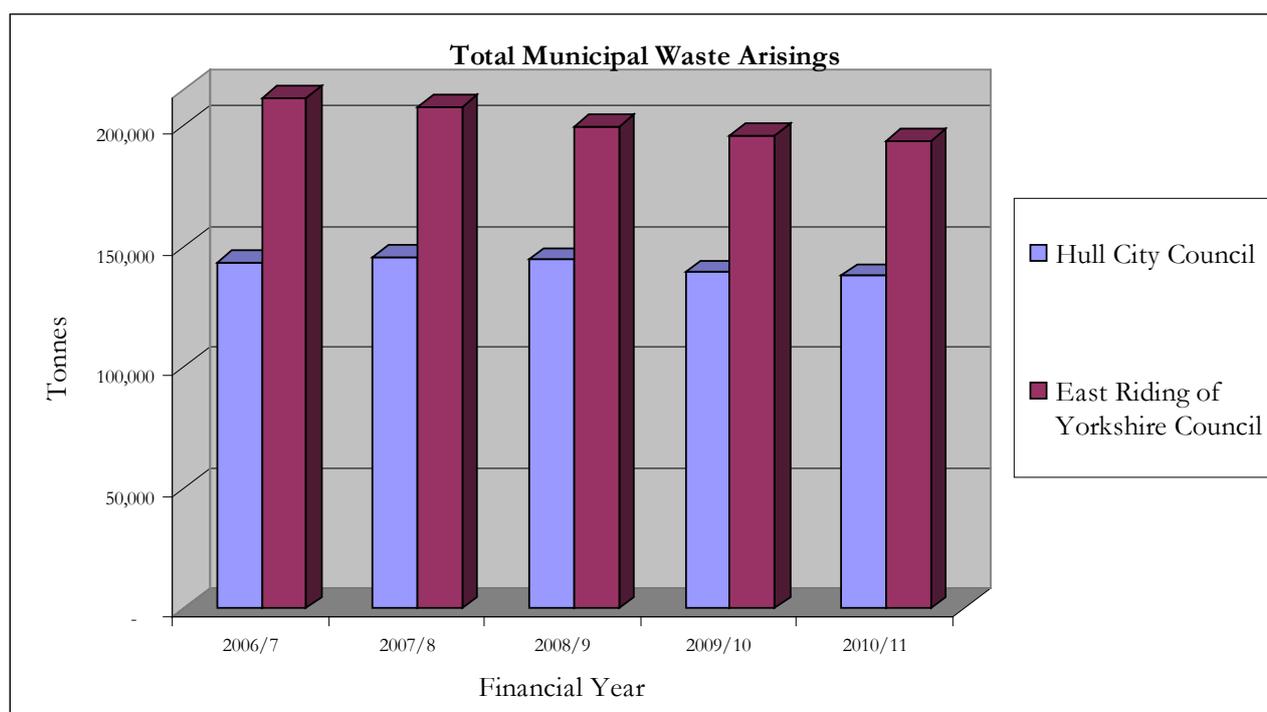
2.3 Waste Composition

Since 2006 both Councils have undertaken a number of waste composition analyses in order to understand the nature of the waste being collected and how residents use the kerbside collection services. These analyses have helped the Councils develop new recycling and composting collection services and ensure that they are fit for purpose. The waste composition data collected has helped the Councils to understand where there is the potential to recycle more material. The details of waste composition for both Councils are shown at Appendix 1.

2.4 Waste Arising

Household and commercial waste combined with waste collected through delivery of other Council services is referred to as Municipal Solid Waste (MSW). The overall waste tonnages collected in the East Riding of Yorkshire Council area are higher due to there being more households and an increased population level in this area. The amount of MSW collected by the Councils between 2006/07 and 2010/11 is summarised in Figure 2 below:

Figure 2 – MSW collected by the Councils between 2006/07 and 2010/11



2.5 The Change in Waste Arisings

When the original Strategy was adopted, both Councils outlined strategic targets in the action plan to reduce waste growth. Table 2 below provides a summary of the change in MSW collected between 2006/07 and 2010/11. The figures illustrate a downward trend in MSW generated overall. The reduction is a result of a number of factors, notably the effect of the recession on the economy and a drive by central government to reduce packaging coupled with an increased public awareness of the need to reduce the amount of waste produced since the introduction of the Strategy in 2006.

Table 2 - Change in MSW collected

Change in Total Municipal Waste Arisings from 2006/7 to 2010/11						
Year	Hull City Council		East Riding of Yorkshire Council		Combined	
	Tonnes	% Change	Tonnes	% Change	Tonnes	% Change
2006/7	143,600	-1.76%	211,670	2.70%	355,270	0.85%
2007/8	145,689	1.45%	207,932	-1.77%	353,621	-0.46%
2008/9	144,419	-0.87%	199,846	-3.89%	344,264	-2.65%
2009/10	139,388	-3.48%	196,006	-1.92%	335,394	-2.58%
2010/11	137,876	-1.08%	194,016	-1.01%	331,893	-1.04%
Overall Change	-5,724	-3.99%	-17,654	-8.34%	-23,378	-6.58%

Source: WasteDataFlow Submissions for 2006/7 to 2010/11

Table 2 above illustrates the overall reduction in MSW collected for each Council. In Hull, the amount of MSW has reduced by 3.99%. In the East Riding the amount of MSW has reduced by 8.34%. Overall, total MSW collected has reduced by 6.58%.

Figures 3 and 4 below illustrate the amount of waste collected through the different services provided by the Councils.

Figure 3 – MSW collected by Hull City Council

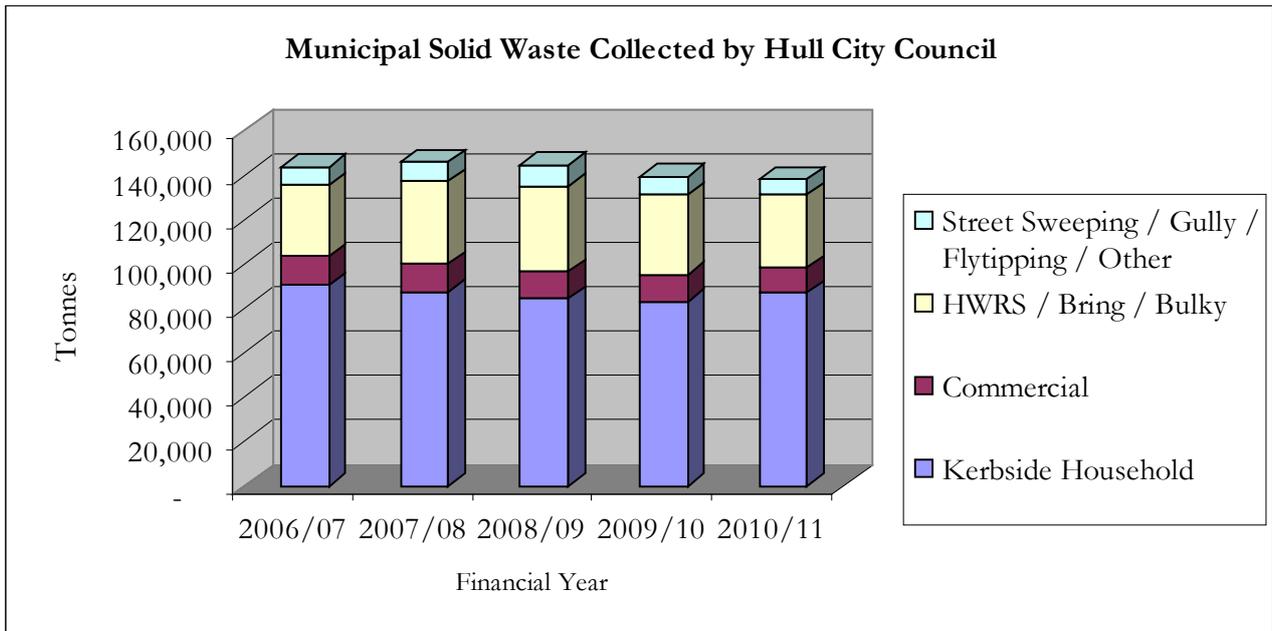
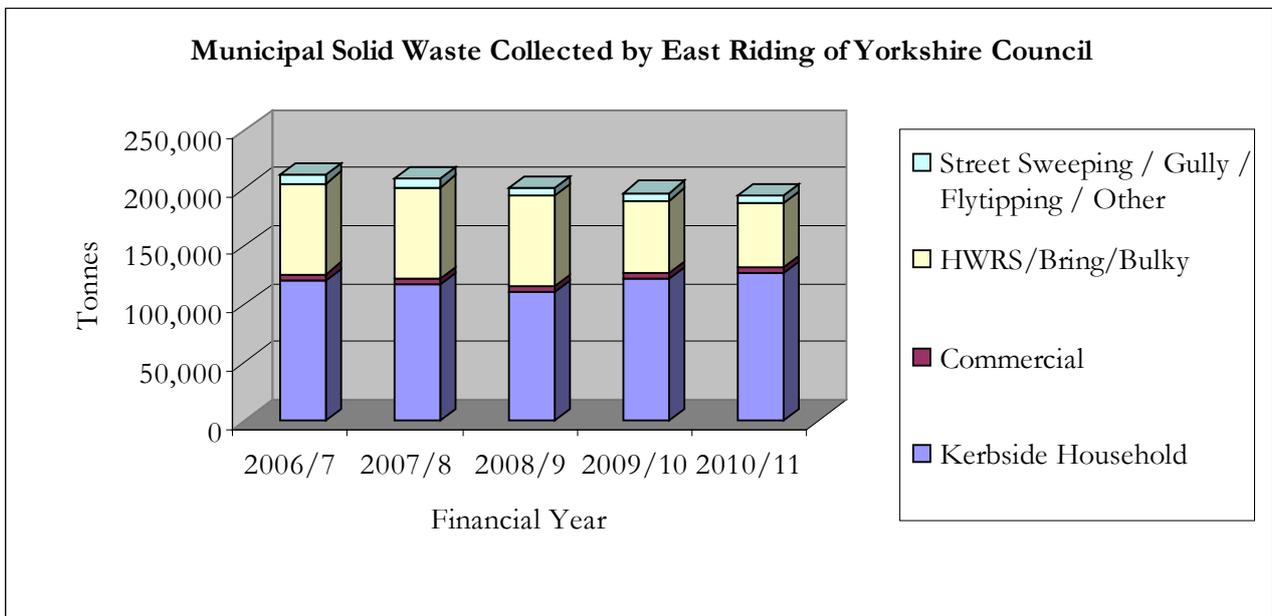


Figure 4 – MSW collected by East Riding of Yorkshire Council



Figures 3 and 4 illustrate that the majority of waste is collected through the household kerbside collection service across both Council areas. The HWRSSs, Bring Sites and bulky item services provide the second largest waste stream, representing approximately 25% of MSW collected in Hull and nearly 30% of MSW in the East Riding. The amount of waste from street cleansing, fly-tipping, gully cleansing and commercial waste services is significant but represents a relatively small percentage of total MSW.

2.6 Trends and Reporting

There are regular peaks and troughs in waste arisings reflecting the impact of the economy as well as local factors such as weather, tourism and population change.

Although there has been a reduction in the amount of waste generated over a period of years, both Councils are alert to the threat of increasing costs of waste management posed by an upward turn in waste growth linked to the recovery of the economy when this arrives. To this end, the Strategy will seek to identify actions to continue to mitigate waste growth and to focus on achieving challenging recycling and composting targets and diversion of waste from landfill.

The original Strategy recycling target of 45% was reported in line with nationally set Best Value Performance Indicator (BVPI) reporting guidelines. After the introduction of the Strategy, reporting requirements for Councils were changed to a range of National Indicators (NI).

These were:

- NI191 (Kg of residual waste per household)
- NI192 (Percentage of household waste sent for reuse, recycling or composting)
- NI193 (Percentage of municipal waste landfilled)

Since 2006/07 the Councils have submitted waste tonnage information through the central Government online reporting system, Wastedataflow. Wastedataflow summarises the Councils' performance against National Indicators on a quarterly basis. Within the Government Review of Waste Policy in England 2011, the requirement of local authorities to report the waste indicators NI 191, 192 and 193 ended in March 2011. However, Councils are still required to report waste data through Wastedataflow to inform the national picture.

Both Councils consider it to be important and good practice to monitor their performance and will continue to do so against these National Indicators.

2.7 Recycling and Composting

Major progress has been made by both Councils in improving recycling and composting performance since the adoption of the Strategy in 2006. There has been multi-million pound investment in the recycling and composting collection infrastructure, leading to improvements in performance.

Figure 5 illustrates the recycling and composting performance of the Councils between 2004/5 and 2010/11. It highlights the Councils' NI 192 performance; the percentage of household waste sent for reuse, recycling and composting against local and national targets.

Figure 5 - Percentage of household waste recycled and composted from Hull and East Riding 2006/7 to 2010/11

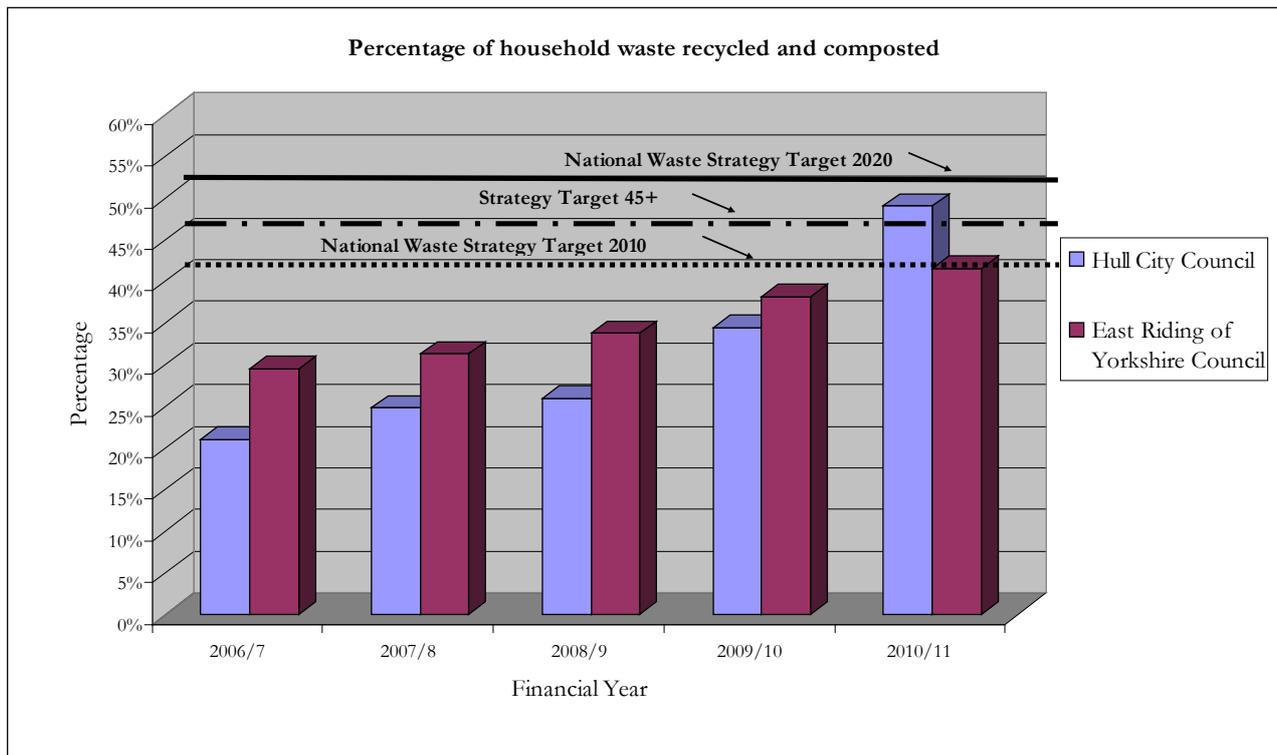


Figure 5 above shows the steady increase in percentage of household waste recycled and composted. Hull City Council made a considerable increase in the amount of household waste recycled and composted between 2009/10 and 2010/11 due to the improvements made to the kerbside recycling and composting collections. Table 3 below provides a breakdown of both the tonnages and percentages of waste recycled and composted for both Councils.

Table 3 - Household waste recycled and composted 2006/7 to 2010/11

Percentage of household waste recycled and composted from Hull and East Riding				
	Hull City Council		East Riding of Yorkshire Council	
	% Recycled	Tonnes	% Recycled	Tonnes
2006/7	21.02%	25,389	29.59%	55,765
2007/8	24.81%	30,293	31.32%	58,058
2008/9	25.93%	31,157	33.80%	60,499
2009/10	34.43%	39,572	38.20%	66,735
2010/11	49.06%	56,231	41.60%	72,306

Source: Waste Data Flow Submissions for 2006/7 to 2010/11

The projected performance for the Councils by March 2012 is:

- East Riding of Yorkshire Council 53%
- Hull City Council 50%

Figures 6 and 7 below illustrate the relative contribution of different services to the overall amount of waste recycled and composted.

Figure 6 - Composition of household recycling and composting in Hull

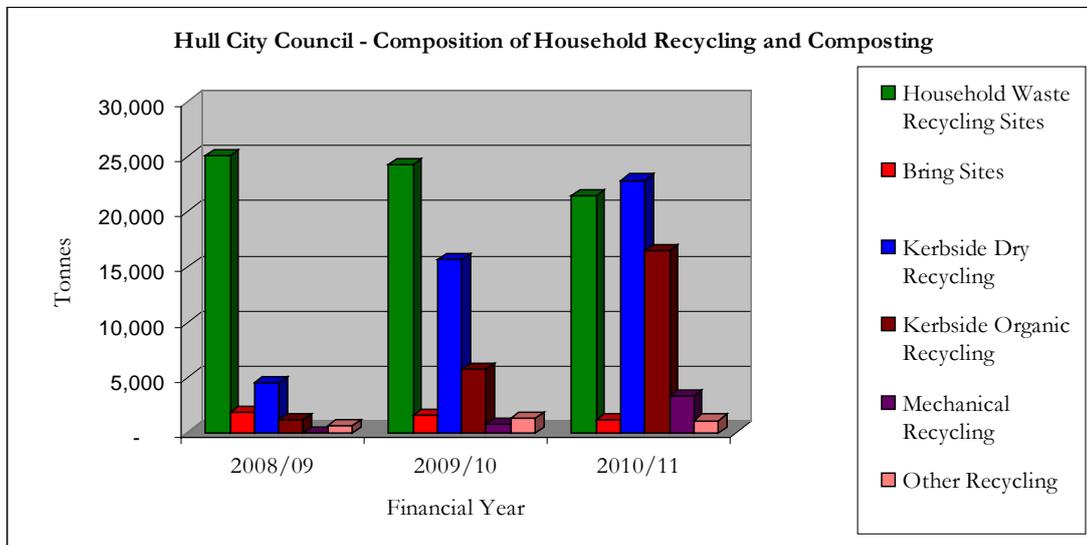
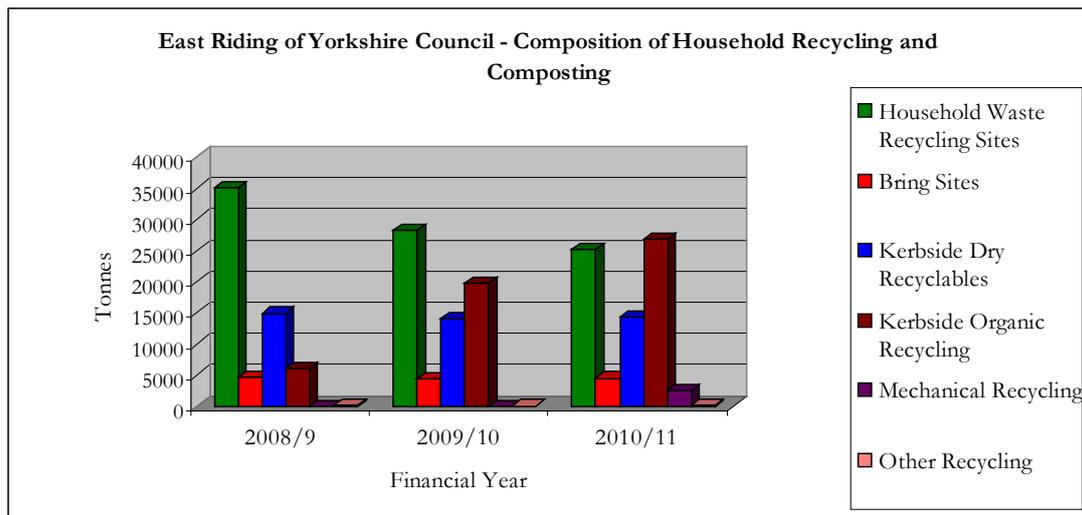


Figure 7 - Composition of household recycling and composting in the East Riding



These graphs demonstrate the significant increase in materials collected at the kerbside following the introduction of the new blue and brown bin collection services for recyclables and organic waste. The graphs also illustrate the decline in the amount of waste collected at the HWRSSs. While this decline is in line with the overall reduction in MSW, the amount of garden waste has significantly reduced following introduction of the new kerbside collection services.

The graphs also highlight the introduction of new schemes for the recycling of mechanical street sweepings and gully waste from 2010.

2.8 Waste Reduction

One of the key aims of the Councils' Strategy is to reduce the amount of waste produced and increase the amount recycled and composted. The waste left over after recycling is referred to as 'residual waste'. The amount of residual waste per household is a good indicator of overall progress. Figures 8 and 9 illustrate the reduction in residual waste per household between 2006/7 and 2010/11.

Figure 8 - Residual waste per household produced in Hull

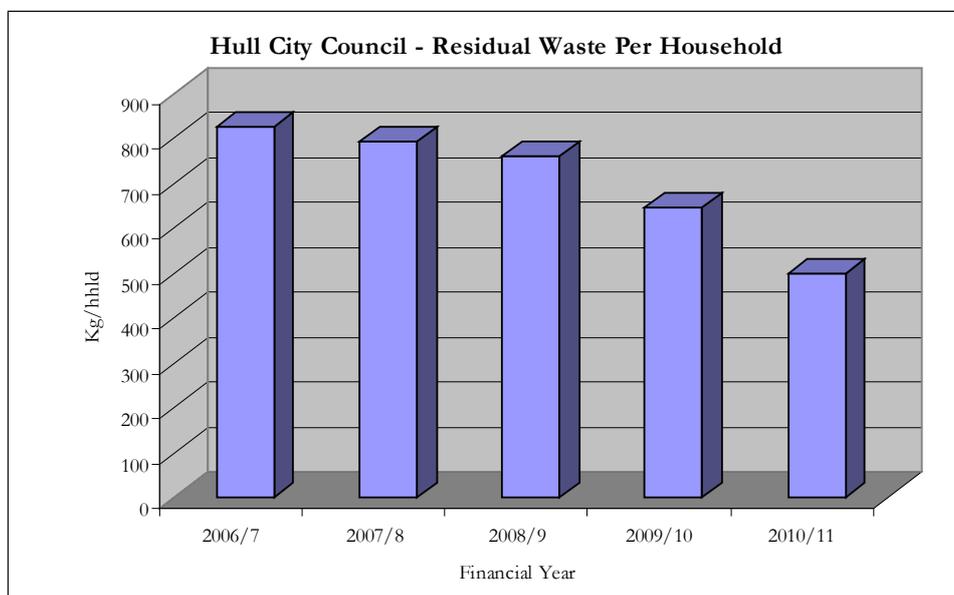
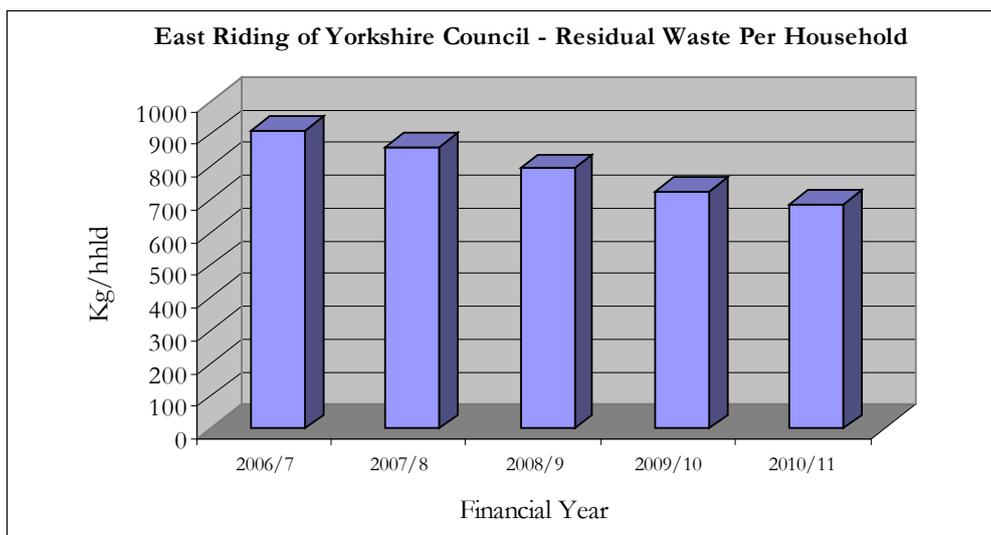


Figure 9 - Residual waste per household produced in the East Riding



Figures 8 and 9 above show that the Councils' improvements in waste recycling and composting have led to a significant improvement in the amount of residual waste produced per household across both areas.

3. Key Strategy Drivers

Over the last 20 years, legislation governing the management of waste has changed significantly. These fundamental changes in law have imposed financial incentives to ensure compliance and move the management of waste up the waste hierarchy. The Government has also changed national strategy in line with changing legislation. This section outlines some of the key drivers for the Councils' Strategy.

3.1 Environmental Protection Act 1990

In 1990 the Environmental Protection Act (EPA) set out the fundamental structure and legislation about waste management and the control of emissions into the environment. Part II of the EPA sets out a regime for regulating and licensing the acceptable disposal of waste. The EPA places a duty on Local Councils to collect, dispose of and undertake recycling of waste. The EPA also required that a National Waste Strategy for England and Wales was created.

3.2 EU Landfill Directive 1999

In 1999 the EU Landfill Directive was created and later transposed into UK law through the Landfill Regulations 2002. The objective of this Directive was to prevent or reduce the negative effects that landfilling has on the environment through the introduction of stringent technical requirements for waste and landfills. The UK Landfill Regulations require the reduction of biodegradable waste sent to landfill to the following levels:

- 75% of 1995 levels by 2010
- 50% of 1995 levels by 2015
- 35% of 1995 levels by 2020

3.3 National Waste Strategy

In May 2000 the Government produced the Waste Strategy 2000 for England and Wales in response to the earlier EU Directives on waste. This National Waste Strategy set out the Government's views on the future for waste management in England and Wales. A number of targets were included within the National Waste Strategy focussing on recovery, recycling, composting and landfill reduction.

The National Waste Strategy was reviewed in 2007 setting out key aims to tackle the growth in waste whilst aiming to use resources more efficiently and making greater use of secondary materials.

The key objectives within the National Waste Strategy for England 2007 are to:

- decouple waste growth (in all sectors) from economic growth and put more emphasis on waste prevention and re-use;
- meet and exceed the landfill directive diversion targets for biodegradable municipal waste in 2010, 2013 and 2020;
- increase diversion from landfill of non-municipal waste and secure better integration of treatment for municipal and non-municipal waste;
- secure the investment in infrastructure needed to divert waste from landfill and for the management of hazardous waste;
- get the most environmental benefit from that investment, through increased recycling of resources and recovery of energy from residual waste using a mix of technologies.

To reach the objectives of the National Waste Strategy for England 2007 the Government set a number of targets for diverting waste away from landfill. The targets are set out in Table 4 below:

Table 4 - National Waste Strategy for England 2007 Targets

Household Waste Recycling	Year	Target
	2010	40%
	2015	45%
	2020	50%
Recovery of Municipal Waste	Year	Target
	2010	53%
	2015	67%
	2020	75%
Household Residual Waste	Year	Target
	2010	29% reduction since 2000
	2015	35% reduction since 2000
	2020	45% reduction since 2000

3.4 Waste Framework Directive

The Waste Framework Directive was first passed into law in 2006 and provides the overarching legislative framework for the collection, transport, recovery and disposal of waste across Europe, including the UK. A revised version of the Directive was adopted in November 2008 and this was transposed into UK law in February 2011. The policies needed to meet the Waste Framework Directive requirements are already in place.

At the heart of the revised Waste Framework Directive is the updated waste hierarchy set out in Section 1.

The Waste Framework Directive Targets are:

- to recycle or prepare for reuse 50% of household waste by 2020
- to reuse, recycle or recover 70% of non-hazardous construction and demolition waste by 2020
- to set up separate collection of at least paper, metal, plastic and glass from the household waste stream by 2015

3.5 National Waste Policy Review for England 2011

In 2011 the Government reviewed all aspects of waste policy and delivery in England. The review's findings were published in June 2011, alongside a series of actions for the future. Although the 2007 National Waste Strategy for England remains in place, the Government made the following commitments as part of the 2011 review:

- Work with businesses on a range of measures to prevent waste occurring wherever possible, ahead of developing a full Waste Prevention Programme by December 2013
- Explore the potential for new voluntary responsibility deals to drive waste prevention and recycling, including in the hospitality sector and with the waste management industry and for direct mail, textiles, and construction waste
- Launch a grant funding scheme for innovative reward and recognition schemes which could incentivise people to 'do the right thing'
- Encourage councils to sign new Recycling and Waste Services Commitments, setting out the principles they will follow in delivering waste services to households and businesses

- Provide technical support to councils and businesses who want to see recycling-on-the-go schemes grow
- Consult on the case for increased recovery targets for packaging waste, in time for a final decision in the 2012 Budget
- Consult on introducing a restriction on the landfilling of wood waste and review the case for introducing landfill restrictions on other materials, including textiles and biodegradable waste
- Scrap unfair bin fines and taxes while bringing in powers to deal with repeat fly-tipping offenders and genuine nuisance neighbours

3.6 Landfill Tax and the Landfill Allowance Trading Scheme (LATS)

Since their introduction, Landfill Tax and the Landfill Allowance Trading Scheme (LATS) have been the most important financial drivers for change affecting the Councils' Strategy for managing waste.

To incentivise diversion of waste from landfill, Landfill Tax was introduced in 1996 as a way to help the UK meet its obligations under the 1999 EU Landfill Directive. The idea was that making disposal of landfill more expensive would make other waste treatment options more attractive.

Landfill Tax was initially introduced at a rate of £7 per tonne for typical household and commercial waste. This was increased steadily until 2007 when it reached £24. In 2008 it was increased to £32 per tonne and from then onwards it has increased by £8 per tonne every year and will continue to do so until 2014 when it reaches £80. It is not known whether it will continue to rise thereafter.

The Landfill Allowance Trading Regulations came into effect on the 1st April 2005. These regulations set out the detail for the operation of LATS and allocated allowances for the amount of biodegradable waste such as garden, food waste, paper and cardboard that each English Council was permitted to landfill between 2005 and 2020.

LATS is a scheme by which Councils can trade their allowances depending on whether they need to use or expect to exceed their allocation. The penalty for non-compliance with the LATS allowance was set at £150 per tonne by the Landfill Allowances and Trading Scheme (England) (Amendment) Regulations 2005 that came into force in May 2005. The Government has also reserved the right to pass on any European fine imposed by the European Court of Justice on the UK for missing the Landfill Directive targets onto the Councils who have exceeded allowable levels. The Councils performance in relation to the LATS is outlined in Section 5 of the Strategy.

The Government announced in 2011 that the LATS will cease from 2013 on the basis that the continuing increase in Landfill Tax is sufficient to incentivise diversion from landfill.

3.7 Regional and Planning Context

The Councils are committed to working in partnership and recognise the benefits of joint working on strategic waste management issues. While the Councils seek to manage waste locally, the spread of existing facilities and appropriate locations are such that cross-administrative boundary flow of waste is inevitable to some extent. In addition, the development of more strategic facilities can help to improve economies of scale.

The Yorkshire and Humber region has a variety of waste facilities that have been or are being developed through new and existing waste contracts. It is important for the Councils to remain aware of current and future regional developments in waste management services and facilities to ensure that any changes made will complement the region's waste network. Despite the major cuts in funding which have affected local government and the disbanding of government organisations such as

Yorkshire Forward who have supported sustainable waste management, the Councils continue to play an active role in joint working and sharing of best practice at a regional level at the Waste and Recycling Advisory Group (WRAG).

As Waste Disposal Authorities, the Councils have responsibility for managing all the municipal waste that is collected by the Councils. However, municipal waste only accounts for approximately 30% of all waste produced in the area. As Waste Planning Authorities, the Councils also have responsibility for developing plans to ensure that the area has appropriate land allocated for the management of waste. As part of any planning application for a local waste management facility, in the role of Planning Authority, the Council would test any application against a suite of planning policies. These policies are based on key principles such as the waste hierarchy, local capacity requirement and the proximity principle.

In 2008 the Regional Spatial Strategy (RSS) was adopted: 'The Yorkshire and Humber Plan'. RSS's were introduced in place of county-level structure plans in the Planning and Compulsory Purchase Act 2004. However, the Localism Act 2011 brought in the power to revoke RSSs and the Government are consulting on a report into the environmental consequences of revocation. The aim of the RSS was to take a regional approach to ensuring the area was well served in terms of waste management facilities. Each RSS became the strategic level plan for a region in England - a statutory, legal document - charged with informing every Local Development Framework (LDF) within that region. LDFs are a collection of local development documents, written by each Council, that have regard to the RSS in their particular region.

The Joint Waste Development Plan Document (DPD) is a shared waste planning document for Hull City Council and East Riding of Yorkshire Council and is a local development document that sits within the LDF. It will provide policies and preferred areas for development to include maps and information on the allocated sites. The Document will provide a detailed policy framework for assessing planning applications for waste related developments and will set out how we will manage and treat waste from industry and business sources as well as municipal waste.

The Joint Waste DPD is currently at the 'Issues and Options Stage', an early consultation stage of development. When completed, the Joint Waste DPD will replace the Joint Waste Local Plan, which has been in place since November 2004 and will complement the Councils' Strategy. Any new developments required in the area to manage municipal waste will need to comply with the policy framework contained within the Joint Waste Local Plan at present and Joint Waste DPD when finalised. This policy framework will consider key sustainability issues such as Environmental Impact Assessment, Sustainable Transport Plans, Biodiversity Action Plan and Strategic Flood Risk Assessments.

4. Why do we need to review the Joint Sustainable Waste Management Strategy?

Since the development of the Councils' Strategy in 2006 there have been considerable legislative changes as well as major service improvements delivered by the Councils and a significant change in the waste management market place.

The changes implemented by the Councils to the way waste is managed have led to increased diversion of waste away from landfill. There has been a change at a national level leading to the average residual waste per person reducing by over 25% since 2006/07 across the UK. Nationally these changes have led to a saving of more than 18 million tonnes of carbon dioxide a year (equivalent to taking 5 million cars off the road).

Nationally, there has also been a 10% reduction in the overall amount of waste produced since 2006. This national trend has been brought about through tighter regulation aimed at reducing the overall volume of waste generated, coupled with the global recession and local waste prevention initiatives. This trend has been mirrored locally so there is a need to update the Councils' current position with targets that also reflect these changes.

There has also been a dynamic change in the waste management market leading to more recycling and composting facilities being developed as Councils implement new waste collection strategies. There has also been a move away from the traditional 25 year integrated waste management contract due to the cessation of Private Finance Initiative (PFI) credits, difficulties with securing bank funding and a move to shorter term contracts becoming more commonplace. Central Government's focus is on the need to support this changing market place with more facilities and technologies coming on line with a greater emphasis on energy production from the waste treatment process. There is significant planned capacity available within the UK as well as an estimated surplus of capacity in northern Europe for Refuse Derived Fuel (RDF).

All of the changes referred to above contribute to the need to update the Councils' Strategy to ensure that it is fit for purpose and provides a good foundation for future improvements in relation to waste management in the area.

4.1 Sustainability Appraisal

Although there is no statutory requirement for the Councils to develop a Strategy, the Councils remain committed to jointly developing a long term strategic approach to waste management. Revision to Government guidance on the development of waste strategies means it is no longer recommended that Councils undertake a Best Practicable Environmental Option (BPEO) assessment. The new guidance recommends that Councils follow the Strategic Environmental Assessment (SEA) Directive which requires that all strategic level plans, policies and programmes (including Municipal Waste Strategies) that could result in significant environmental effects be subject to a Sustainability Appraisal.

In order to assess the effect of the revision of the Councils' Strategy and specifically the modified strategic aims and targets, this Strategy has been subject to a Sustainability Appraisal (SA) to consider its implications in terms of sustainability and environmental impact. The objective of undertaking an SA is to ensure that the Strategy will have a positive environmental impact.

Although an SA is not a mandatory requirement, Defra's guidance states that in addition to environmental effects, Councils should undertake a thorough evaluation of socio and economic factors in addition to the environmental impacts. By subjecting this Strategy to an SA the Councils are following Government guidance.

The SA process has encompassed an appraisal of the revised aims and targets set out in Section 5 against the Sustainability Appraisal Objectives in Table 5 below:

Table 5 - Sustainability Appraisal Objectives

1.	To reduce waste, by using fewer natural resources, and to decouple waste growth from economic growth
2.	To increase the diversion of waste from landfill and to reuse, recycle and recover as much waste as possible
3.	To increase awareness and responsibility for waste
4.	To ensure the provision of adequate facilities and infrastructure for the efficient and safe management of waste
5.	To protect and improve surface and groundwater quality and resources
6.	To reduce the risk of flooding and coastal erosion
7.	To maintain and improve local air quality
8.	To reduce greenhouse gas emissions and ensure a managed response to the effects of climate change, and to increase renewable energy generation
9.	To protect and enhance the quality and diversity of rural and urban landscapes, particularly those areas of high landscape value
10.	To protect and enhance biodiversity and geodiversity
11.	To protect and enhance cultural, historic and archaeological assets and their settings
12.	To promote and ensure high standards of sustainable design and construction, optimising the use of previously developed land and buildings, and to protect good quality agricultural land and soils
13.	To promote sustainable travel, improve access for all, and to encourage the efficient and safe movement of people and goods
14.	To reduce social exclusion, ensure equality for all, and to create vibrant inclusive communities with a sense of identity
15.	To reduce health inequalities and improve the health and well being of people
16.	To maintain and improve safety and reduce crime, the fear of crime and anti-social behaviour
17.	To improve levels of skills, education and training, to create good quality employment opportunities, and ensure high and stable levels of employment and economic growth

The SA process helps to identify where changes to targets and aims within the revised strategy have a positive or negative impact when compared to the previous aims and targets. This is illustrated in the form of a compatibility matrix. To ensure the Strategy changes have no negative impact or a positive impact, the Councils have considered a number of criteria against each SA objective. As the SA criteria are wide ranging, they are not all directly relevant to this Strategy. The criteria are attached at Appendix 2. A copy of the full Sustainability Report outlining the results of the SA is attached at Appendix 3.

5. Proposed Aims, Targets and Actions for the Joint Sustainable Waste Management Strategy 2012

This section sets out the strategic aims and targets for the Joint Sustainable Waste Management Strategy 2012. This review includes updated strategic aims, actions and targets where required in order to reduce the amount of waste produced, improve recycling and composting performance, divert more waste from landfill and continue to drive waste up the waste hierarchy.

The delivery of the Strategic Aims and Targets that are set out below will be funded through the Councils' Medium Term Financial Plans.

5.1 Aim 1 - Deal with municipal waste in the most sustainable way by moving waste management practice up the waste hierarchy

The waste hierarchy continues to be the foundation of sustainable waste management practice. The Councils will strive to drive waste up the hierarchy through a range of actions identified below and the targets reflect waste prevention, recycling and composting and energy recovery.

Waste Prevention

Greater emphasis is required over the time covered by this Strategy to raise awareness and influence behavioural change to support waste prevention. The best way we can manage waste is by not producing it in the first place wherever possible. Where it is necessary to produce products that end up as waste then we need to treat it as a resource to maximise its potential value.

The proposed new Strategy target indicator for waste reduction is National Indicator (NI) 191, Kilogrammes (Kg) of residual waste per household. This indicator measures the amount of household waste not recycled or composted. By measuring the amount of residual waste produced per household, performance is not affected by an overall increase or decrease in the number of households in the area. The targets for reduction of residual waste are outlined in Table 6 below:

Table 6 – Waste Reduction Target

Target 1 – Reduction in Kg of residual waste per household per annum		
	East Riding of Yorkshire Council	Hull City Council
2010/11	678 Kg per hhld	499 Kg per hhld
2015/16	443 Kg per hhld	450 Kg per hhld
2020/21	421 Kg per hhld	400 Kg per hhld

The Councils are required to report kilogrammes of residual waste per household through the Government's WasteDataFlow system. Performance can therefore be tracked and measured easily and will reflect the Councils' progress on reducing waste at a household level. The targets represent a reduction in residual waste of approximately 38% for East Riding and 20% for Hull. The higher reduction in East Riding is due to the later implementation of its kerbside recycling and composting service which makes a significant reduction in the residual waste produced between 2010/11 and 2015/16. These targets have been set such that they reflect the different baseline positions in 2010/11, the urban and rural nature of the area, and are in line with realistic but challenging recycling and composting diversion targets set out in Table 7 below.

Actions - What are the Councils going to do to reach this target?

- Review waste collection policies and operations to encourage practice which seeks to maximise waste prevention
- Develop a new waste minimisation plan with activities focusing on prevention and reuse
- Produce a communications plan to raise public awareness of waste prevention and reuse
- Continue to lobby Government through the Chartered Institution of Waste Management (CIWM), Local Government Association (LGA), Local Authority Recycling Advisory Committee (LARAC) and the National Association of Waste Disposal Officers (NAWDO) to promote the reduction of packaging

Recycling and Composting

The improvements in the Councils' waste collection services have helped to ensure a positive increase in recycling, composting and diversion of more waste from landfill. The key is now to build on this performance and set further targets which focus on recycling and composting as much waste as possible.

The Councils will remain focused on maintaining and increasing current levels of participation and endeavour to improve performance through a range of services and initiatives. Proposed targets relating to the percentage of household waste sent for reuse, recycling and composting are outlined in Table 7 below:

Table 7 – Recycling and Composting Targets

Target 2 – Increase recycling and composting of household waste		
	East Riding of Yorkshire Council	Hull City Council
2010/11	41.6%	49.09%
2015/16	62%	55%
2020/21	65%	60%

The new targets emphasise the Councils' commitment to driving recycling and composting performance above nationally expected levels. To put this in context, the National Waste Strategy for England's target for recycling of household waste is 45% by 2015 and 50% by 2020. Both Councils' targets are significantly higher than this which reflects the importance placed on diverting waste from landfill. The variance in target between the Councils reflects the difference in demographics, housing stock and waste composition. For example, Hull has a higher proportion of flats where recycling is more difficult and there is a significantly higher proportion of garden waste in the East Riding that can be composted.

Actions - What are the Councils going to do to increase recycling and composting and reach this target?

- Sign up to the Government's Household Services Commitment attached at Appendix 4
- Review the success and performance of the kerbside collection service and listen to feedback from residents in considering future changes

- Promote the new recycling collection services to businesses
- Consider bidding to the Government's £250 million waste collection fund after assessing which material streams may have most effect on reducing residual waste per household
- Investigate the potential for increasing the range of materials collected at the kerbside or at Bring Sites to include batteries and small Waste Electrical and Electronic Equipment (WEEE)
- Produce and implement a communications plan to promote services and maximise participation in all recycling and composting schemes
- Deliver an infrastructure improvement programme to enhance accessibility across HWRSs in the East Riding
- Promote bulky item community re-use schemes through the Call Centre and Customer Service Centres in Hull
- Increase provision for mechanical sorting of residual waste through the Councils' waste contract procurement process

Energy/other recovery

The treatment of residual waste will form a key part of the Councils' waste contract reprocurement exercise. Given the advancements made in waste treatment technologies, the Councils are no longer proposing a specific waste treatment technology. Instead, the Councils are seeking to enshrine the strategy performance targets within the new Waste Contract specification.

The key target proposed for energy recovery combines the need to divert residual waste from landfill through waste treatment facilities that comply with the waste hierarchy definition of recovery. This will ensure that the use of landfill is significantly reduced and energy is generated from the residual waste. The targets are outlined in Table 8 below:

Table 8 – Residual Waste Diversion Target

Target 3 – Diversion of municipal waste from landfill		
	East Riding of Yorkshire Council	Hull City Council
	Tonnes sent to landfill	Tonnes sent to landfill
2010/11	112,723	70,041
2015/16	29,100	20,681
2020/21	19,400	13,788

The targets in Table 8 represent a municipal waste diversion rate of 85% by 2015/16 and 90% by 2020/21 when compared to 2010/11 performance. To achieve these targets, residual waste will need to be processed at new or alternative facilities. There are some difficult waste types that may still need to be landfilled in the future such as asbestos or residues from waste treatment processes. However, the Councils will aspire to achieving 'zero waste to landfill' by 2020/21.

- Include the landfill diversion and aspirational ‘zero waste to landfill’ target for Municipal Waste within the Councils’ Waste Contract specification and require proposed waste treatment technologies or facilities to comply with the waste hierarchy definition of recovery
- Procure new Waste Contracts that are operational no later than April 2015

5.2 Aim 2 - Raise public awareness and responsibility for waste

The new targets reflect the Councils’ continuing need to focus on engaging the public on waste issues. Whilst both Councils have made significant progress in improving recycling, there still needs to be focus on increasing performance. Raising awareness and promoting responsibility for waste will contribute to delivering Targets 1, 2 and 3. The targets outlined in Tables 9 and 10 below seek to improve participation, set out and capture rates ensuring that targeted recyclable materials are placed in the appropriate bins.

Performance against Target 4 is expected to increase gradually as new waste collection initiatives are introduced by the Councils that will help residents to recycle and compost more of their household waste at the kerbside. This will be coupled with improved communications and promotions to increase awareness of the need to reduce waste. The targets represent the Councils’ aim to increase the proportion of the overall waste stream that is recycled and composted. There will be a corresponding reduction in the amount of residual household waste collected at the kerbside if these targets are achieved so the overall amount of waste collected will not increase.

Table 9 – Kerbside Collected Recycling and Composting Targets

Target 4 – Increase the collection of recyclables and organic waste at the kerbside		
	East Riding of Yorkshire Council	Hull City Council
2010/11	271 Kg per hhld	327 Kg per hhld
2015/16	445 Kg per hhld	360 Kg per hhld
2020/21	494 Kg per hhld	392 Kg per hhld

Table 10 – Reduction of Contamination Levels

Target 5 – Reduce contamination levels within recycling and composting kerbside collections		
	East Riding of Yorkshire Council	Hull City Council
2010/11	5 %	5 %
2015/16	4 %	4 %
2020/21	3 %	3 %

The recycling and composting targets in Tables 9 and 10 above are in line with the overall recycling and composting performance targets outlined in Aim 1 above.

Actions - What are the Councils going to do to reach these targets?

- Establish a suite of reporting data on performance related to recycling including tonnages, bin presentation rates and participation monitoring

- Establish baseline information on poorer performing areas and produce a targeted action plan to improve participation in these areas
- Develop a targeted communications plan based on customer segmentation information to increase the number of committed recyclers
- Evaluate the potential for incentive schemes to encourage improved participation
- Develop local initiatives to promote national awareness raising campaigns
- Develop an education plan for work in schools and community groups to include a combination of environmental education and awareness raising with waste enforcement considered as a last resort. The Councils will consider the wider implications of environmental impact relating to waste issues such as littering, fly-tipping and poor waste containment to raise awareness of their impact on the streetscene and natural environment
- Improve information provision through the Councils' various customer access channels for residents and businesses

5.3 Aim 3 - Provide a network of local recycling facilities for residents and ensure that waste is processed through treatment facilities in accordance with relevant legislation and where appropriate with due recognition of the local planning process

It is essential that the Councils provide local recycling centres for residents to take their waste and local reception facilities to receive delivery from the Councils' waste collection vehicles. Whilst it may be preferable that the development of processing facilities for organic waste, recyclables and residual waste are provided locally, it is possible that more environmentally friendly and cost effective solutions outside of the Councils' area are proposed by bidders as part of the Waste Contract procurement process.

The Councils are mindful of the proximity principle and aim to develop local facilities where possible but will need to establish evaluation criteria based on deliverability, price, quality, performance and overall environmental impact in assessing the best solutions for managing waste in the future.

The new targets reflect the changing waste management needs of the Councils since the implementation of the original strategy in 2006 and are outlined in Table 11 below:

Table 11 – Waste Management Contract Requirement Target

<p>Target 6</p> <p>Ensure Waste Management Contracts are in place up to 2020/21 to process:</p> <ul style="list-style-type: none">• Organic Kerbside Collected Waste• Dry Recycling Kerbside Collected Waste• Residual Waste <p>Ensure Waste Management Contracts are in place up to 2020/21 to manage:</p> <ul style="list-style-type: none">• Household Waste Recycling Sites• Community Recycling Centres <p>Ensure Waste Management Contracts are in place up to 2020/21 to provide and manage as appropriate:</p> <ul style="list-style-type: none">• Waste Transfer Stations in the Hull, Goole and Carnaby areas for all waste streams collected by the Councils
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With the exception of a contract to process residual waste as an alternative to landfill, the current Waste Contract with WRG provides the Councils' requirements. Following termination of this Contract, it is important that the specification for new Waste Contracts not only delivers the requirements of Target 6 but also includes the performance requirements outlined in the various other targets within this Strategy.

Actions - What are the Councils going to do to reach this target?

- Procure new Waste Contracts that contribute to the provision of the necessary waste management facilities and infrastructure no later than April 2015
- Include the targets for recycling, composting and diversion of waste from landfill within the Councils' Waste Contract specification
- Continue to manage the existing Waste Contract with WRG against existing performance specifications
- Ensure that the principles of sustainable development are considered during the design, site selection, construction, development and operation of any new waste management facilities

5.4 Aim 4 - Divert Biodegradable Waste from Landfill

The Government introduced the Landfill Allowance Trading Scheme (LATS) in April 2005. Under this scheme, the amount of biodegradable waste that Councils are allowed to send to landfill is restricted. Where a Council exceeds their allocation, allowances can be traded from other Councils who did not use their full allocation.

Although the Councils have significantly reduced the amount of biodegradable waste sent to landfill, the lack of a residual waste treatment facility has led to the Councils exceeding their LATS allocations. Actual performance against allocation is outlined in Tables 12 and 13 below:

Table 12 – East Riding of Yorkshire Council LATS Performance

Year	Biodegradable Waste Landfilled	Biodegradable Waste Allocation	Allowance Purchased
2005/06	105157	109,397	0
2006/07	102072	103,347	0
2007/08	97866	95,280	2,586
2008/09	89261	85,197	4,064
2009/10	80656	73,097	7,559
2010/11	74357	64,961	9,396

Table 13 – Hull City Council LATS Performance

Year	Biodegradable Waste Landfilled	Biodegradable Waste Allocation	Allowance Purchased
2005/06	83,336	85,361	0
2006/07	80,767	80,214	553
2007/08	78,274	73,351	4,923
2008/09	76,605	64,773	11,832
2009/10	67,067	54,479	12,588
2010/11	50,206	48,415	1,791

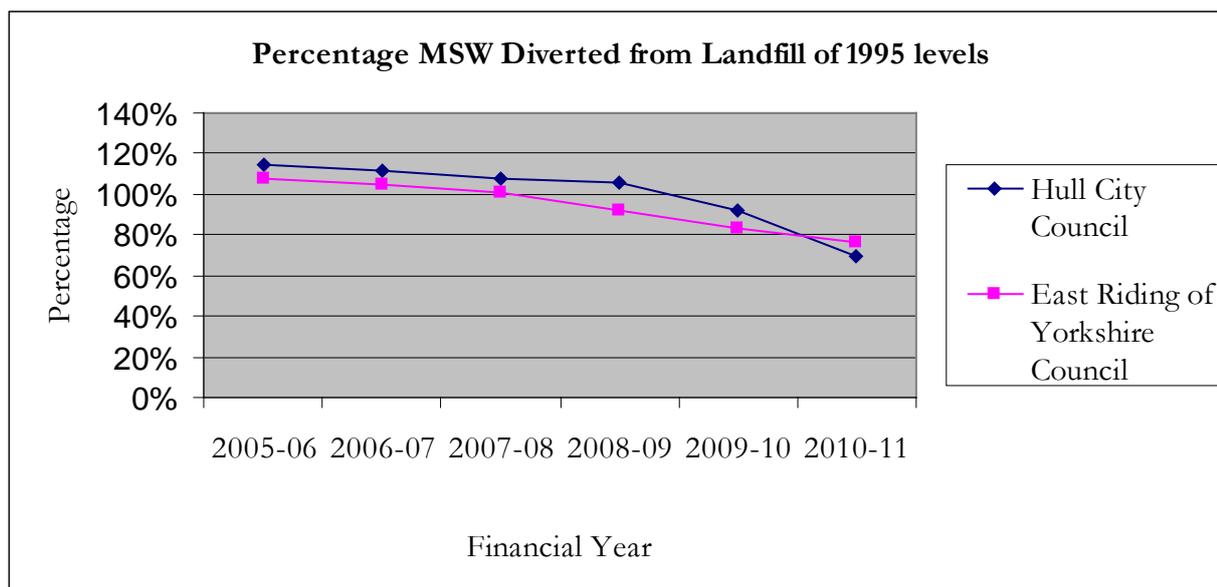
In the Government Review of Waste Policy in England 2011 it was acknowledged that although the LATS has undoubtedly been effective, the level of Landfill Tax set to rise from £56 per tonne in 2011/12 to £80 per tonne in 2014/15 means it is now the most significant driver. The Government has therefore decided that the LATS will cease at the end of 2012/13.

Although the LATS will cease from 2012/13, the Landfill Directive targets will remain in place. The Landfill Directive targets are as follows:

- Reduce Biodegradable Waste landfilled to 50% of the 1995 level by 2013/14
- Reduce Biodegradable Waste landfilled to 35% of the 1995 level by 2020/21

The Councils' current position compared to 1995 levels is illustrated in Figure 10 below:

Figure 10 – MSW diverted from landfill compared to 1995 levels



Although the Councils still need to improve diversion from landfill significantly to meet the Landfill Directive targets, the Councils believe that provision of residual waste treatment facilities by 2015/16 will deliver diversion rates that exceed the Landfill Directive targets. The Councils’ targets are outlined in Table 14 below:

Table 14 - Diversion of Biodegradable Waste from Landfill Target

<p>Target 7</p> <ul style="list-style-type: none"> • Reduce Biodegradable Waste landfilled to 20% of the 1995 level by 2015/16 • Reduce Biodegradable Waste landfilled to 15% of the 1995 level by 2020/21

Actions - What are the Councils going to do to reach this target?

- Continue to divert biodegradable waste from landfill by increasing recycling performance and developing alternative waste treatment facilities to landfill

5.5 Aim 5 - Provide leadership in dealing with the Councils’ own internal waste

It is important that the Councils continue to encourage sustainable waste management throughout their organisations. With the improved kerbside recycling infrastructure in place for commercial properties, the Councils are now in a much improved position to provide comprehensive recycling services to all buildings. The proposed targets are outlined in Table 15 below.

There has been progress made in raising the profile of sustainable waste management through the introduction of environmental management systems within both Councils. Internal communications campaigns have been undertaken that have run alongside the introduction of the new kerbside collection schemes to raise the profile of the importance of waste and how it is managed. This has involved a range of activity including: global emails, articles in Hull Talk, Hull in Print, Grapevine and Your East Riding. More Council departments are recycling than ever before and this is increasing the

amount of waste diverted from landfill. This is as result of the introduction of the commercial recycling schemes and increased awareness of the benefits of recycling.

Table 15 – Internal Recycling Targets

Target 8 – Increase Internal Recycling Performance		
	East Riding of Yorkshire Council	Hull City Council
2015/16	62%	62%
2020/21	65%	65%

The targets have been set in line with the targets for household waste. These targets exceed the national target to recycle 50% of household waste by 2020. Achieving this challenging target will make a significant contribution to reducing the Councils’ Carbon Footprint.

Actions - What are the Councils going to do to reach this target?

Hull City Council

- Undertake an internal service review to establish a baseline of current waste management arrangements across the Council
- Provide segregated recycling facilities in all Council Offices / Buildings by 2013/14
- Develop a communications plan to promote waste prevention and use of recycling facilities
- Promote the principle of sustainable procurement and include it in Council policies
- Monitor carbon emissions relating to internal waste collection arrangements (see Aim 8)

East Riding of Yorkshire Council

- Undertake an internal service review to establish a baseline of current waste management arrangements across the Council
- Introduce additional recycling facilities at corporate sites through the use of the Council’s Commercial Waste Services
- Implement improvements in waste management procedures (management of WEEE and Hazardous waste)
- Work with Leisure Centres to produce a waste minimisation plan
- Produce an Annual Environmental Report in line with EMAS principles to outline the Council’s current environmental performance and identify the next year’s actions
- Promote the principle of sustainable procurement and include it in Council policies
- Monitor carbon emissions relating to internal waste collection arrangements (see Aim 8)

5.6 Aim 6 - Provide a sustainable waste management service for households and businesses which achieves value for money and high levels of customer satisfaction and which aims to achieve top 10% performance

This new aim is an amalgamation of the original Strategic Aims 6 and 7. The need to deliver high levels of customer satisfaction for residents and businesses, balanced against the drive for increased value for money, has become a key challenge for local Councils in the wake of Local Government funding cuts.

The targets outlined in Table 16 below reflect the Councils' ambition to deliver excellent, value for money services.

Table 16 - Cost and Customer Satisfaction Targets

<p>Target 9 – Achieve top 10% performance compared against Councils with similar waste management systems for the cost of household waste collection and waste disposal per household</p> <p>Target 10 – Achieve customer satisfaction levels greater than 90% for waste collection services and Household Waste Recycling Site provision</p>

To achieve these targets the Councils will provide a regular and reliable kerbside collection service to households and businesses when requested.

Actions - What are the Councils going to do to reach these targets?

- Benchmark performance with top performing Councils and those Councils with similar waste management systems in place
- Network with local Councils within our comparator groups and national forums to develop improved waste services and share best practice
- Monitor and analyse complaints to address service delivery issues
- Monitor and measure customer satisfaction to improve performance across all waste services
- Work with new waste contractors to monitor and improve customer service standards at all Household Waste Recycling Sites
- Undertake regular reviews and optimisation of waste collection rounds to maximise efficiency
- Sign up to the Business Recycling and Waste Service Commitment – see Appendix 5

5.7 Aim 7 - Work with local and regional stakeholders to ensure delivery of the Councils' strategic objectives

The Government's localism bill seeks to empower local communities and reinvigorate local democracy, understanding, accountability and participation. The new aim outlined above seeks to encompass this from a waste management perspective.

The targets can be seen as a reflection of the Councils' commitment to delivering local priorities for local people in terms of waste management and are set out in Table 17 below:

Table 17 – Working with local and regional stakeholders

<p>Target 11 – Deliver flexible services which reflect local need</p> <p>Target 12 – Work with local Social Enterprises and the Voluntary and Community Sector to support local waste minimisation, reuse and recycling initiatives</p>

The Councils recognise the need for flexibility to deliver quality services across a diverse range of residential neighbourhoods. Areas with limited storage space, houses of multiple occupancy and flats often require different solutions to a traditional housing estate.

Social enterprises and organisations in the voluntary and community sector are actively involved in delivering services which support recycling, waste and environmental management and the Councils aim to support these activities where possible.

Actions - What are the Councils going to do to reach these targets?

- Map social enterprises and organisations in the voluntary and community sector engaged in recycling and promote and advertise these organisations to residents through the Councils’ access channels
- Identify funding initiatives and links to other priorities to promote community composting and community recycling projects
- Support initiatives that reduce landfill such as food banks, and recycling and reuse projects
- Identify and agree a form of engagement and consultation with local areas and neighbourhoods on recycling and waste collections
- Work with neighbouring Councils to develop regional waste initiatives where possible that deliver economies of scale and improved awareness
- Develop communication strategies that address specific community needs and maximise inclusion and access to services through a combination of service design and community engagement

5.8 Aim 8 - To reduce the climate change impact of the Councils’ waste services

The production of carbon dioxide emissions (CO₂) through the provision of waste management services is significant. The ongoing development of increased recycling services from the kerbside (both household and commercial) and in onward markets has the potential to increase these emissions, although the impact is offset by the reduction in use of raw materials. There is, therefore, a need for these services to de-carbonise so that potentially increased waste management services can be provided alongside declining emissions. The Councils wish to see reduced CO₂ emissions both from the services delivered by the Councils and their appointed contractors.

The target is rooted in key elements of national and local policy. The Climate Change Act has set a 34% reduction target in national CO₂ emissions by 2020 from a 1990 baseline. The Low Carbon Transition Plan sets out detailed actions for this decarbonisation and attempts to break the link between economic growth and CO₂ emission growth. The Energy Act 2011 and associated Energy Roadmap clearly indicate the drive for the increased electrification of the transport network.

Locally, the new target will also assist the Councils in achieving their CO₂ reduction target commitments, as set out in their respective strategic documents.

Table 18 – CO₂ Reductions

Target 13 - Reduce CO₂ emissions relating to waste collection and disposal services by 2 to 3% per annum, from the baseline year 2012/13

Actions - What are the Councils going to do to reach this target?

- Develop a baseline position for CO₂ emissions and monitoring arrangements relating to waste management services from 2012/13 for household and commercial waste management services
- Implement a timetable for transition of existing fleet to low carbon power vehicles
- Reschedule and optimise waste collection rounds on a regular basis to ensure that they are efficient, minimise travel time and therefore reduce vehicle emissions
- Ensure that CO₂ emissions reduction targets are included in any future Waste Contract tender evaluation process
- Encourage any future waste contractor to comply with the Councils' CO₂ emission reduction targets in dealing with our waste
- Instigate research into how the greenhouse gas emissions created by waste collected (in landfill, etc.) can be effectively measured
- See also actions relating to Aim 5: provide leadership in dealing with the Councils' own internal waste

6. Monitoring and Review

The Joint Sustainable Waste Management Strategy approved in 2006 included a planned five-yearly review. This review will be subject to internal and external consultation to build upon the wide ranging and comprehensive consultation undertaken in 2005.

The proposed aims and targets in this Strategy are the subject of public consultation to gain the views of key stakeholders, partners and residents in the area. If required, we will amend and update the Strategy to reflect the response from consultees.

The targets within the Strategy differ between Councils but we are working together towards the strategic aims set out in this document.

The Strategy covers the period from 2012 to 2020. The Strategy and Action Plan will be subject to regular review and will take account of policy, legislative change and changes in waste growth. Performance will be monitored against targets.

The Councils' action plans for the delivery of this Strategy are shown at Appendices 6 and 7. Each strategic aim has a number of specific actions as set out in Section 5 with targets and timescales. The action plan will be a working document and will be monitored through the Councils' respective governance arrangements and risk registers will be developed where appropriate.

The Strategy itself will be reviewed every five years to take account of legislative change, the impact of the global economy on waste production, the increasing importance to reduce carbon emissions and changes in technology for treating waste and recyclables as well as any variations in consumer behaviour, all of which impact on waste production.

Glossary

Biodegradable waste	Waste that will break down over time, such as food, garden waste, paper and card etc.
Best Practicable Environmental Option (BPEO)	A study that identifies the best option which would provide the most benefits or the least damage to the environment, as a whole, at acceptable cost.
Bring Site	A collection point for residents to use to recycle materials such as glass, paper and cans. Bring sites are often located in supermarket car parks.
Bulky waste	Items which are too large to place in a standard household wheeled bin for collection.
Commercial waste	Waste from businesses such as shops and offices.
Composting	The breakdown of organic wastes (such as garden waste) in the presence of oxygen to produce fertiliser or soil conditioner. This can either be an enclosed process (in-vessel) or operated outside as an open process.
Clinical waste	Clinical waste is the term used to describe waste produced from healthcare and similar activities that may pose a risk of infection or may prove hazardous.
Chartered Institution of Wastes Management (CIWM)	The Chartered Institution of Wastes Management (CIWM) is the leading membership organisation for professionals in the Waste Management Industry in the United Kingdom and overseas.
Department for Environment, Food and Rural Affairs (DEFRA)	The Department for Environment, Food and Rural Affairs (Defra) is the government department responsible for environmental protection, food production and standards, agriculture, fisheries and rural communities in the United Kingdom.
Energy from Waste (EfW)	Energy from Waste (EfW) is the process of creating energy in the form of electricity or heat from the incineration of waste source.
Environmental Protection Act 1990	The Environmental Protection Act 1990 defines the legislation for waste management and control of emissions into the environment within England, Wales and Scotland.
European Union Landfill Directive	The Directive's overall aim is 'to prevent or reduce as far as possible negative effects on the environment, in particular the pollution of surface water, groundwater, soil and air, and on the global environment, including the greenhouse effect, as well as any resulting risk to human health, from the landfilling of waste, during the whole life-cycle of the landfill' across Member States.
Fly-tipping	The illegal deposit of waste on land.
Green waste	Vegetation and plant waste from household gardens and public parks and gardens.

Hazardous waste	Wastes that are harmful to human health, or to the environment, either immediately or over an extended period of time.
Household waste	Household waste includes waste produced at a domestic property, waste placed in litter bins and street sweepings. It excludes waste produced by businesses, waste that has been fly tipped, gully waste, parks waste and construction and demolition waste. It also excludes soil and rubble even if this originates from a domestic property.
Household Waste Recycling Site	A facility which is open to residents for the recycling and/or disposal of household waste. Separate containers are provided for garden waste, wood, scrap metal, general waste and recyclables etc.
Joint Waste Contract	The current joint waste management contract awarded by the Councils to Waste Recycling Group for the management of all household waste within the Councils' areas (excluding waste collection).
Kerbside collection	Any regular collection of waste from the kerbside from household, commercial or industrial premises.
Kerbside Dry Recycling	Items collected by the Councils for recycling using blue bins. Materials include paper, cans, glass, plastics etc.
Kerbside Organic Recycling	Materials collected by the councils for composting using the brown bins and kitchen caddies. Materials include kitchen and garden waste.
Landfill	The disposal of waste materials by burial at an approved landfill site.
Landfill Allowance Trading Scheme (LATS)	In order to ensure that the UK meets its obligations under the Landfill Directive, the Waste and Emissions Trading Act (WET Act) requires an allowance to be set for the tonnage of biodegradable municipal waste that can be landfilled in the UK. This allowance scheme is called the Landfill Allowance Trading Scheme. Landfill allowances are allocated to each Council to enable England to meet its targets. These allowances set out limits on the tonnage of biodegradable municipal waste that Councils can send to landfill and the allowances can be banked, borrowed or traded.
Landfill Tax	A tax placed on any waste material that is disposed of at a landfill site.
Local Authority Recycling Advisory Committee (LARAC)	An organisation that represents Council officers on recycling and waste management issues.
Local Government Association (LGA)	The Local Government Association (LGA) is a voluntary lobbying organisation acting as the voice of the local government sector in England and Wales.
Materials Recycling Facility (MRF)	A place where the segregation of recyclable materials is undertaken.

Municipal Solid Waste (MSW)	Waste, including household, commercial, clinical, hazardous, fly-tipping, street sweepings and any other waste that is controlled by the Councils.
National Association of Waste Disposal Officers (NAWDO)	NAWDO is the primary network for senior Council waste managers in England and Wales with responsibility for the treatment and disposal of waste.
National Waste Strategy for England	The National Waste Strategy is a government policy with the aim of moving towards sustainability in waste management.
NI 191: Residual household waste per household	This indicator monitors the Councils' performance in reducing the amount of waste that is sent to landfill, incineration or energy recovery.
NI 192: Household waste reused, recycled and composted	This indicator measures the percentage of household waste arisings which have been sent by the Councils for reuse, recycling, composting or anaerobic digestion.
NI 193: Municipal waste land filled	This indicator measures the proportion of municipal waste landfilled.
Participation	The proportion of households who use the recycling scheme, given that they have access to it.
Private Finance Initiative	A method of funding public infrastructure projects with private capital.
Recovery	Recovery is obtaining value from waste through reuse; recycling; composting; other means of material recovery or energy reduction?
Recycling	Recycling involves the reprocessing of waste material, either into the same product or a different one. Many non-hazardous wastes such as paper, glass, cardboard, plastics and scrap metals can be recycled.
Reduction	Minimising the amount of waste produced.
Refuse Derived Fuel	A fuel produced from waste that is dried and shredded and is then burnt to generate energy production.
Residual Waste	The waste which is left over after recyclables and organic (kitchen and garden) waste has been separately collected.
Reuse	Householders can buy refillable containers or reuse plastic bags. Reuse contributes to sustainable development and can save raw materials, energy and transport costs. The commercial sector can reuse products designed to be used a number of times such as reusable packaging.
Strategic Environmental Assessment (SEA)	A method of incorporating environmental considerations into plans and policies in line with EU policy.
Sustainability Appraisal	A study on the economic, environmental and social implications of a plan. This study will identify ways in which to promote sustainable development.

Target 45+	The name given to the Councils' Joint Sustainable Waste Management Strategy.
Waste arisings	The amount of waste produced in a given area during a given period of time.
WasteDataFlow	WasteDataFlow is the web based system for municipal waste data reporting by local authorities to government.
Waste Composition	A detailed breakdown of materials contained within a waste stream.
Waste Framework Directive	The Waste Framework Directive provides the overarching legislative framework for the collection, transport, recovery and disposal of waste across Europe.
Waste Hierarchy	The waste hierarchy classifies waste management strategies according to their desirability.
Waste Management Practice	The methods and services used to manage waste.
Waste minimisation	Limiting the quantity (weight and volume) of waste produced.
Waste Recycling Group	The private sector company responsible for delivering the Councils' current Joint Waste Management Contract.
Waste Transfer Station	A local facility where waste and recycling is deposited before being bulked and transported for further recycling, treatment or disposal.