UK LOCAL AUTHORITY KERBSIDE RECYCLING AND ALTERNATIVE RECYCLING METHODS: AWARENESS, USAGE AND CORRELATIONS

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ABSTRACT

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Following the implementation of the UK's Waste Strategy 2000 and later the implementation of EU Directive 2008/98/EC, recycling rates have improved dramatically within the UK. The expansion of this sector has created multiple avenues for households to reuse or recycle their goods. This Master's thesis aimed to identify correlations between the awareness and usage of local authority kerbside recycling versus that of alternative recycling methods. The research questions focused on identifying awareness and usage levels of alternative recycling methods; motivations for using alternative recycling methods; correlations between local authority kerbside recycling usage and alternative recycling methods. This was a mixed methods research which entailed the distribution of 145 questionnaires. Data analysis for questionnaires was conducted through the use of SPSS and content analysis, the local authority recycling methods were examined via data published on the WasteDataFlow online platform. The results were multifaceted. Decreased awareness levels of alternative recycling methods were linked with decreased usage rates amongst those who were aware. Financial incentives did not appear to be a primary motivator for using alternative recycling methods which offered a financial incentive. People who believe they are hindered from utilising local authority kerbside recycling are also significantly less likely to use alternative recycling methods. The usage of alternative recycling methods appeared to compliment local authority kerbside recycling and did not detract from it. The range of materials collected by local authority kerbside recycling services did not impact upon the usage of alternative recycling methods.	
Key words Recycling methods; kerbside recycling; UK; private sector; third sector	
Place of storage Jyväskylä University Library	

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1 INTRODUCTION

1.1 Motivation for Research

My motivation for this research is based upon my own personal experience of recycling in several different UK local authorities. Each local authority in the UK is required to collect a minimum of two types of recyclable material via kerbside collection, the types of material collected is for the decision of the local authority, as is the decision of whether to collect more than just two types of recyclable materials (Household Waste Recycling Act 2003). As such, the range of materials collected can differ significantly from one local authority to another, with some only collecting the bare minimum and others offering a far more comprehensive kerbside collection service. This has meant that in each local authority I have resided it has been necessary for me to seek alternative ways to recycle those materials not accepted via kerbside collection. As such, I have become accustomed to recycling my waste through a wide range of recycling methods. Depending on location there can be several alternative options available, these include: recycling banks / bring recycling sites; civic amenity sites (CA sites) or household waste recycling centres (HWRCs); reverse vending machines; battery boxes in certain retail shops; posting certain products to recyclers; charity shop drop off; charity shop doorstep collections; home composting.

This introduces a number of barriers. Firstly, the above mentioned alternatives also vary considerably in what recyclable materials they are willing to accept and this can therefore result in residents having to utilise multiple recycling facilities and potentially travel considerable distance in order to recycle all of their remaining recyclable materials.

In relation to this, certain recyclable materials can often be both heavy and bulky making such trips impractical without the use of a car. This is of particular importance to inner city areas where car ownership is lower than the UK average, for example, the number of households in City of London who have access to a car stands at only 13% whereas in the outer London Borough of Richmond upon Thames it stands at 75% (Transport for London, 2013).

Considering the inconvenience that above barriers create and with many local authorities collecting a wide range of recyclable materials I am intrigued that so many non-kerbside recycling collection methods exist, this is particularly pertinent in Wales, a devolved UK nation whose kerbside recycling levels far exceed those witnessed in the rest of the UK and whose recycling targets surpass other nations within the UK and the EU's target of recycling 50% of waste materials from households by 2020 (Directive 2008/98/EC of The European Parliament and of the

Council, 2008). Yet, with this in mind the range of alternative recycling methods available are as varied in Wales as other parts of the UK.

With such a diverse range of recycling methods available my interest lies in identifying people's reasons and motivations for using one method over another and whether any correlations can be identified between the use local authority kerbside collection schemes and the use alternative recycling or reuse schemes.

1.2   Aim and Scope of Research

This research aims to shed light on the various ways materials can be recycled or reused through means other than local authority kerbside collection services in the United Kingdom (UK). The research endeavours to gain a better understanding of the UK population's awareness of alternative recycling or reuse methods and where applicable their motivations for utilising these alternative methods. The research also aims to identify any correlations that may exist between people's usage of kerbside recycling services and their usage of alternative recycling / reuse methods.

The research intends to achieve the above through the analysis of government published recycling data and through the distribution of questionnaires.

1.3   Research Problem

The research questions that this study will seek to answer are as follows:
1. What is the current state of the recycling industry in the UK with particular reference to non-kerbside collection recycling schemes?
    a. How aware are people regarding recycling methods other than local authority kerbside collection recycling schemes?
    b. What are people's motivations for using recycling methods other than local authority kerbside collection recycling schemes?
2. Do any correlations exist between the range of recyclable materials collected or the services offered via local authority kerbside collection recycling schemes and the utilisation of alternative recycling schemes?
3. Do any correlations exist between people's usage of local authority kerbside collection recycling services and their usage of alternative recycling services?

2 THEORETICAL FRAMEWORK

2.1 Past Research

Considerable research has been carried out within the field of UK recycling. Government institutions including WRAP (Waste and Resource Action Programme) and DEFRA (Department for Environment, Food and Rural Affairs), private companies with an interest in the waste and recycling industry such as WYGs annual Review of Kerbside Recycling Collection Schemes in the UK (in collaboration with Biffa, Kier, Serco and Plastics Europe) and by numerous academics.

Much of this research has focused on identifying the various factors that influence people's participation in kerbside recycling schemes through reporting on regional differences in recycling rates throughout the UK and attempting to identify any correlations with variables such as demographics, collection methods (i.e. co-mingled, multi streamed etc.), types and size of collections bins/containers, and frequency of collections. According to Sidique, Joshi and Lupi (2010, 243) the majority of research on recycling and waste management can be classed into two categories: 1) studies which utilise community level data and 2) studies which focus on household data, usually based on surveying large groups of householders.

WYG Group (2013) ranked UK local authorities by overall dry recycling at the kerbside rates. It then compared the methods used by the 30 best performing local authorities versus the 30 poorest performing local authorities. The data WYG analysed was obtained via WasteDataFlow, this is an online portal where UK local authorities submit waste collection data to UK central government. The data is available for all to view and analyse. The report identified a number of key differences: the use of co-mingled collections was far more common amongst the top 30 local authorities than the bottom 30 local authorities who tended to favour separate waste stream collections; all 30 of the top performing local authorities collected at least 5 waste materials whereas only 14 of the 30 poorest performing local authorities collected at least 5 waste materials; the top 30 local authorities typically offered fortnightly recycling collections and fortnightly refuse collections whereas the bottom 30 local authorities totally offered fortnightly recycling collections but weekly refuse collections. (WYG Group, 2013, 33-40.)

There has also been considerable research into the Intention-Behaviour Gap and the role that this plays in kerbside recycling participation. Rosenthal (2018, 10) demonstrated that the gap between recycling intention and recycling behaviour is minimised when individuals are already armed with the required recycling knowledge to follow through on their intention validating the important role that knowledge plays in this process. Barr, Guilbert, Metcalfe, Riley, Robinson and Tudor (2013) conducted research into waste-related practices and attitudinal factors to

explore the complexities of how households deal with waste. They found that both internal and external factors play a part and that households interact with materials and 'waste' through different lenses. These lenses framing the household practices may be a part of one's identity, such as the concern for the environment, or a result of household negotiations, the understanding of social norms or the impact of built environment. (Barr, Guilbert, Metcalfe, Riley, Robinson and Tudor, 2013, 71-75.) Halvorsen (2012, 18) undertook an international comparison of 10 OECD countries to understand household recycling practices and how they are affected by varied policy measures.

However, whereas the above mentioned research predominately focuses on people's participation in kerbside recycling, there appears to be little if any research into people's attitudes towards recycling those materials that are not collected at kerbside by many local authorities. The materials in question vary across each local authority as The Household Waste Recycling Act 2003 requires all UK local authorities to have arrangements in place for the collection of at least two types of recyclable waste together or individually separated from the rest of the household waste, UK local authorities were given free will to decide which materials would be collected (Household Waste Recycling Act 2003).

2.2   Incentives, Motivations and Barriers to Recycling

The UK government has a focus on the sustainable management of natural resources through raising the proportion of recycled waste and reducing the amount of waste produced. These measures reduce the amount of waste sent to landfill, therefore reducing the amount of methane emissions, noise pollution and odour whilst preventing groundwater contamination. (Abbott, Nandeibam & O'Shea, 2011, 2214.) Recycling is therefore a priority for the UK government.

Despite the initial rapid growth, recycling rates in OECD countries have begun to plateau (Moloney & Doolan, 2016, 347). Significant regional and intra-regional variations exist in the UK, despite the overall recycling rate improving (Abbott et al., 2011, 2214). Governments have undertaken various policy initiatives to increase recycling rates to meet the desired targets. However, research has proven that household recycling behaviours are extremely complex and this chapter focuses on further examining these complexities.

2.2.1 Influences to Recycling

Moloney and Doolan (2016) categorise influences on recycling into six categories: 1) government finances and household economics; 2) Municipal Solid Waste (MSW) administration and personnel education; 3) technology and human resources; 4) government policy; 5) household education and 6) local recycling market. They have also conducted comparisons on these elements in developed and emerging countries, finding significant differences between the obstacles to recycling. (Moloney & Doolan, 2016, 347.) I will next discuss the above categories with a focus on developed nations to align with my research.

The strain budgetary outfalls can put on MSW systems demonstrates how government finances and household economics can influence recycling. This can be the case if the government is unable to cover any budgetary holes for MSW and when households are unable to afford the MSW fees to cover the necessary costs. Experienced personnel, reliable MSW administration and a Municipal Solid Waste Management (MSWM) plan also contribute significantly to recycling rates. The category of technology and human resources includes the cost of human work force and the effectiveness and availability of technology. Material recovery can be improved through waste characterization, which involves assessing the generation, recovery rates and composition of the waste stream. (Moloney & Doolan, 2016, 348-350.)

Government policy often begins with broader environmental aims and then progresses to the introduction of material recovery policies as social consensus forms over waste mitigation and landfills near their capacity. Local governments usually control the municipal waste policies with a focus on education, punishment, rewards or system enhancement. Household education campaigns aim for optimal material recovery through covering the when, what, how and where of recycling. In addition to household education affecting recycling rates, evidence has shown that the recycling behaviours of an individual can be significantly affected by the actions of family, friends and neighbours. A significant motivator for material recovery is an existing and profitable local recycling market. In order for the market to become sustainable, government incentives or another form of non-market intervention is often required. (Moloney & Doolan, 2016, 347-349.) Although my research examines elements of recycling policies, local recycling market and household education, the main focus of my research is to investigate recycling behaviours.

2.2.2 Household Recycling Behaviours

According to Barr et al. (2013) recycling services have been improved in the developed world over the recent decades but the overall volume of collected materials and the expanding range of materials still causes challenges to local authorities. Consequently, local authorities are further investigating engaging with

individuals to change their behaviour from disposing of items to re-considering waste by creating value. (Barr et al., 2013, 67.) The founding principle of waste management is referred to as the 3 Rs: reduce, reuse, recycle. Various models have expanded upon this adding words such as repair, repurpose, reclaim, refuse and rethink to change the way individuals perceive items they initially regard as waste, leading to a change of habits and a consequent reduction of total waste. In my thesis I have explored not only alternative recycling methods but also reuse methods.

According to a report by the House of Lords Science and Technology Committee (2011) the United Kingdom government has seen the behavioural change of individuals as a key mechanism to delivering targets and has explored different regulatory and non-regulatory policies to achieve this. The non-regulatory interventions have been titled as "nudge interventions", aiming to alter the surrounding context or environment around individuals' choices and influencing behaviour without people noticing the change in their behaviour. Social marketing techniques have also been used for this aim. (House of Lords Science and Technology Committee, 2011, 5-88.) However, Barr et al. (2013, 68) highlight the importance of understanding all the complexities involved in households dealing with waste in their home instead of only focusing on recycling as the standard model for waste management or on setting up frameworks of pro-environmental behaviour. The research they conducted on these complexities lead to a categorisation of six clusters of people:

1) 'The re-users' with a tendency to repair, restore, re-use, sell/donate or store items
2) 'Normative wasters' who make some conscious decisions to re-use or reduce but also recycle fairly large amounts of waste
3) 'Hidden waste managers', utilising the municipal recycling scheme at relatively low levels but undertaking high levels of repairing, restoration and re-using of products as well as utilising dedicated waste collections for composting and recycling
4) 'The refusenics' who exhibit low participation levels for all waste practices
5) 'Conscious consumers and disposers' choose consciously to responsibly dispose of any products whilst choosing to purchase all products with low waste
6) 'Eco-angels' with practices which are environmentally conscious throughout. (Barr et al., 2013, 71-72.)

Barr et al. (2013) concluded that the waste problem cannot be seen resulting from a complete rejection of the environmental cause. The complex waste management practices which households utilise, derive from internal and external factors and the focus should be on the ways households interact with different products and the ever-changing social practices linked to these behaviours. (Barr, 2013, 75.)

Halvorsen (2012) has conducted an international comparison on how policy incentives and norms affect household recycling practices in 10 different OECD

countries. In many cases no incentives or sanctions exist but households still continue to make considerable efforts to dispose of their waste in the correct manner. It is therefore important to evaluate the non-economic motivations linked to household recycling. (Halvorsen, 2012, 18.)

Abbott, Nandeibam and O'Shea (2013) talk about the importance of warm-glow in the success of recycling policies. Clark, Kotchen and Moore (2003, 244) define warm-glow as the intrinsic satisfaction from taking part in an activity. Halvorsen (2008) discusses warm-glow as the positive feeling resulting from making a contribution to a just cause. He has developed a model "to describe how norms affect the recycling decision through feelings of self-respect, guilty conscience, and warm-glow, as well as respect in, and sanctions from, the community". Utilising this model he concluded household recycling efforts are increased through moral and social norms as well as all indicators of warm-glow. (Halvorsen, 2008, 501-502.) It is therefore very clear how important role intrinsic motivation plays in household recycling rates. Abbott et al. (2013) undertook varied modelling of social norms, recycling behaviour, warm-glow and environmental concern with English local authority kerbside provision and recycling volume data to confirm that a social norm effect on recycling exists and that there is also a peer effect, which is particularly strongly linked with age and ethnicity. A link was also found with environmental concern. They concluded that this result would indicate that it may be best for policymakers to focus on social norms instead of other policy measures to increase recycling rates. Measures to activate the social norm would be more beneficial than mandated recycling rates and the responsibility for enforcement and monitoring is shifted to the community. This approach can be more effective as well as reduce costs as a result of decentralisation. (Abbott et al., 2013, 16.)

Halvorsen (2012) describes how following norms affects our welfare and our behaviour through influencing how we feel about ourselves and how we are viewed by others. In his research he found that households with high recycling activity exhibit the following characteristics:

- "strong moral commitment"
- "a high expectation about the effectiveness of recycling to improve environmental quality"
- "a positive attitude towards environmental policies in general". (Halvorsen, 2012, 19-25.)

As individual's underlying preferences and attitudes affect their current behaviour, it can be assumed that information campaigns to change attitudes and norms would be effective. Reaching individuals who do not currently believe in the importance of recycling could be difficult with this method. However, this research concluded that believing recycling is a civic duty and good for the environment was indeed the most significant motivation for household recycling. (Halvorsen, 2012, 25.)

2.2.3 Policy Measures

According to Halvorsen (2012) different monetary incentives and policy measures also affect recycling rates. Improving recycling services, particularly with door-to-door collection and drop-off centres has a positive effect on recycling rates. However, if services for new materials are introduced when the recycling burden is already heavy, this can result in a reduction in recycling rates. To avoid these adverse effects, government recycling programmes should focus around the recycling of the most important materials. (Halvorsen, 2012, 25.)

Messaging around Recycling and Recycling Knowledge

Del Cimmuto, Mannocci, Ribatti, Boccia and La Torre (2014) researched the knowledge base of general population regarding recycling methods, specifically the door-to-door collection system and the street separate collection system as well as their feelings of anxiety concerning the waste and their knowledge regarding the risks related to waste management. Each waste type had specific street containers in the street separate collection whereas for the door-to-door collection system each waste type was collected in specific bags or containers. The research control group continued with the street separate collection system whereas the intervention group received further information and recycled with a door-to-door recycling system. The results demonstrated that the door-to-door system was clearly preferred and more effective. The research concluded that through household education and the consequent recycling knowledge the intervention households were able to recycle more accurately and felt that good waste management was important. (Del Cimmuto, Mannocci, Ribatti, Boccia and La Torre, 2014, 556-561.)

Recycling knowledge is essential for the success of any recycling method. Rhodes, Beauchamp, Conner, deBruijn, Latimer-Cheung and Kaushal (2014) conducted a randomized trial to investigate recycling messaging around 1) planning regarding central depot and community recycling, 2) effect, 3) utility and 4) awareness/instructions. Each randomized trial group received one of the following four types of messaging:

1) "standard instructions" containing general information regarding what to recycle and the differences of kerbside and depot collection
2) "instructions and messaging targeting the utility of depot recycling" containing standard information as well as information regarding the environmental benefits of recycling
3) "instructions and messaging targeting the affective benefits of depot recycling" containing standard information as well as arguments around feeling good about recycling
4) "instructions and directions on how to set plans to perform depot recycling" containing standard instructions as well as a guide for planning the

practicalities of recycling such as when and by whom the recycling is transported and setting up memory prompts. (Rhodes, Beauchamp, Conner, deBruijn, Latimer-Cheung & Kaushal, 2014, 1-3.)

The research included two recycling methods for their different advantages and disadvantages: community depot recycling can have restricted hours but has the benefit of being at a closer proximity whereas large municipal recycling depots have longer opening hours but are removed from the community. (Rhodes et al., 2014, 1-3.). I have included a very broad range of alternative recycling methods in my research to provide a comprehensive an overall picture of the recycling and reuse options available each with their own distinct advantages and disadvantages.

As a result of this trial there was a significant increase for both depot recycling methods over the first four weeks and the increased results were still there for the recycling at the municipal depot at the end of the trial at 8 weeks. However, for community depot recycling the initial effect waned by the end of the trial period. (Rhodes et al., 2014, 1.) The positive results demonstrate the importance of recycling knowledge and the messaging around recycling. I will examine the knowledge based and the received recycling messaging in my research. According to Rhodes et al. (2014) the research also found that there were significant moderators for the effect. If the baseline recycling behaviour was low, the change to recycling behaviour was greater. Community recycling was higher if households access to a car was low. The closer the community recycling depot was, the greater the recycling rate. (Rhodes et al., 2014, 1.) Some of these moderators reflect the practical elements linked to household recycling and I will also examine these factors in my research.

Approaches to Recycling

Kerbside collection is the primary method of collecting recyclable materials form households within the UK. Abbott et al. (2011) conducted research covering all 434 local authorities in the UK to examine the recycling rates. Their research aims focused on four specific areas: 1) examining the regional and intra-regional variations to recycling rates, 2) studying composting rates and dry recyclables separately, 3) investigating how the quality and quantity of kerbside recycling scheme can improve recycling rates and 4) determining how household recycling rates are impacted by residual waste collection. Their research highlighted the importance of the chosen recycling method and also found a relationship between recycling rates and the frequency of the residual waste collection. The results demonstrated that higher recycling rates can be achieved through lower residual waste collection frequency as this incentivises households to sort their waste between non-recyclables and recyclables. The research also proved that the container or recycling method impacts dry recycling more than it impacts composting and that for recycling rates the method of residual waste collection is unimportant. (Abbott et al., 2011, 2214-2222.)

The recycling rates in the UK have improved through kerbside recycling (Abbott et al., 2011, 2222). Baird, Curry and Reid (2013) have researched the factors affecting the municipal kerbside yield in order to evaluate the efficacy of municipal kerbside model to inform the design and development of kerbside recycling programmes. They focussed on some of the key elements of recycling and waste infrastructure, such as the collection frequency and the container capacity. The research concluded that 80% of the yield variability of the principal recyclate services is linked to three main factors: the number of materials collected, the weekly residual waste and recycling capacity. (Baird, Curry and Reid, 2013, 306-313.)

Sidique, Lupi and Joshi (2013) have researched drop-off recycling sites with a focus on site characteristics and travel costs. Drop-off sites can be defined as designated sites where the recyclers drop off and dispose of their recyclables in categorised containers for the range of materials accepted at the site. (Sidique, Lupi & Joshi, 2013, 339.) Drop-off sites are widely used in UK and come in many forms, I have therefore included several types of drop of sites within my research. This recycling method is very cost effective for local authorities to run as the recyclers incur any travel costs and the labour costs are reduced. Sidique et al. (2013) concluded from their research how important the location of the drop-off site is as increased travel costs resulted in a significant reduction in frequency of visits. They also found that the site characteristics, such as the number of accepted recyclables and whether commingled recyclables and yard-waste were accepted affected the frequency of visits. The practical aspects such as the hours of operation were also found to be significant. (Sidique et al., 2013, 339.)

In addition to this, I looked at many other methods of recycling or reuse to gain a comprehensive and overall understanding of peoples' attitudes towards and usage of a broad variety of recycling and reuse methods. Other methods considered included: charity shops, in-store deposits, reverse vending machines, return postage services, exchanging or selling goods through retailers, selling goods privately and giving goods away to family and friends.

Monetary Incentives

Monetary incentives have been used internationally as a means to motivate households to recycle. According to Halvorsen (2012) the results of monetary incentives have been mixed. It is vital that monetary incentives are carefully considered as there is a risk that the monetary incentives may crowd out the voluntary contributions motivated by moral intentions. (Halvorsen, 2012, 25.) Abbott et al. (2013) refer to Kreps (1997) highlighting that supporting the voluntary nature of the desired behaviour should be the focus of economic incentives in order for them to be complementary to the intrinsic incentives (Kreps, 1997, referenced from Abbott et al., 2013, 16).

Abbott et al. (2011) refer to the provision of kerbside recycling service as the key initiative for encouraging recycling. Conventionally the focus on explaining the demand for recycling services and waste disposal has revolved around the price customers are charged for waste collection. However, in the UK the funding for recycling services and residual waste collections is generated through property taxes, council tax and a central government grant as local governments are not allowed to charge for waste collection. Consequently, no monetary incentives exist for households to increase their recycling rates or minimise their waste production. Improving recycling rates through financial measures has been directed at local authorities with policies such as the introduction of a two-tier landfill tax along with a scheme of landfill allowances. (Abbott et al., 2011, 2215.)

Although the focus is often on individuals and their recycling efforts, waste management is a shared process including manufacturers and producers, retailers, local authorities, consumers and the waste management industry. This is where monetary incentives may play a larger role, encouraging the industry to further focus on environmental sustainability through more effective waste management through recycling practices and production methods as well as enhancing their approaches to reusing and reducing materials.

2.3   Methods of Recycling

2.3.1 Kerbside Collection

In July 2020, the UK government also confirmed that it would be transposing the EU's Circular Economy Package into UK law. This will commit the UK recycling 65% of municipal waste by 2035 and aims to reduce municipal waste going to landfill to 10% by 2035 (Circular economy measures drive forward ambitious plans for waste, 2020). The UK also confirmed that it's departure from the EU will not impact upon the recycling targets that have been set. The UK is bound by the previous legislation, EU Directive 2008/98/EC on waste. This directive states that by 2020, 50% of waste materials from households and other origins similar to households will need to reused or recycled (Directive 2008/98/EC of The European Parliament And Of The Council, 2008). Between 2001 and 2010 the UK's recycling rate increased by more than any other EU country, from 12% to 39%, an increase of 27% (European Environment Agency, 2013). This is a title that the UK held on to until 2014 when it's recycling rate reached 43.4% versus just 11.1% in 2000 representing a remarkable 32.3% improvement. However, since 2014 recycling rates have stagnated varying between 43.3% in 2015 to 44.1% in 2018 (the latest data available as of 4/10/2020) and the UK has dropped from a peak of 8th highest recycler in the EU in 2012 to 13th in 2018 (EuroStat, 2021). These figures have

understandably lead to fears that despite the great progress that has been made, the UK may now struggle to achieve the 50% target set out by Directive 2008/98/EC yet alone the more ambitious target of recycling 65% of municipal waste by 2035.

However, the picture is quite varied between the four nations within the UK in regards to both recycling ambitions and results to date as each devolved government is responsible for setting its own targets and implementing its own recycling strategies. For example there have been no recycling targets imposed upon English local authorities with ministers stating that "it is for local authorities to decide what aspirations on recycling are appropriate for their area" (Appleyard, 2011), whilst in contrast to this Wales have set ambitious goals exceeding those of the EU and impose these targets on individual local authorities, failure by a local authority to achieve the set target can result in large fines (LetsRecycle, 2015).

Please see Table 1 below for details of recycling rates and targets of each of the devolved nations in the UK. These figures represent the total recycling, composting and preparing for re-use of waste from households.

Country	2019 Population*	Proportion of UK Population (%)	2018 Recycling Rates	2020 Target	2025 Target	2035 Target
European Union	N/A	N/A	41.8%	50.0%	N/A	65.0%
United Kingdom	66,796,807	100%	45.0%	50.0%	N/A	65.0%
England	56,286,961	84%	44.7%	50.0%	N/A	65.0%
Scotland	5,463,300	8%	42.8%	60.0%	70.0%	N/A
Wales	3,152,879	5%	54.1%	64.0%	70.0%	N/A
Northern Ireland	1,893,667	3%	47.7%	50.0%	N/A	N/A

* Please note the reporting period of England and Scotland is from 1st January to 31st December. The reporting period for Wales and Northern Ireland is from 1st April to 31st March. As such, the data in the above data is not directly comparable. For ease of reading, the above table combines both reporting periods in to one category e.g. 1st January 2013 – 31st December 2014 and 1st April 2013 – 31st March 2014 are both treated as 2013.

* Population estimates for the UK, England and Wales, Scotland and Northern Ireland: mid-2019, using April 2019 local authority district codes (2019).

Table 1 Recycling rates and targets for the devolved nations in the UK

These diverse approaches to how many and what type of materials are collected as well as the lack of imposed targets on local authorities within nations other than Wales may provide some insight in to the differing levels of variance in recycling rates that can be witnessed between local authorities within each devolved nation as per Table 2 below.

Region	Lowest Recycling Rate (2018)	Highest Recycling Rate (2018)	Variance	Reference
England	17% Newham London Borough Council	65% East Riding of Yorkshire Council	48%	Statistics on waste managed by local authorities in England in 2018/19 (2019)
Scotland	10.5% Shetland Islands	65.2% West Lothian	55%	Scottish Household waste – summary data 2018, p2 (2019).
Wales	58.9% Carmarthenshire and Newport	69.9% Isle of Anglesey	11%	Annual reuse/recycling/composting rates by local authority (n.d.)
Northern Ireland	44.3% Derry City & Strabane	56.1% Antrim & Newtownabbey	12%	Northern Ireland Local Authority Collected Municipal Waste Management Statistics Annual Report 2018/19 (2019).

Table 2 Variance of recycling rates within devolved nations in the UK

In Wales, 2018 recycling rates ranged from 58.9% in Carmarthenshire and Newport to 69.9% in Isle of Anglesey, an 11% variance ("Annual reuse/recycling/composting rates by local authority", n.d.). In England however, recycling rates vary from 17% in the London Borough of Newham to 65% in East Riding of Yorkshire Council, an enormous 48% variance (Defra, 2019). An example of the impact that a change in the type of recycling system employed by a local council can have on recycling levels is well demonstrated by Ashford Borough Council which increased its 'household waste' recycling rate from 12% to 42% from 2012/13 to 2013/14, following the introduction of new recycling arrangements which includes green recycling (Kane, 2014).

2.3.2 Waste Electrical and Electronic Equipment (WEEE)

Waste Electrical and Electronic Equipment (WEEE) is stream of waste that applies to most products that have a plug or need a battery. It is estimated that 2 million tonnes of WEEE items are discarded by UK householders and companies every year. The WEEE regulations categorise WEEE waste into 10 broad categories and large household appliances which includes items such as fridges and washing machines account for over 40% of WEEE. ("Waste Electrical and Electronic Equipment recycling", n.d.).

Due to WEEE being such a significant waste stream, it has its own specific targets that differ to that of the general waste stream. EU regulation specifies that as of 2019, either a minimum of 65% of Electrical and Electronic Equipment (EEE) put on the market should be collected separately from other waste streams (based on the average weight of WEEE placed on the market over the past 3 years) or that 85% of Electrical and Electronic Equipment generated by a country is collected separately to other waste streams (Summary document of the Waste electrical and electronic equipment rates and targets, 2, n.d.). Further targets are present for sub categories of WEEE. This legislation was transposed in to UK law via the Waste Electrical and Electronic Equipment Regulations 2013.

As defined in schedule 11 (24) of the legislation (Waste Electrical and Electronic Equipment Regulations 2013), WEEE is further broken down into 10 sub-categories and each sub-category has its own specific target. Sub-category targets have increased over the years but as of 2019, only 6 of these 10 categories now have specified targets within the UK.

To assist the UK government in achieving these targets, both producers and distributors of EEE are required to fulfil certain obligations. If producers place less than 5 tonnes of EEE on the UK market per year they can simply register themselves as a small producer with the environmental regulator. If however, they exceed this amount they need join a producer compliance scheme (PCS) that will require a financial contribution that contributes to cost of collecting and treating EEE waste in an environmentally friendly manner (Regulations: waste electrical and electronic equipment, 2021). Distributors are required to accept receipt of like for like WEEE from customers free of charge when if they are purchasing a new product even if the purchase was made online. Larger retailers (sales area of EEE greater than 400 square meters) must also accept small WEEE (less than 25 cm on its longest side) completely free of charge from members of the public regardless of whether they are customers or not, providing it relates to private households and not commercial or industrial waste (Regulations: waste electrical and electronic equipment, 2021).

Smaller businesses who sell less than £100,000 per year can avoid obligation this by join the Distributor Takeback Scheme (DTS) from 1 January 2021 (Regulations: waste electrical and electronic equipment, 2021). The UK's Distributor Takeback Scheme (DTS) is operated by Valpak. To join the DTS a fee is due, the fee is determined according to the total value of all EEE sold in the most recent year. The money raised goes towards supporting local authorities to increase WEEE collection rates (DTS Information, n.d.).

"Consumers are not entitled to free collection of WEEE through these regulations. A distributor, local authority or a producer may choose to offer collection as part of their customer service either free of charge or on payment of a reasonable fee, to cover transport and handling costs" (WEEE Regulations 2013, c. 7, 2014).

2.3.3 Home Composting

Home composting within the UK was traditionally seen as a horticultural recreational activity undertaken by keen gardeners. However, since the introduction of various EU legislation it has gained attention for the huge potential it offers in assisting to meet such legislation (Ankidawa & Nwodo, 2012). EU Landfill Directive (1999/31/EC) which requires all Member States to reduce the amount of biodegradable municipal waste that they landfill to 35% of 1995 levels by 2016 (for some countries by 2020) with a range of intermediary targets up to this point (Biodegradable waste, n.d.)). This legislation has been transposed into UK law via The Landfill (England and Wales) Regulations 2002. As the UK started from a point where over 80% of this waste was being landfilled in 1995, the UK was one of the countries allowed a four-year exemption on these targets. The full list of targets is shown below:

- By 2010 reduce the biodegradable waste landfilled to 75% of that produced in 1995.
- By 2013 reduce the biodegradable waste landfilled to 50% of that produced in 1995.
- By 2020 reduce the biodegradable waste landfilled to 35% of that produced in 1995. If by 2016, the target can be reached, the derogation will not be used for this target. (Landfill Directive 1999/31/EC.)

As of 2018 biodegradable municipal waste (BMW) sent to landfill had fallen to 20% of the 1995 baseline level (Fisher, 2020, table 2.2).

The UK government also aims to phase out the use of peat in horticultural activities by 2030, with three intermediary targets up to this point, as detailed below:

- A progressive phase-out target of 2015 for government and the public sector on direct procurement of peat in new contracts for plants;
- A voluntary phase-out target of 2020 for amateur gardeners; and
- A final voluntary phase-out target of 2030 for professional growers of fruit, vegetables and plants

(The Natural Choice: securing the value of nature, 2011). The use of compost as a substitute material by itself or as a blend with other materials plays a key part in this phasing out of peat. (Bek, Lennartsson-Turner, Lanari, Conroy & Evans, 2020).

Finally, the UK charges two rates of Landfill Tax aimed at making alternative methods of waste processing more appealing. A lower Landfill Tax of £3.10 per tonne is charged for inactive waste such as soil and rock. A standard landfill tax rate of £96.70 per tonne is charged for active waste such as biodegradable waste (Environmental taxes, reliefs and schemes for businesses, n.d.). Boulding and Barker (2021) state that as a result, the average gate fee including tax charged for disposing of waste at a landfill in the UK for the year 2019-2020 was £116 per tonne, in contrast to this the average gate fee charged for disposing of organic waste via alternative methods were as follows:

- In-Vessel Composting (IVC): £37 per tonne
- Anaerobic Digestion (AD): £35 per tonne
- Energy from Waste (EfW): £93. (Boulding & Barker, 2021.)

As such, there is considerable incentive for UK local authorities to target the biodegradable waste stream. According to the UKs latest statistics on waste, biodegradable municipal waste (BMW) represented 49% of the municipal waste that was sent to landfill within the UK (Fisher, 2020, table 2.2). This demonstrates that there is still much to be done to tackle this waste stream.

In addition to the above legislation and as mentioned earlier, the UK is bound by EU Directive 2008/98/EC on waste. This directive states that by 2020, 50% of waste materials from households and other origins similar to households will need to be reused or recycled, compositing also falls within the accepted materials. As such low organic recycling rates are often a key contributing factor to lower overall recycling rates reported by local authorities. This is a significant factor that often leads to inner city areas reporting lower overall recycling rates. According to the European Environment Agency, low collection rates of biodegradable waste is the most important cause of the low total recycling rates for Inner London and it is almost 4 times lower than the next poorest performer, the report attributes this partially due to lower generation of garden waste amongst other factors (Watson, 2013, 10-12).

Local authorities who address the waste stream typically do so in one of two ways, either through offering a collection service or through promoting home composting. Home composting is arguably the preferential option due to reduced transportation, processing and disposal costs.

According to WRAPs Promoting home composting report, on average home composting diverts 150kg of biodegradable waste per household per annum. They also advise, that for every household that purchases of compost bin there will be an annual lapse rate of 3.9% (Promoting home composting, n.d.).

Approximately 75 % of local authorities provide subsidised compost bins in order to boost home composting rates, however, as it is not possible to quantify with certainty how much waste has been diverted, home composting is not recognised by the government when determining recycling rates (Smith & Jasim, 2009).

2.3.4 Recycling Banks

Wrap defines bring recycling sites as: "areas in car parks and on streets, at which local authorities or third parties, provide containers ("banks") for the public to deposit recyclable materials" (SKM Enviros, 2013). Recycling Banks experienced a peak usage rate in 2007/2008 and since this time, usage has slowly declined in line with an increase in the use of kerbside recycling services. In tandem with this, the number of recycling banks has also decreased year on year since 2006/2007. A significant benefit of recycling banks is that they are relatively low cost to operate

and due to having separate recycling banks for each material they typically suffer less from contamination than co-mingled kerbside recycling schemes. In addition to this, further advantages of recycling banks are that they provide households with a means to recycle materials that are not offered via kerbside recycling service (e.g. textiles, books, media, WEEE); provide households who do not receive a kerbside recycling service with a means to recycle (typically residents situated in high rise apartments); provide households with a means to recycle surplus materials in-between kerbside collection dates. However, some of the disadvantages associated with the use of Recycling Banks is that they often suffer from fly tipping, vandalism, use by trade and the presence of rogue recycling banks which often impersonate legitimate charities (SKM Enviros, 2013).

2.3.5 Civic Amenity Sites

Civic Amenity (CA) sites which are often also referred to as Household Waste Recycling Centres (HWRCs) are typically large sites operated by local authorities or an appointed contractor than can accept a wide range of materials and are capable of dealing with large volumes of waste. The National Assessment of Civic Amenity Sites (NACAS) report recommends that HWRCs are located within a catchment radius of no more than three miles in urban areas and seven miles in rural areas (Household Waste Recycling Centre Guide, 2018).

Recycling rates at HWRCs have improved significant over time with contractors and local authorities placing ever greater emphasis on this aspect and households being far more engaged with recycling. Data specific to this waste stream is unfortunately only available up to 2013/2014, however, up to this point there was relatively little change in in the composition of materials deposited at HWRCs and the contribution that HWRCs made to overall household recycling rates. Garden waste followed by wood represent the greatest tonnage of materials disposed of at HWRCs and HWRCs accounted for approximately 25% of waste recycled by local authorities (Household Waste Recycling Centre Guide, 2018).

Many HWRCs are also able to accept small materials such as s CDs, printer cartridges and books, these are often collected by charities to create additional income. As new recycling market develop there is also the opportunity for HWRCs to collect ever more niche waste materials that can be sold to these developing recycling markets (Household Waste Recycling Centre Guide, 2018).

2.3.6 Reverse Vending Machines

In 2019, the UK government began consulting on plans to roll-out a deposit return scheme throughout England, Wales and Northern Ireland in 2023 for single use plastics. A similar scheme is already planned commence in Scotland ahead of this target (Introducing a Deposit Return Scheme (DRS) in England, Wales and Northern

Ireland: Executive summary and next steps, 2019). This scheme is likely to operate through the use of reverse vending machines.

Reverse vending machines are a niche concept in the UK and are very limited in quantity especially when compared to those countries who have long established Container Deposit Legislation (e.g. Finland, Germany, Sweden, Austria etc.). Due to the lack of any Deposit Legislation in the UK this initiative has been led by the private sector, mainly by two key companies; Tesco Plc (the UK's leading supermarket in terms of market share) and IKEA.

Reverse vending machines in IKEA are limited to accepting old light bulbs and in exchange IKEA will donate a small sum of money (£0.10) to one of its four chosen charities which the customer can select or alternatively offer customers a free coffee (Reverse Vending Machines – Ikea, 2018). Statistics detailing the success of these machines is not available, however in 2012 shortly after launching the scheme, IKEAs Sustainable Development Manager, Charlie Browne, stated in a presentation that they were receiving approximately 300 light bulbs per month but expected this to increase over time (Light Bulb Recycling Reverse Vending Machine (n.d.).

There is limited information available on Tesco's Automated Recycling Machines. The latest official information concerning the scheme comes from a 2012 Tesco Factsheet which states "There are more than 100 automated recycling machines at our UK stores and every year, three million of our customers use them. The machines help you recycle cans, glass and plastic bottles more efficiently: compacting the waste on the spot and saving seven times more vehicle miles than conventional recycling bins." The incentives given out by Automated Recycling Machines have changed over time. Tesco operate a loyalty scheme where consumers can earn points for spending at Tesco. One point is equivalent to £0.01. Originally Tesco's Automated Recycling Machines rewarded customers with points for recycling any of the accepted materials, however due to misuse (citing examples such as customers cutting plastic bottles in half to double their points) and changes in the value of recycled goods, customers are now only rewarded with one point for every two aluminium cans they recycle (Quilter, 2009). All other materials are however still collected but no reward is given to the customer. Whilst there has been no official communications, these units now appear to have been removed from all stores.

There are a limited number of other reverse vending machines located throughout the UK. These typically consist of pilot schemes or small scale schemes to help promote the environmental credentials of some organisations. To date there has not yet been a full-scale role-out for a large retailer within the UK.

2.3.7 Battery Box at Shop

The EU Batteries Directive came into force on 26th September 2009 and states that producers of batteries and accumulators or products containing either batteries or

accumulators are responsible for the waste management of the batteries or accumulators that they produce. The EU Battery Directive requires that Member States achieve minimum collection rates of 45% from 26 September 2016 onwards (Directive 2006/66/EC of the European Parliament and of the Council of 6 September 2006). The UK transposed the EU Batteries Directive into the UK Waste Batteries and Accumulators Regulations 2009 (Batteries Regulations, n.d.). In 2017 and 2018 the UK narrowly failed to achieve the 45% target, however 2019, the UK did indeed achieve a battery and accumulator recycling rate of 45.36% (UK Portable Batteries Data Summary for Quarter 1 of the 2021 Compliance Period: Update, 2021). Full data is not yet currently available for 2020 as these are typically published in June the following year, however based on current projections the UK appears to be on track for improving upon this figure (Gaubert, C., 2020). Consultations are currently taking place within the EU as to whether this target should be raised to 65% from 2025 onwards and 70% from 2030 onwards (Smulian, 2020). It is not yet clear if UK will aim to match the levels (Langley, 2020).

The UK Waste Batteries and Accumulators Regulations 2009 legislation applies to any retailer or distributor who supplies or sells 32kg or more of portable batteries a year. In such cases these sellers must provide customers with a collection point where they can dispose of their used batteries and ensure that there is information in store notifying customers of this option (Battery waste: retailer and distributor responsibilities, n.d.). The batteries will then be collected free of charge by one of the five Approved Batteries Compliance Schemes (BatteryBack; ecosurety, ERP UK Ltd, REPIC; Valpak Ltd) who are then responsible for ensuring that the batteries are recycled (Batteries Compliance Schemes (n.d.).

2.3.8 Posting Items to Organisations for Reuse

Within the UK there are many established businesses that specialise in the reuse of mobile phones, ink cartridges and toner cartridges. Such businesses operate by encouraging consumers to post in their disused mobile phones, ink cartridges and toner cartridges where the business then prepares the items for reuse. These businesses typically provide consumers with a prepaid envelope or postage label and can offer a variety of incentives including direct financial payment, vouchers / discounts of future purchases or a promise to donate a proportion of funds to a charity. Such services are highly beneficial to the environment as it is far more efficient and less wasteful to reuse an item than to recycle it or send it to landfill.

Following a decision by the European commission to expand the scope of the WEEE directives, as of 2016, ink cartridges and toner cartridges were re-classed as WEEE, having previously been classed as consumables (Whittaker, 2015). As such all, three of the above items are now subject to the relevant WEEE regulations. However, the UK environmental agency has confirmed that ink cartridges and ink toners sent for refilling and reuse will not be counted as waste and therefore will not

count towards achieving the UK's national WEEE recovery targets. Only when an ink cartridge or toner cartridge is deemed not fit for reuse and then disposed of, will it become subject to WEEE regulations (Waste ink and toner cartridges (n.d.).

In addition to the above specialist companies, the majority of major printer manufacturers and mobile phone operators also offer their own take-back schemes free of charge and often offer a financial incentive. Printer manufacturers offering such services include: HP; Samsung; Brother; Lexmark; Xerox; Canon (Recycling Empty Ink and Toner Cartridges, n.d.). In the UK over 65 million printer cartridges are sold each year and of these it is estimated that 15% are recycled or reused (Reasons Why We Recycle Cartridges (n.d.). This is roughly in line with estimates published by Cash for Cartridges who estimate that 60 million printer cartridges are sold each year in the UK and of which only 10% are recycled (https://www.cashforcartridges.co.uk/why-recycle).

The mobile phone manufacturer Apple also offer a postal take-back scheme and offer store credit in return (Turn the device you have into the one you want (n.d.). In addition to mobile phone manufacturers, the UK's three largest mobile phone operators (O2; EE; Vodaphone) which together account for 75% of the UK market share (O'Dea, 2020) all offer free postal take-back schemes. O2 operates a scheme called O2 Recycle which has existed since 2009. According to O2 (2019) in the ten years this scheme has run they have received over 3 million devices from 2.7 million consumers and have paid out £226 million to customers who returned their devices. Of these 3 million devices, approximately 95% were reused back in to the market (Green, 2019).

According to a study by Ongondo and Williams (2011) over 100 mobile phone voluntary take-back schemes are operating in the UK. Approximately 83% of these schemes are operated for profit or to raise funds for charities with the majority of the schemes utilizing pre-paid postage to collect mobile phone handsets. (Ongondo & Williams, 2011, 1307.) Ongondo and Williams (2011) consolidated their findings in Table 3.

Key characteristics of voluntary mobile phone takeback schemes in the UK.						
	Charities	Retailers	Network Operators	Manufacturers	RRR	Totals
Number of schemes	28	8	8	4	54	102
Collection methods						
Freepost	27	5	8	4	37	81
Post	0	3	0	0	2	5
Courier	8	0	0	0	23	31
In-store	4	2	6	1	2	15
Incentives offered						
Charity donation	28	3	6	0	9	46
Free postage	27	5	8	4	37	81
Envelopes, bags, boxes	22	3	6	1	26	58
Courier collection	8	0	2	0	23	33
Monetary payment	2	2	2	0	39	45
Discounts, store credits	0	1	1	0	2	4
Prize draws	1	0	1	0	0	2
Environmental incentive	0	0	0	0	1	1
Mobile phone airtime	n/a	n/a	3	n/a	n/a	3
Mobile phone bill discount	n/a	n/a	1	n/a	n/a	1
Target groups						
Individuals	28	8	8	4	32	80
Businesses	9	1	3	0	20	33
Education* and clubs	4	0	0	0	17	21
Charities	n/a	0	0	0	15	15

The integers in the table represent the number of schemes that exhibit a particular aspect. For instance, 27 charity schemes offer free postage; totals add across the rows; n/a = not applicable; *= schools, colleges and universities.

Table 3 Mobile phone collection, reuse and recycling in the UK (Ongondo and Williams, 2011).

Mobile phones are included within WEEE Directive (2012/19/EU) under category 6 of Annex III. This states that from 15 August 2018, 75% of mobile phones should be recovered and 55 % should be prepared for re-use and recycled (Directive 2012/19/EU of the European Parliament and of the Council of 4 July 2012 on waste electrical and electronic equipment (WEEE), annex V).

However, a study by Geyer and Blass (2010) suggest that mobile phone recycling practice typically crush and smelt mobile phones prior to disassembly and then focus on recovering copper and precious metals which constitute only 12%-19% of the total mobile phone material. They suggest that in order to achieve the WEEE targets, mobile phones would need to be disassembled first and may even require a redesign of mobile phone handsets. The authors highlight that due to WEEE directives applying to overall categories this is unlikely to happen as efforts will focus on other larger pieces of equipment within this category. (Geyer & Blass, 2010, 515-525.)

2.3.9 Private Sector Used Goods Market

The private sale and purchase of second hand goods is a well-established and thriving sector within the UK. According to Marketing Weekly, seven out of 10 shoppers have purchased second-hand books, with DVDs and CDs also proving

popular (Chahal, 2013). The industry has previously encompassed large online market places such as eBay and Amazon; high street based entertainment retailers such as Game and CDex; and traditional but still widely utilised car boot sales. However, recently several well-known large retailers including Asda, Primark, Selfridges and M&S have also offered a clothing take-back scheme, with Asda teaming up with specialist wholesaler Preloved Vintage Kilo to resell used clothing in its stores. In 2019, Ikea also commenced a buy back a resell scheme for its furniture (Asda: George Brand to Sell Second-hand Clothing in Shops, 2020). There has been a particularly large increase in the online purchase and sale of used goods in the UK during COVID-19 lockdowns with eBay reporting that in June 2020 there was a 1,211% increase in the sale of second hand goods compared to the June 2018 and 404% year-on-year increase from 2018 to 2020 (Wightman-Stone, 2020).

2.3.10 Charity Shops

It is estimated that there are 11,209 charity shops operating within the UK representing 3.65% of all retail units. These charity shops diverted 339,000 tonnes of textiles from landfill or incineration in 2018/19 and in doing so they are estimated to have saved local authorities £31m annually in reduced waste disposal costs. Through this diversion of textiles from landfill or incineration, charity shops generated a profit of £331m in 2018/19 for parent charities (Key statistics, n.d.). A market analysis by Charity Retail Association, which looked at sales at the 5,315 shops run by the umbrella body's members, revealed that in the last three months of 2019 average weekly sales reached their highest point since 2014 (Cooney, 2020). 67% of people within the UK have purchased items from a charity shop (Chahal, 2013).

Within the charity shop sector, textiles are divided into two grades, higher grade textiles are sold on directly to members of the public and lower grade textiles are sold on to textile merchants for recycling or preparation for reuse, the latter grade are referred to as "Charity Shop Grade" (CSG) or "Rag". In 2017, the estimated amount of CSG textiles recycled from households through charity retailers was 137,000 tonnes, equivalent to 5.4kgs per UK household. The amount of textiles from households recycled through the local authorities from kerbsides, local authority managed recycling banks and civic amenity centres was 119k tonnes (Castresana, 2018).

2.3.11 Council Collection (Bulk / Large Items)

Most local authorities offer some form of bulky waste collection; some may charge a fee whereas others may offer a limited annual quota of free collections per household. Bulky waste refers to any article that exceeds 25kg in weight and/or does not fit into either the receptacle for household waste as provided by the local

authority or cylindrical container 750 millimetres in diameter and 1 metre in length. Common articles falling into this category include large items of furniture, white goods (e.g. fridges; washing machines) and bicycles.

A 2012 study by Wrap found that residents disposing of particularly large items that are difficult to transport such as sofas, mattresses and beds were far more likely to utilise local authority bulky waste kerbside collection services than they would for other large items such as TVs, carpets and wardrobes where households are more likely to transport the items to their local HWRC themselves (Composition and Re-use Potential of Household Bulky Waste in the UK, 2012). The study also indicated that of the bulky waste processed, approximately one third derived from kerbside collection and two thirds was deposited at HWRCs directly. The study found that bulky waste collections represented 2.5% of the materials collected via kerbside collections. Based on weight, furniture was by far the most prevalent material collected at kerbside accounting for 52.3%, followed by textiles (20.9% and WEEE (16.9%) (Composition of Kerbside and HWRC Bulky Waste, 2012, 20). A further Wrap study assessed the condition of bulky waste that collected via kerbside collection and estimated that 33% was in good enough condition to be reused as it was (Bulky Waste Collections, 2012).

3 RESEARCH METHODOLOGY

3.1 Aims and Research Questions

This Master's thesis aims to identify correlations between awareness, knowledge and usage of local authority kerbside recycling services versus that of alternative recycling services provided by the private sector and third sector. The research also aims to explore key motivations for utilising private and third sector recycling services. This Master's thesis is focused on the UK market. Within the UK, the Household Waste Recycling Act 2003 requires all UK local authorities to have arrangements in place for the collection of at least two types of recyclable waste together or individually separated from the rest of the household waste (Household Waste Recycling Act 2003). I will include all private and third sector recycling services known to me within the research in order to gain an overall understanding of the UK recycling market as a whole. This research also aims to find a means to accurately determine knowledge levels concerning kerbside recycling to identify how this may correlate with private sector and third sector recycling awareness, knowledge and usage.

The research questions were defined as:

1. How aware are people regarding non-kerbside collection recycling schemes?
2. What are people's motivations for using non-kerbside collection recycling schemes?
3. Do any correlations exist between the range of recyclable materials collected via a resident's local authority kerbside collection scheme and the utilisation of alternative recycling schemes by the respondent?
4. Are respondents who indicate that there are factors present that hindered their ability to recycle via local authority kerbside recycling more or less likely to utilise alternative recycling methods?
5. Do any correlations exist between people's awareness, knowledge and usage of their local authority kerbside collection services and their awareness, knowledge and usage of alternative recycling methods?

3.2   Research Strategy

Creswell and Creswell (2018) state that research approaches are often divided into quantitative, qualitative and mixed methods. However, the divisions are not rigid as these approaches exist on a continuum with mixed methods in the middle, incorporating elements of both approaches, and quantitative and qualitative approaches at the opposite ends. (Creswell & Creswell, 2018, 51.) This research involves elements of both approaches and can therefore be defined as a mixed methods research. The primary research involves a questionnaire where the majority of data is quantitative. Similarly the secondary documentary research is primarily quantitative, focussing on the statistical numeric data provided on Waste Data Flow. However, elements of the questionnaire, such as the free text boxes, involve the qualitative data and a qualitative analysis approach.

Lichtman (2017) discusses the differences between the qualitative and quantitative approaches. The quantitative approach focuses on generalisations and hypothesis testing through laboratory experiments or large scale surveys whereas qualitative research aims to understand phenomena and human interaction through studying humans in their natural settings. Quantitative research revolves around isolating and manipulating variables whereas in qualitative research understanding the phenomena as a whole is key. (Lichtman, 2017, 6.)

Mixed methods research appeared to be the most suitable option for my research as I was interested in conducting a large scale survey but also wanted to examine the reasons behind individual respondent's behaviour. According to Saunders, Lewis and Thornhill (2007) both quantitative and qualitative data collection techniques and analysis are utilised in mixed methods research either one after another in a sequential manner or at the same time in a parallel form. However, these methods are not combined, differing from the mixed model research approach. (Saunders, Lewis & Thornhill, 2007, 143.) In my research the mixed methods approach was utilised as described above.

Utilising mixed methods provides multiple benefits to the research. Different methods can be used for different purposes in the same research whilst the triangulation of methods can help determine whether the data is telling the researcher what they think it is telling them, providing greater confidence of research conclusions (Saunders et al., 2007, 139-147). These advantages applied to my research and enabled my research to be more thorough and reliable.

3.3   Data Collection

3.3.1 Survey Research

Survey strategy is commonly used in business and management research (Saunders et al., 2007, 138). According to Creswell & Creswell (2018, 61) "survey research provides a quantitative or numeric description of trends, attitudes, or opinions of a population by studying a sample of that population". Correctly designed and administered survey can provide inferior data compared to other sources through 1) probability sampling, which mitigates research bias and enables estimating the accuracy of data, 2) standardised measurement, providing comparable and consistent data across all respondents and 3) special-purpose surveys, meeting the required analysis needs to enable the analysis of related variables (Fowler, 2012, 5).

Surveys are a cost effective way to collect a large amount of data from a sizeable population, allowing easy comparison of standardised data. However, due to there being a limit to the number of questions that can be asked in a questionnaire, the data collected through this method may not be as wide-ranging compared to other methods. (Saunders et al., 2007, 138). This highlights the importance of a carefully designed questionnaire. Despite its limitations, I feel that the survey strategy with administering questionnaires to a sample population was the most suitable for investigating household recycling behaviours, providing descriptive statistical data for the recycling behaviours of the researched population.

Sampling

Sapsford (2011) states that choosing to use a sample population instead of surveying the whole population is a commonly used practice in research. There are many reasons for this choice: 1) the time and cost involved in surveying the whole population would not be feasible, 2) issues with coverage as very large surveys can only ask for very limited data and 3) the training requirement for conducting very large surveys not being met. (Sapsford, 2011, 7.) Research literature divides sampling methods into random/probability sampling and non-probability sampling (Saunders et al., 2007, 207; Balnaves & Caputi, 2011, 93-96; Stacks & Michaelson, 2010, 115; Walliman, 2018, 109; Creswell & Creswell, 208, 247). For this research I wanted to ensure that I would get a relatively large number of responses. According to Saunders et al. (2007) a widely used non-probability sampling method of convenience sampling involves utilising the cases that are easiest to obtain. For research questions that do not require statistical generalisations of the characteristics of the population, non-probability sampling methods can be used. (Saunders et al., 2007, 234.)

The questionnaire was published online and participants were invited to participate through electronic mediums including the use of email, social media and the posting of the questionnaire link on relevant forums. Numerous online platforms including Facebook, Twitter, LinkedIn, Quora, Reddit were utilised to circulate the questionnaire. An online questionnaire was chosen as the most effective method of obtaining and processing results. Research has found web-based questionnaires achieve comparable or higher response rates with lower costs in comparison with traditional paper questionnaires (Hohwü, Lyshol, Gissler, Jonsson, Petzold & Obel1, 2013, 9; Greenlaw & Brown-Welty, 2009, 473). According to Greenlaw and Brown-Welty (2009) also concluded that the administration of a web-based questionnaire is less labour intensive. Web-based questionnaires allow reminders to be sent, responses to be tracked and the questionnaire can easily be sent to new participants. Digital data from web-based questionnaires is also more accurate as it can be downloaded directly from the software for analysis, saving time and resources. (Greenlaw & Brown-Welty, 2009, 476.) These were only some of the reasons why I web-based questionnaire was chosen.

In my opinion a web-based questionnaire has multiple benefits. I feel that respondents would be more likely to provide truthful answers than if they were completing the questionnaire in the presence of the researcher. Providing the questionnaire does not require any contact information so there is complete anonymity on behalf of the respondent. This could not be achieved by email, telephone or mail administered questionnaires, or personally administered questionnaires. Web-based questionnaire enabled me to reach a wide range of audience at a national level. It was also user-friendly as respondents could complete the questionnaires at a time to suit their needs on any device that provided internet access (e.g. mobile phone, tablet, laptop, PC) without the need for any additional software (e.g. a spreadsheet package). However, some respondents may feel this approach is less convenient to being stopped in the street and asked the questions by the researcher. Respondents are also less likely to seek guidance if they are uncertain on the meaning of a question or on how to complete it. This may lead to respondents skipping the question or answering it inaccurately thereby leading to poorer data quality. The web-based questionnaire also requires a basic degree of IT literacy, potentially excluding some respondents.

Questionnaire Design

Saunders et al. (2007) state that as questionnaires only offer one chance of collecting data, it is vital that the questionnaire questions are defined precisely prior to data collection. Planning the exact data needed and the way the data will be analysed is crucial in ensuring the research questions can be answered. (Saunders et al., 2007, 361.) My questionnaire was built around finding answers to my research questions.

The design of my questionnaire began with researching literature to enable me to precisely define my questions. Saunders et al. (2007, 361) also highlight the importance of utilising research literature to define the appropriate characteristics to answer one's research questions. As an example, to examine factors hindering respondents' ability to recycle via local authority kerbside recycling, I utilised research results by Miliute-Plepiene, Hage, Plepys & Reipas (2016) to determine some of the variables and detail required for the questionnaire question. The categorisation of materials collected from Government waste statistics in WasteDataFlow contributed to the options presented to the questionnaire respondents relating to materials collected by their local authority.

Saunders et al. (2007, 362) refer to Dillman (2000) categorising questionnaire data variables into attributes, behaviours and opinions (Dillman, 2000, referenced from Saunders et al., 2007, 362). All of these categories were also present in my questionnaire. To provide some examples, attributes included the demographics collected in the questionnaire, behaviours were investigated in the questions asking about research behaviour and opinions were examined in the questions investigating participant motivations for using varied recycling schemes.

Due to the financial constraints of the research, only free online survey services were considered for use in this research. Meeting these criteria several online survey sites were assessed (Qualtrics, freeonlinesurveys.com, kwiksurveys.com, surveyplanet.com, smartsurvey.co.uk, surveymonkey.com, google.com/forms) for their suitability in this research. Of these services Qualtrics was chosen as the most appropriate service due to the following reasons:

- no advertising present upon respondents completing the online survey preventing them from being distracted or swayed in any way when answering the questions
- user friendly nature of the questionnaire
- no constraints on the number of surveys that could be completed thereby ensuring maximum possible number of completed questionnaires
- lots of flexibility in the type and format of questions that can be asked and in particular the inclusion of matrix questions and open ended questions
- the ability for respondents to complete the survey on mobile devices

It was important for me to design the survey in a user-friendly manner, including drop down boxes, options, tick boxes and varied questions to prevent the questionnaire being monotonous whilst requiring minimal effort to complete. Participant effort was also minimised through matrix questions, which were quick for participants to complete but enabled a large amount of data to be captured in one question. I wanted to include some open ended questions to allow for unexpected responses and minimise the risk of not capturing valuable information. Utilising question where options had to be ordered by importance were used to tease out answers and to force respondents to reveal their thoughts for each option rather than giving the same average score for different options.

Perfecting the questionnaire prior to the large scale data collection was vital. Consequently pilot questionnaires were sent out and answers analysed so that the questionnaire design could be examined for misinterpreted questions or other errors. Any common themes that would have appeared in drop down boxes could have also been turned into extra question but this was not necessary. Only minor revisions were made prior to the questionnaire being circulated.

3.3.2 Documentary Research

The secondary data for this research was collected from the official Government waste data published online. All UK local authorities are required to complete a Defra Municipal Waste Management Survey which enables the UK government to monitor progress towards various waste and recycling targets and generate statistical reports. To facilitate this requirement the government hosts an online platform called WastDataFlow for local authorities to upload the necessary data (https://www.wastedataflow.org/). Data is uploaded on a quarterly basis by local authorities in England, Wales and Northern Ireland and on an annual basis in Scotland. Once the data has been validated by the Environment Agency it is made available to the public.

As part of this research, the raw data for each local authority in the UK was downloaded and analysed in order to establish what range of materials each local authority accepted as part of their kerbside dry recycling service and to establish what other kerbside recycling services they offered residents (e.g. green waste collection, nappy collection service). Within the questionnaire respondents were asked to indicate which local authority they resided in, which materials their local authority collected via kerbside recycling and which kerbside services their local authority provided. This then provided a means to cross check respondents answers with the data uploaded by local authorities on WasteDataFlow and assign each respondents with a knowledge score that could be used as means to identifying correlations between knowledge of kerbside services against knowledge of alternative recycling methods.

3.4   Data Analysis

The varied data was utilised for different research questions. Table 4 presents in detail which data was utilised for each research question.

Research Questions	Data Utilised	
	Questionnaires	Analysis of Government Recycling Statistics
1. How aware are people regarding non-kerbside collection recycling schemes?	√	
2. What are people's motivations for using non-kerbside collection recycling schemes?	√	
3. Do any correlations exist between the range of recyclable materials collected via a resident's local authority kerbside collection scheme and the utilisation of alternative recycling schemes by the respondent?	√	√
4. Are respondents who indicate that there are factors present that hindered their ability to recycle via local authority kerbside recycling more or less likely to utilise alternative recycling methods?	√	
5. Do any correlations exist between people's awareness, knowledge and usage of their local authority kerbside collection services and their awareness, knowledge and usage of alternative recycling methods?	√	√

Table 4 Data utilised for data analysis

The questionnaire data was analysed with SPSS (Statistical Package for the Social Sciences) software. The data analysis enabled me to identify trends and correlations in the data and the process is further discussed in the "Results" section of the thesis. Two key significance tests were utilised: 1) the Pearson correlation test was utilised to measure the association between two variables that were interval in nature and were normally distributed whereas 2) the Man-Whitney U test for used to compare two independent groups that were either interval in nature and non-normally distributed or ordinal in nature. F For ordinal and nominal data, frequency tables were used to calculate the total numbers of responses given to each category and the percentage this represented compared to other possible options that could have been selected.

For the second research question regarding people's motivations for using alternative recycling schemes I utilised qualitative content analysis. Hsieh and

Shannon (2005) categorise the different approaches of content analysis into conventional, directed and summative content analysis. Both the directed and the summative approach analyse the data with pre-determined theory or keywords whereas in the conventional approach the categories are derived from the data. (Hsieh & Shannon, 2005, 1286.) The questionnaire question for this research question involved a free text box, enabling respondents to freely describe their motivations without pre-set options. According to Hsieh and Shannon (2005) conventional content analysis starts with the achieving a whole picture by immersing oneself with the data through multiple read-throughs, proceeding to each word being read one by one for codes to be derived. This is completed through highlighting words capturing key contexts, followed by notes of the initial analysis being made. Through the process, labels capturing more than one word appear and become the initial coding scheme. Categories are then established, with definitions and related codes. (Hsieh & Shannon, 2005, 1279.) This approach was adopted for my content analysis. Table 5 demonstrates an example of the data categorisation. The advantage of this approach is the direct information gained from respondents, however the danger is that through not understanding the whole context the research fails to identify key categories and therefore presents incorrect findings (Hsieh & Shannon, 2005, 1279-1280).

Examples of Respondents Free Text Responses	Assigned Category	
"Too bulky for bin"	------>	**Not enough Space in kerbside**
"cannot fit in the recycling bin"		
"Christmas overflow"		
"Too much for kerbside"		
"council does not collect"	------>	**Kerbside collection not offered**
"No kerbside"		
"Not able to recycle at kerbside"		
"Bulkier items not collected at kerbside"		
"better than landfill and easiest option"	------>	**Convenience**
"available locally"		
"Ease of use"		
"convenient"		
"For reuse by others"	------>	**Benefit Others**
"Always prefer something to go to "a good home""		
"benefits charities"		
"help others"		
"better than waste"	------>	**Do not want to go to waste**
"Better to be reused rather than throw away"		
"Better to reuse than get rid"		
"Because they have a use for the thing"		
"loyalty points"	------>	**Financial Benefit**
"As money can be used to buy new games when needed"		
"cash incentive"		
"money for me"		
"moving houses"	------>	**Other / N/A**
"new machines purchased"		
"A specific place"		
"If quality is not high enough for charity shops"		

Table 5 An example of the conducted content analysis

Statistical analysis was carried out on the UK governments' official waste data figures. This data was then used to create a database specific to each local authority that was used in conjunction with respondents' answers to the questionnaire to determine the accuracy of their answers and consequently assign each respondent with an awareness and knowledge score. This score was then used as a basis for identifying any correlations that may be present regarding awareness and knowledge of alternative recycling methods.

3.5   Validity, Reliability and Ethical Issues of Research

The credibility of scientific research is often assessed through the measures of validity and reliability. Walliman (2018) states that research should have both internal and external validity. These concepts link to the research reflecting the real world, with internal validity focused on how the research supports the ideas about cause and effect and with external validity being based on how the results can be generalised to populations or other settings. (Walliman, 2018, 121.) Validity presents slightly different aspects in my primary research with questionnaires and my secondary documentary research.

According to Saunders et al. (2007), questionnaires possess internal validity if they measure what they are intended to measure and the results therefore represent the reality. This can be problematic as the questionnaires often aim to examine unknowns about the reality. However, questionnaire validity can also be measured through content validity, criterion-related validity and construct validity. Content validity examines whether the questionnaire provides sufficient coverage for the investigative questions and can be achieved when the design of the questionnaire is being informed by literature and sometimes by prior discussion with others. Criterion-related validity focuses on whether the questions in the questionnaire can lead to accurate predictions. Determining this predictive validity often involves statistical analysis, such as investigating correlation. Construct validity determines if the presence of the constructs the questionnaire intends to measure can be measured with the questionnaire questions. However, validating such constructs against existing data can be very difficult. (Saunders et al., 2007, 366-367.) In my research I have aimed to exhibit these varied elements of validity in my questionnaire design although some of them are difficult to verify.

Examining validity for the secondary documentary research is slightly different. According to Pierce (2008, 83) "validity of information is its relevance and appropriateness to your research question and the directness and strength of its association with the concepts under scrutiny". I feel these conditions of validity are met with the WasteDataFlow statistics used in my research.

Reliability in research can be defined through consistency (Saunders et al., 2007, 367; Pierce, 2008, 83). According to Saunders et al. (2007) the reliability of a questionnaire is exhibited through the robustness of the questionnaire and whether the findings it produces are consistent in varying conditions, such as different times or different samples. Saunders et al. (2007, 367) refer to Mitchell (1996) describing three ways of assessing reliability as:

1) test re-test: involving the respondents responding to the questionnaire twice in near equivalent conditions to enable correlations to be drawn
2) internal consistency: involving drawing correlations between the responses received to different questions in the questionnaire

3) alternative form: involving the comparison of responses with alternative forms of the same question or groups of questions. (Mitchell, 1996, referenced from Saunders et al., 2007, 367.)

Although it would not have been feasible or even possible to expect for the respondents to complete the questionnaire twice, I have searched for correlations between the different questions and alternative forms of the same question.

Assessing the reliability of my secondary documentary research was completed differently. According to Pierce (2008) reliability for literary accounts is assessed through the reputability of the source and the extent to which one can rely on the data itself. Consistency is key and reliable data is defined as trustworthy, authentic, sure, unfailing, genuine, reputable and dependable. (Pierce, 2008, 83.) As WasteDataFlow is managed by the UK government, I feel the data itself and the source are as reliable as they can be for my research.

3.5.1 Specific Ethical Considerations for Questionnaires

There are many considerations linked to the ethical issues of questionnaires. Research literature highlights the importance of the participants' contributions being voluntary (Eriksson & Kovalainen, 2011, 71; Saunders et al., 2007, 181; Fowler, 2012, 163). This is closely linked to participants giving their consent. Knussen and McFadyen (2010) have collated advice on using online questionnaire platforms. They discuss informed consent being vital and advise that the following information be presented to the respondent at the very start of the questionnaire: researcher(s) name, contact details, a statement regarding the purpose of the survey; details regarding how the data will be used. Due consideration should be given to the consent procedure through the inclusion of the items normally found in paper-based content forms to enable the endorsement to take place prior to the next page being opened. (Knussen & McFadyen, 2010, 1.)

Saunders et al. (2007, 181) stress the importance of protecting participants' possible and actual privacy. According to Knussen and McFadyen (2010) one of the key advantages of using online software tools is that it is impossible to trace respondents as the IP addresses are not collected. Email addresses are also not required which adds further protection for the participants' privacy. However, these advantages have a consequent risk of participants who should be excluded from taking the questionnaire completing the survey as there is no way to verify the participants' identities. (Knussen & McFadyen, 2010, 2.)

Online software tools provide the researcher with minimal control over the engagement with and access to the material (Knussen & McFadyen, 2010, 2). However, participants hold rights to their information and data. Saunders et al. (2007) state that any research should maintain the confidentiality of the data participants provide and protect their anonymity. Participants should not be distressed in any way throughout the different stages of research, including data

collection, analysis and reporting. (Saunders et al., 2007, 181). Only the question regarding consent should be mandatory in the questionnaire and participants need to be made aware of the relevant questionnaire functionalities, such as their ability to exit the questionnaire and their rights to withdraw or delete their responses (Knussen & McFadyen, 2010, 1). I have followed the ethical measures discussed in this chapter for my questionnaire.

3.5.2 Ethical Conduct

Ethical conduct is important throughout the research, including the ways in which the research is carried out and reported as well as the issues of bias and the accurate recognition of other researchers (Eriksson & Kovalainen, 2011, 64). I will further discuss these elements in this section.

Eriksson and Kovalainen (2011) state that all research needs to give credit to previous researchers' work, publications and scientific achievements. This should be done through all stages of the research, from mentioning the intelligent origins of one's research to writing the report. A vital element of any research activity is the accurate and correct referencing of other researchers. (Eriksson & Kovalainen, 2011, 73-74.)

Preventing bias is key element of ethical conduct and the credibility of any scientific research. According to Creswell and Creswell (2018), objectivity is at the basis of any competent research inquiry, involving the researcher analysing their research methods and results for any bias. They also link the concepts objectivity and bias with the measures for validity and reliability discussed earlier in this section. (Creswell & Creswell, 2018, 55.) I have been aware of the need to be objective and unbiased throughout my research and critically assessed my thought process throughout. I have also described the research process in a transparent manner to enable the reader to evaluate the credibility of my research for themselves.

Saunders et al. (2007, 612) discuss subject or participant bias where the research results are distorted due to the research subjects providing inaccurate responses. In my research I have reviewed the questionnaire data critically, running varied tests on the questionnaire data to ensure the credibility of the data (see "Evaluation of research" section). I have also completed the content analysis of the questionnaire multiple times and critically reviewed the coding of data to mitigate for any bias in my analysis.

Saunders et al. (2007) discuss measurement bias with reference to evaluating secondary data sources in particular. Measurement bias can take place in situations where the method of collecting the data has changed or where the data has been deliberately or intentionally distorted. (Saunders, 2007, 268). I have chosen my secondary data source carefully as an attempt to mitigate any potential measurement bias of the secondary data.

4   RESULTS

In total, 145 questionnaires were completed. In addition to the data collected via questionnaires, each respondent was assigned two scores, one measuring the respondent's awareness of the kerbside recycling schemes offered by their local authority and the other measuring the respondent's knowledge concerning which materials their local authority accepted via its kerbside dry recycling scheme. These scores were determined by comparing the answers respondents gave regarding these items (questions 10 and 11) with data published by local authorities via the UK government's recycling portal (WasteDataFlow Waste Management). Table 6 is a frequency table summarising the key demographics of respondents prior to any recoding of categories.

			Frequency	Percent	Valid Percent	Cumulative Percent
Gender	Valid	Male	57	39.3	39.3	39.3
		Female	88	60.7	60.7	100
		Total	145	100	100	
Age	Valid	<18	1	0.7	0.7	0.7
		18-24	6	4.1	4.1	4.8
		25-29	25	17.2	17.2	22.1
		30-34	42	29.0	29.0	51.0
		35-39	24	16.6	16.6	67.6
		40-44	15	10.3	10.3	77.9
		45-49	9	6.2	6.2	84.1
		50-54	13	9.0	9.0	93.1
		55-59	8	5.5	5.5	98.6
		60-64	2	1.4	1.4	100.0
		Total	145	100.0	100.0	
Highest Level of Education	Valid	No formal qualifications	1	0.7	0.7	0.7
		GCSEs (or equivalent)	12	8.3	8.5	9.2
		A-Levels (or equivalent)	17	11.7	12.0	21.1
		Bachelor's Degree (or equivalent)	64	44.1	45.1	66.2
		Postgraduate Degree	48	33.1	33.8	100.0
		Total	142	97.9	100.0	
	Missing	System	3	2.1		
	Total		145	100.0		
Employment Status	Valid	Full-time employment	106	73.1	75.2	75.2
		Part-time employment	14	9.7	9.9	85.1
		Unemployed	3	2.1	2.1	87.2
		Student	7	4.8	5.0	92.2
		Retired	3	2.1	2.1	94.3
		Self-employed	4	2.8	2.8	97.2
		Living of own means	4	2.8	2.8	100.0
		Total	141	97.2	100.0	
	Missing	System	4	2.8		
	Total		145	100.0		
Salary	Valid	£0-£14,999	19	13.1	14.1	14.1
		£15-£24,999	26	17.9	19.3	33.3
		£25-£34,999	51	35.2	37.8	71.1
		£35-£44,999	20	13.8	14.8	85.9
		£45k+	19	13.1	14.1	100.0
		Total	135	93.1	100.0	
	Missing	System	10	6.9		
	Total		145	100.0		

Table 6 Questionnaire demographics

4.1   Awareness of Alternative Recycling Schemes

In question 12 of the questionnaire, respondents were presented with a list of alternative recycling methods and were asked to indicate whether they were aware of the service, whether they use the service and if applicable how frequently they use the service. As the purpose of this research was to assess respondents' common recycling behaviours, recycling methods that were utilised less frequently than once a year by the majority of respondents (50% and over) were excluded from further analysis when measuring usage. This applied to "Store collection of bulky electrical items (e.g. washing machine, fridge, TV) when purchasing a new like for like electrical product" and "Collection through a private company (e.g. skip hire, Hippo bag, man and van)". Table 7 provides a summary of respondents' answers.

Alternative Method	Awareness and Usuage							Frequency				Frequency (cumulative)			
	Not Aware	Aware but not used	Aware and used	Aware regardless of use	Count Total	Aware regardless of use (%)	Awareness to Usuage Conversion Rate	Monthly or Less	Quarterly	Yearly	Every 2+ Years	Monthly or Less	Quarterly or Less	Yearly or Less	Every 2+ Years or Less
Civic amenity sites (council-run recycling sites)	7	20	111	131	138	95%	85%	21%	48%	26%	5%	21%	69%	95%	100%
Give away to family or friends	3	23	111	134	137	98%	83%	17%	36%	36%	11%	17%	53%	89%	100%
Deposit at a charity shop, reuse organisation or as arranged via Freecycle	3	28	108	136	139	98%	79%	17%	43%	29%	11%	17%	60%	89%	100%
Selling used goods privately (e.g. via eBay, GumTree, AdTrader, car boot sale etc.)	1	55	81	136	137	99%	60%	12%	36%	34%	18%	12%	48%	82%	100%
Recycling banks (e.g. those often found in supermarket car parks)	3	58	78	136	139	98%	57%	13%	40%	30%	17%	13%	53%	83%	100%
In-store deposit (e.g. containers in shops for depositing batteries, light bulbs, water filters etc.)	17	61	60	121	138	88%	50%	16%	54%	26%	4%	16%	70%	96%	100%
Return postage services (ink cartridge / mobile phone / batteries)	40	64	33	97	137	71%	34%	4%	17%	48%	30%	4%	22%	70%	100%
Collection from your doorstep by a charity, reuse organisation or user of Freecycle	15	91	31	122	137	89%	25%	7%	38%	52%	3%	7%	45%	97%	100%
Exchange or sell used goods through a high street retailer (e.g. CDs, DVDs, games and mobile phones via shops such as Game and CDex)	24	78	31	109	133	82%	28%	9%	18%	50%	23%	9%	27%	77%	100%
Reverse vending machines (e.g. Tesco, IKEA)	109	23	4	27	136	20%	15%	0%	50%	0%	50%	0%	50%	50%	100%

Table 7 Awareness and usage of alternative recycling schemes

Awareness and usage of reverse vending machines is by far the lowest amongst respondents with 109 out of 136 respondents who recorded an answer stating that they were unaware of the service. Given that this concept is a relativity new to the UK market and is only being used by a limited number of retailers it is unsurprising that awareness is low. What is surprising however is that amongst 27 respondents who recorded that they were aware of the service, only 4 recorded that they had actually used the service. At 15% this was the lowest awareness to usage rate amongst all the methods listed despite this service providing users with financial incentives (in the form of a voucher) to use the service.

This trend was also seen amongst other recycling options, as overall awareness levels decreased so too did the awareness to usage rates. To accompany this, an additional trend relating to frequency of use was also identified. As awareness and awareness to usage levels decreased, so too did frequency of use amongst the users who reported using a particular service. A possible reason for this is that as the service is required on a less frequent basis, so people are less habitually familiar with its use. This then presents two potential barriers, when the public has an applicable material that could be recycled through one of these methods the lack of familiarity in using a particular service may lead to respondents forgetting about the service or the service may be seen as requiring a greater deal of effort. If such a hypothesis were true, it could be argued that fragmented specialist recycling services would face an uphill battle in gaining a foothold within the UK recycling market.

Return postage services for recycling items such as ink cartridges and mobile phones had a lower than average awareness rate at 77% and a particularly low awareness to usage rate of 34%. Again this is despite this service often providing users with some form of financial incentive or by offering to make charitable donation on the user's behalf. This would seem to align with previous studies which have shown that the offer of financial incentives does not always lead to an increase in recycling behaviour (Halvorsen, 2012).

Selling goods privately (e.g. via eBay, GumTree, AdTrader, car boot sale etc.) benefitted from the highest awareness rate at 99% and an above average awareness to usage rate of 60%. Contrasting this somewhat was the sale or exchange of goods through high street retailers (e.g. CDs, DVDs, games and mobile phones). Awareness of such services sat at 82% but awareness to usage was only 28%, less than half that of selling goods privately. This perhaps can be attributed to the perceived greater ease of selling goods online which can be done from the comfort of your own home, with no travel required, no time restrictions and able to accommodate a far wider range of materials or goods. As discussed in the literature review, a study by Sidique et al. (2013) found that travel costs significantly impacted frequency of visits to drop off sites, as did times of operation and number of recyclables accepted to a lesser extent.

Civic amenity sites, giving items away to family or friends and donating items to others via a charity shop or reuse organisation were the three methods

with the greatest usage. Civic amenity sites in particular were also used on a very frequent basis versus other methods.

Doorstep collections by charities and reuse organisations also benefited from high awareness levels but far lower usage rates with an awareness to usage rate of only 25%. The high usage rate of civic amenity sites which are typically located away from residential areas and the low usage of doorstep collections by charities and reuse organisations is a surprising result that contrasts what was found when comparing the use of selling goods privately via online platforms versus visiting high street shops who purchase or offer exchanges for used goods. However, a possible reason for this is that some respondents stated that they were distrustful that charities offering this service were always legitimate, this could be a view shared by the wider general public.

Recycling banks which once served a key role within the recycling sector still benefitted from one of the highest awareness rates with 136 out of 139 of the recorded answers stating that they were aware of the service but with only 78 continuing to use them (57%).

Awareness regarding the ability to deposit certain goods (e.g. batteries, light bulbs, water filters etc.) via in store containers sat relatively high at 88%. Whilst it only had a 50% awareness to usage rate it was also the most common service to be utilised at least every 3 months or less.

4.2 Motivations for Using Non-kerbside Collection Recycling Schemes

In question 12 of the questionnaire, respondents were asked to state their reason for using each alternative recycling method. Respondents were provided with a text box and were therefore able to freely express their reason without constraint. The answers were reviewed and categorised into one of seven prevailing themes. These themes were:

- Don't want to go to waste
- Convenience
- Kerbside collection not offered
- Not enough space in kerbside
- Other
- Benefit others
- Personal Gain

Table 8 includes a full summary of the findings for this research question.

Alternative Method	Reason for Usage													Total
	Don't want to go to waste		Other		Convenience		Benefit Others		Kerbside collection not offered		Not enough Space in kerbside		Personal Gain		
	Count	%	Count	%	Count	%	Count	%	Count	%	Count	%	Count	%	
Civic amenity sites (council-run recycling sites)	1	2%	14	22%	10	16%	0	0%	19	30%	20	31%	0	0%	64
Give away to family or friends	17	38%	4	9%	3	7%	21	47%	0	0%	0	0%	0	0%	45
Deposit at a charity shop, reuse organisation or as arranged via Freecycle	19	37%	6	12%	8	16%	17	33%	1	2%	0	0%	0	0%	51
Selling used goods privately (e.g. via eBay, GumTree, AdTrader, car boot sale etc.)	9	25%	6	17%	2	6%	3	8%	0	0%	0	0%	16	44%	36
Recycling banks (e.g. those often found in supermarket car parks)	7	15%	6	13%	15	32%	1	2%	8	17%	10	21%	0	0%	47
In-store deposit (e.g. containers in shops for depositing batteries, light bulbs, water filters etc.)	12	55%	3	14%	5	23%	0	0%	2	9%	0	0%	0	0%	22
Return postage services (ink cartridge / mobile phone / batteries)	3	21%	3	21%	4	29%	1	7%	1	7%	0	0%	2	14%	14
Collection from your doorstep by a charity, reuse organisation or user of Freecycle	3	17%	6	33%	3	17%	5	28%	1	6%	0	0%	0	0%	18
Exchange or sell used goods through a high street retailer (e.g. CDs, DVDs, games and mobile phones via shops such as Game and CDex)	2	15%	1	8%	0	0%	2	15%	0	0%	0	0%	8	62%	13
Reverse vending machines (e.g. Tesco, IKEA)	0	0%	1	50%	0	0%	0	0%	0	0%	0	0%	1	50%	2
Total	73		50		50		50		32		30		27		

Table 8 Summary of findings for research question 2

It is important to note that due to the shortness of explanations and the inability to seek further clarification there is the possibility for misunderstanding when assigning responses to a category. Data quality was prioritised over data quantity and as such data was only assigned to a category where the researcher felt there was a sufficient degree of confidence to do so. Where it was difficult to infer meaning behind the respondent's explanation with a reasonable degree of confidence answers were categorised under "other".

In relation to the above, it is often difficult to determine whether the answer someone has provided is the primary reason or secondary reason. For example, if someone stated that their reason was convenience with no further explanation, this could mean that of all the options available to them (reuse / recycling / regular rubbish) this particular method was the most convenient, in which case convenience would be the primary reason. However, they could also be answering on the assumption that it is known that they wish to dispose of the item in an environmentally friendly manner and of the environmentally friendly options available to them (reuse / recycling), this particular method is the most convenient, in which case convenience would be the secondary reason and wishing to dispose of the item in an environmentally friendly manner would be the primary reason.

In relation to this, of the six categories above, several could be viewed as sub-categories of environmental concern but without further details it not possible to conclude this definitively as there could also be various other explanations for such responses. For example, where respondents have indicated convenience as their primary reason for using an alternative recycling method, it could be assumed that they do not wish for that material to go to landfill and therefore the method they have chosen is the most convenient way to recycle that material. However, it could also be due to the fact that they have a large amount

of waste to dispose of and they do not have the space to store this until the next kerbside collection and as such they are utilising the selected alternative method more for personal reasons / space restrictions than for environmental reasons.

An additional example, a common reason cited by several respondents was "too good to throw away", such responses have been categorised under "Don't want to go to waste", whilst it could be assumed that such respondents have stated this with environmental concerns in mind, it could also be that they have a sentimental attachment to that product and it is easier to depart with such a possession at a charity shop where it will be reused by others than to landfill, consequently it is difficult to infer the true motivation behind the answer. However, the data does allow for the potential identification of overarching themes.

Due to the limited usage of reverse vending machines, only two explanations for usage were provided and as such it is not possible to obtain any meaningful insight into common motivations that may be linked to this method.

"Kerbside collection not offered" and "Not enough space in kerbside collection" were the two most common reason cited amongst respondents who used Civic amenity sites representing 30% and 31% respectively. Recycling banks shared a similar profile to recycling centres but with a greater number of respondents indicating "convenience" as their primary reason at 32%, the highest convenience rate amongst all the alternative methods listed. This is likely reflective of the fact that there are greater number of recycling banks and they tend to be positioned in residential areas or in supermarket car parks which people visit frequently and there are no opening hours to be concerned with. The reason "not enough space in kerbside collection" was often attributed to surplus waste after a particular event such as Christmas or a party.

"In-store deposit" received the greatest number of responses that fell into the category "Don't want to go to waste" at 55% and "Exchange or sell used goods through a high street retailer" received the greatest number of responses that fell into the "Personal gain" category at 62%.

"Deposit at a charity shop, reuse organisation or as arranged via Freecycle" and "Give away to family or friends" both shared similar profiles with "Don't want to go to waste" and "Benefit Others" as two most common reasons given for both methods. "Collection from your doorstep by a charity, reuse organisation or user of Freecycle" had a high proportion of ambiguous answers and it may be due to this that it's profile did not follow quite so closely with fewer respondents citing "Don't want to go to waste" as their primary reason.

Interestingly, concerning the method "Selling used goods privately", whilst personal gain represented the greatest proportion of responses, this still only sat at 44%, "Don't want to go to waste" still accounted for a significant 25%. One factor to consider is the inability for charity shops to accept electrical goods, this may encourage respondents to dispose of such assets via this means. Should such electrical assets be of lower value, environmental concerns may serve as the primary benefit over and above that of potential for financial gain. Similarly, of

the respondents who utilised "Return postage services" only 14% cited "personal gain" as their primary motive despite such services often incentivising users with vouchers. The primary motive for using "Return postage services" was "convenience" at 29%.

4.3 Correlations between the Range of Recyclable Materials Collected with Kerbside Collection Scheme and the Utilisation of Alternative Recycling Schemes

Question 4 of the questionnaire asked respondents to enter the name of the local authority in which they reside. Using data from Waste Data Flow, the number of dry materials collected via kerbside collection by each local authority within the UK was recorded. These two data were then integrated to reveal the number of dry materials collected and recycled by each respondent's local authority.

Question 12 of the questionnaire provided respondents with a list of 12 alternative recycling methods as per the below list:
- Recycling banks (e.g. those often found in supermarket car parks)
- Civic amenity sites (council-run recycling sites)
- Store collection of bulky electrical items (e.g. washing machine, fridge, TV) when purchasing a new like for like electrical product
- Collection through a private company (e.g. skip hire, Hippo bag, man and van)
- Deposit at a charity shop, reuse organisation or as arranged via Freecycle
- Collection from your doorstep by a charity, reuse organisation or user of Freecycle
- In-store deposit (e.g. containers in shops for depositing batteries, light bulbs, water filters etc.)
- Reverse vending machines (e.g. Tesco, IKEA)
- Return postage services (ink cartridge / mobile phone / batteries)
- Exchange or sell used goods through a high street retailer (e.g. CDs, DVDs, games and mobile phones via shops such as Game and CDex)
- Selling used goods privately (e.g. via eBay, GumTree, AdTrader, car boot sale etc.)
- Give away to family or friends

Respondents were provided with three options: "Not Aware"; "Aware but Not Used"; "Aware and Used".

A Pearson correlation analysis was then performed to identify any correlations that may exist between the number of dry materials collected by each local authority and the usage of alternative recycling methods by respondents who reside within those respective local authorities. No significant correlation was identified between the two variable (r =0.012, n = 140, p = 0.891). This is an

interesting finding as it could be hypothesised that the greater the number of dry materials collected and recycled by a local authority, the less need there would be for respondents who reside within the respective local authorities to seek out and use alternative recycling methods and vice versa. However, the data would suggest that this is not the case.

4.4 Reported Barriers to Kerbside Recycling and Their Implications on the Usage of Alternative Recycling Methods

In question 9 of the questionnaire, respondents were provided with a list of commonly cited reasons that impact on people's ability to recycle via local authority local authority kerbside recycling schemes. Respondents were asked to indicate if any of these reasons hindered their ability to recycle via local authority kerbside recycling. As there was a limited number of responses for certain categories, reasons were combined into three groups, physical barriers, non-physical barriers and no barriers. Table 9 providers a summary of these responses.

Reason	Type of Hindrance	Count	Percent
I do not possess a suitable recycling container	Physical	7	5%
I do not have the space required to store a recycling container	Physical	11	8%
I often find that I am too busy to separate materials into the recycling container	Non-physical	7	5%
It is not clear which material can and cannot be placed into local authority recycling	Non-physical	40	29%
I often find it too messy to separate recyclable materials and non-recyclable materials	Non-physical	19	14%
I try to recycle but due to habit I often find myself forgetting	Non-physical	12	9%
I see little benefit in recycling	Non-physical	3	2%
None of the above	N/A	78	56%

Table 9 Summary or responses regarding barriers to recycling

A Mann-Whitney U test was performed to assess whether respondents who indicated that there were no factors impacting on their ability to recycle were less likely or more likely to use a greater range of alternative recycling methods. The Mann-Whitney U test indicated, on average, that the usage of alternative recycling methods amongst respondents who indicated there were no factors hindering there use of LA kerbside recycling (mean rank = 76.9, n = 78) significantly exceeded the respondents who indicated that there were factors that hindered their usage of LA kerbside recycling (mean rank = 62.5, n = 62), u = 1919, p = 0.034, z = -2.118.

A Mann-Whitney U test was performed to assess whether respondents who indicated that there was a physical factor(s) impacting on their ability to recycle were less likely or more likely to use a greater range of alternative recycling methods. No statically significant difference amongst users who indicated this option.

A Mann-Whitney U test was performed to assess whether respondents who indicated that there was a non-physical hindrance impacting on their ability to recycle were less likely or more likely to use a greater range of alternative recycling methods. The Mann-Whitney U test indicated, on average, that the usage of alternative recycling methods amongst respondents who indicated there were no non-physical factors hindering there use of LA kerbside recycling (mean rank = 76.1, n = 85) significantly exceeded respondents who indicated that there were non-physical factors that hindered their usage of LA kerbside recycling (mean rank = 61.8, n = 55), u = 1860, p = 0.039, z = -2.061.

A Pearson correlation test was performed to identify the relationship between the number of factors hindering a respondent's ability to recycle via LA kerbside recycling and the number of alternative recycling methods they used. No significant correlation was identified between the two variables (r = -0.112, n = 140, p = 0.188).

This is an interesting finding, for two reasons. Firstly, it could be expected that those who report that barriers exist hindering them from recycling via local authority kerbside recycling would on average be more likely to seek alternative means to recycle their goods, however, the findings suggest that the opposite is true. Secondly, that this correlation was only identified with respondents who reported non-physical barriers. This would seem to suggest that those who report non-physical barriers exist are in general less interested in or engaged with recycling and that these barriers exist more in the mind of the respondent as opposed to being impacted by any unique barriers specific to them.

4.5 Correlations between People's Awareness, Knowledge and Usage of Their Local Authority Kerbside Collection Services and Their Awareness, Knowledge and Usage of Alternative Recycling Methods

In order to identify whether any significant correlation existed between knowledge of kerbside recycling services provided by the local and awareness of alternative recycling methods, data gathered via questions 10 and 12 of questionnaire was analysed.

Question 10 of the questionnaire asked respondents to indicate which kerbside recycling services were offered by their local authority council, the available options were:

- Kerbside dry recycling (e.g. metal cans, glass, paper, cardboard, plastic etc.)
- Kerbside waste food collection
- Kerbside garden waste collection
- Free or subsidised home compost bin
- On request collection of bulky items (e.g. furniture, fridge, TV)
- Nappy collection service

To answer this question, respondents were provided with a drop down menu from which they could select one of four options. These options were as follows:

- My local authority council do not offer this service
- My local authority council offer this service but I do not use it
- My local authority council offer this service and I use it
- I don't know whether my local authority council offer this service.

These answers were then checked using data from Waste Data Flow and the respondent was awarded a knowledge score depending on the number of correct and incorrect answers given. As usage was irrelevant for this particular analysis, responses two and three above were treated as the same and for this particular analysis both were reclassified as "My local authority council offer this service". Where a respondent selected response four from the above list, this was treated as an incorrect answer. The rationale for including this option within the questionnaire was to avoid forcing respondents into guessing where they were not sure or leaving the question unanswered which would have implications on data validity.

Question 12 of the questionnaire provided respondents with a list of 12 alternative recycling methods as per the below list:

- Recycling banks (e.g. those often found in supermarket car parks)
- Civic amenity sites (council-run recycling sites)
- Store collection of bulky electrical items (e.g. washing machine, fridge, TV) when purchasing a new like for like electrical product
- Collection through a private company (e.g. skip hire, Hippo bag, man and van)
- Deposit at a charity shop, reuse organisation or as arranged via Freecycle
- Collection from your doorstep by a charity, reuse organisation or user of Freecycle
- In-store deposit (e.g. containers in shops for depositing batteries, light bulbs, water filters etc.)
- Reverse vending machines (e.g. Tesco, IKEA)
- Return postage services (ink cartridge / mobile phone / batteries)
- Exchange or sell used goods through a high street retailer (e.g. CDs, DVDs, games and mobile phones via shops such as Game and CDex)
- Selling used goods privately (e.g. via eBay, GumTree, AdTrader, car boot sale etc.)
- Give away to family or friends

Respondents were provided with three options: "Not Aware"; "Aware but Not Used"; "Aware and Used". Due to usage being irrelevant in this particular analysis, options two and three were combined. A Pearson correlation test was performed to identify the relationship between knowledge of local authority provided kerbside recycling services and awareness of alternative recycling methods. No correlation was identified between the two variables ($r = 0.143$, $n = 140$, $p = 0.092$).

A Pearson correlation test was also performed to identify the relationship between knowledge of kerbside recycling services provided by the local authority and usage of alternative recycling methods. Usage was determined by totalling the number of times a respondent had selected "Aware and Used" in question 12. The test identified a significant but weak correlation between these two variables ($r = 0.227$, $n = 140$, $p = 0.007$).

Question 11 of the questionnaire asked respondents to indicate which dry recyclable materials were collected by their local authority kerbside dry recycling collection service. They were provided with a list of 16 materials as per below:

- Aerosol Cans
- Cardboard
- Cartons / Tetra Packs (e.g. fruit juice, milk)
- Cling film
- Crisp packets
- Foil / foil containers / foil trays
- Glass bottles and jars
- Metal tins and cans
- Mixed plastic (e.g. yoghurt pots, margarine tubs)
- Other glassware (e.g. wine glasses, pint glasses, oven dishes, vases)
- Paper (newspapers, magazines)
- Plastic bags (e.g. carrier bags, bread bags, bin bags)
- Plastic bottles
- Polystyrene packaging
- Textiles
- Wallpaper

Respondents were given to select one of three options for each of the above materials: Yes; No; I don't know.

These answers were then checked using data from Waste Data Flow and the respondent was awarded a knowledge scores depending on the number of correct and incorrect answers given. Where a respondent had selected "I don't know", this was recorded as an incorrect answer. The rational for including this option within the questionnaire was to avoid forcing respondents into guessing where they were not sure or leaving the question unanswered which would have had implications on data validity.

A Pearson correlation test was performed to identify the relationship between knowledge of dry materials collected at kerbside by their local authority

and usage of alternative recycling methods. The test identified a significant but weak correlation between these two variable (r =0.178, n = 140, p = 0.035).

A Pearson correlation was performed to compare the usage of alternative recycling methods with the quantity of dry materials the respondent recycled via their local authority kerbside dry recycling collection service. No significant correlation was identified (r =0.0, n = 140, p = 0.054). However, the usage of alternative recycling services showed a weak correlation with the quantity a dry waste recycled through any means (r =0.283, n = 140, p = 0.0007). This suggests that to a degree alternative services act as an addition to and do not replace the function of existing council kerbside recycling services.

5   DISCUSSION

5.1   Discussion around Key Results

5.1.1 Awareness of Alternative Recycling Schemes

An interesting finding was that alternative recycling methods which had lower awareness rates also had lower awareness to usage conversion rates. Furthermore, as awareness and awareness to usage conversion levels decreased, so too did frequency of use amongst the users who reported using that particular alternative recycling method. This trend was present even when financial incentives were present. A possible reason for this is that as the service is required on a less frequent basis people are less habitually familiar with its use. This then presents two potential barriers, when people have an applicable material that could be recycled through one of these methods the lack of familiarity in using a particular alternative recycling service may lead to respondents forgetting about the service or the service may be seen as requiring a greater deal of effort. This may partially explain why alternative recycling schemes for specialist items such as ink cartridges and mobile phones have had limited success in increasing recycling rates as discussed in the background.

The above finding was witnessed even when financial incentives were offered for utilising these services. This would seem to align with previous studies which have shown that the offer of financial incentives have had mixed results in increasing recycling rates (Halvorsen, 2012).

Whilst sale of goods privately via online platforms or via high street retailers both benefited from high awareness levels it was interesting to note that online platform received far higher usage (60%) than high street retailers (28%). This perhaps can be attributed to the perceived greater convenience of selling goods online which can be done from the comfort of your own home, with no travel required, no time restrictions and where online platforms are able to accommodate a wider range of goods. This aligns with previous findings by Sidique et al. (2013) found that travel costs significantly impacted frequency of visits to drop off sites, as did times of operation and number of recyclables accepted to a lesser extent.

Somewhat contrasting to the above finding, despite civic amenity sites, charity shops and charity doorstep collections all having high levels of awareness, charity door stop collections had far lower awareness to usage rates at only 25%, versus 85% for civic amenity sites and 79% for charity shops. This is even though civic amenity sites and charity shops both have limited operating hours and require travel whereas charity doorstep collections do not. However, a possible reason for this is that where respondents were asked to provide a reason for using each alternative recycling method, several respondents stated that they were

distrustful of whether the charities offering doorstep collections were always legitimate, this could be a view shared by the wider general public and explain their lower than expected usage rate. Rogue individuals or businesses performing doorstep collections under the pretence of being a legitimate charity is an issue known to the UK government, the UK Fundraising Regulator and UK charities, as is the theft of doorstep charity donations destined for legitimate charities. In January 2020, the UK House of Commons issued a briefing paper titled Bogus charity clothing collections which drew attention to this issue. In September 2018, the Fundraising Regulator and Local Government Association also issued a warning to the public to be aware of potentially fraudulent charity clothing collections (Radojev, 2018).

5.1.2 Motivations for Using Non-kerbside Collection Recycling Schemes

People not wanting items to go to waste was by far the most cited reason. The reason "not enough space in kerbside collection" was often attributed to surplus waste after a particular event such as Christmas or a party. This raises the question of whether local authorities should provide additional recycling collections immediately after the Christmas period to assist with the additional waste that is generated around this time of year as it is possible that a significant proportion of the public will dispose of surplus recyclable materials via the non-recyclable waste stream if they cannot correctly dispose of their recyclable materials in a timely manner due to insufficient capacity within containers or insufficient storage space within their property.

Interestingly, concerning the method "Selling used goods privately", whilst personal gain represented the greatest proportion of responses, this still only represented 44%, "Don't want to go to waste" still accounted for a significant 25%. This would seem to indicate that although goods are being sold, the financial gain is not always the primary motivation, instead serving as a secondary benefit to disposing of an item in a more environmentally friendly manner. In relation to this, charity shops typically accept a far narrow range of goods than could be sold online and are typically unable to accept mains power electrical goods as charity shops do not have the expertise or resource to ensure that the items are fit and safe for resale. As such, respondents who wish to dispose of goods in an environmentally friendly way, who are not motivated by any form of financial gain may still turn to selling goods privately as there are few alternative options available.

Similarly, of the respondents who utilised "Return postage services" only 14% cited "personal gain" as their primary motive despite such services often providing some form of financial incentive. The primary motive for using "Return postage services" was "convenience" at 29%, although as discussed in the results, it could be assumed that convenience actually serves as a secondary reason to environmental concern, as disposing of the item via the regular waste stream would require less effort.

The fact that personal gain featured sparingly would seem to align with previous studies which have shown that the offer of financial incentives does not always lead to an increase in recycling behaviour and can often cloud other motivations for recycling (Halvorsen 2012).

5.1.3 Correlations between the Range of Recyclable Materials Collected with Kerbside Collection Scheme and the Utilisation of Alternative Recycling Schemes

No significant correlation was identified between the number of dry materials collected by each local authority and the usage of alternative recycling methods by respondents who reside within those respective local authorities. This is an interesting finding as it could be hypothesised that the greater the number of dry materials collected and recycled by a local authority, the less need there would be for respondents who reside within the respective local authorities to seek out and use alternative recycling methods and vice versa. However, the data would suggest that this is not the case. This would support the idea that the alternative recycling methods complement local authority recycling and that the usage of alternative recycling methods does not reduce the usage of local authority kerbside recycling.

It could also be hypothesised that respondents who reside within local authorities who collect a wider range of materials than most may be more engaged in recycling in general and as such this could potentially lead to an increased use of alternative recycling methods and vice versa, however, the data does not show this to be the case.

5.1.4 Reported Barriers to Kerbside Recycling and Their Implications on the Usage of Alternative Recycling Methods

Respondents who stated that there were non-physical factors (e.g. it is not clear which material can and cannot be placed into local authority recycling) that hindered them from utilising local authority kerbside recycling were far less likely to use alternative recycling methods than respondents who indicated that there were no factors hindering their ability to utilising local authority kerbside recycling or that there were only physical factors (e.g. I do not have the space required to store a recycling container) that hindered their ability to utilise local authority kerbside recycling.

This is an interesting finding for two reasons. Firstly, it could have been hypothesised that those who report that barriers exist hindering them from recycling via local authority kerbside recycling would be more likely to seek alternative means to recycle their goods as they are less able to recycle their goods through local authority kerbside recycling, however, the findings suggest that the opposite is true. Secondly, an interesting observation was that this correlation was only identified with respondents who reported non-physical barriers. This would seem to suggest that those who report non-physical barriers exist are in

general less interested in or engaged with recycling and that these barriers exist more in the mind of the respondent as opposed to the respondent being impacted by any unique barriers specific to them.

5.1.5 Correlations between People's Awareness, Knowledge and Usage of Their Local Authority Kerbside Collection Services and Their Awareness, Knowledge and Usage of Alternative Recycling Methods

Analysis of questionnaires demonstrated a weak but significant correlation between knowledge of kerbside recycling services provided by the local authority and usage of alternative recycling methods and also between knowledge of dry materials collected at kerbside by their local authority and usage of alternative recycling methods. This would suggest that a greater level of knowledge regarding a resident's local authority kerbside recycling is also likely to lead to increased usage of alternative recycling methods.

The results showed that there was no significant correlation between usage of alternative recycling methods and the quantity of dry materials respondents recycled via their local authority kerbside dry recycling collection service but that there was a weak significant correlation between the usage of alternative recycling services and the quantity a dry waste recycled through any means. This suggests that alternative recycling services appear to complement local authority kerbside recycling and do not replace the function of existing council kerbside recycling services. This also aligns with the finding of research question 3.

5.2   Evaluation of Research

Some of the aspects relating to the credibility and reliability, such as the triangulation of methods and the validity and reliability aspects of this research, have been discussed in the "Methodology" section of this research report. However, in this section I discuss the measures taken to enhance the reliability of the data.

Much of the UK's recycling legislation and recycling targets relate to or cascade down from European Union legislation. However, it is important to note that the questionnaires administered as part of this research were completed prior to the UK's referendum on whether or not to leave the European Union. As such, this external factor would not have impacted upon the answers given by respondents who participated in this research.

Some of the aspects relating to the credibility and reliability, such as the triangulation of methods and the validity and reliability aspects of this research, have been discussed in the "Methodology" section of this research report. However, in this section I assess the measures taken to enhance the reliability of the data.

Data was analysed using IBM SPSS. Data exploration was conducted through the use of frequency tables and / or descriptive tables, accompanied by the use of several types of graphs.

For ordinal and nominal data, frequency tables and bar charts were created within SPSS to identify small group sizes. Where very small group sizes were identified, these were merged with other adjoining groups to aid with later data analysis. In order to assess the central tendency of data, the mean, median and mode were calculated using SPSS and compared against one another to ensure no substantial deviations between the three existed.

For scale data, the interquartile range and standard deviation were also calculated and used to gain a greater understanding regarding the spread of the data. These were used in conjunction with Histograms, Normal Q-Q Plots and Box Plots to review the shape and dispersion of data. This helped to identify abnormal data and allowed me to review such instances to identify any potential data entry errors. Further normality testing was performed by assessing the skew and kurtosis of the data. Z scores were calculated by dividing the skew and kurtosis values by their respective error scores. A score between -3.29 and +3.29 was used to assess whether the data was normally distributed or not (Kim, 2013). Finally, a Kolomogrov-Smirnov test and a Shapiro-Wilk test were performed to assess for normality. A significance value of above 0.01 was used to assess whether the data was normally distributed. It is important to note that all of the above were used in combination to determine whether data was suitable for analysis or not. Data was not automatically dismissed if it did not satisfy one criterion but did satisfy others. Table 10 provides an example of how the results relating to these tests were recorded and tracked.

		Q12.1 - Awareness and usage of alternative recycling methods
Overview	Data Type	Scale
	Valid Responses	140
Central Tendency	Mean	4.9500
	Median	5.0000
	Mode	5
Dispersion	Standard Deviation	2.23228
	Interquartile Range	3.75
Diagram	Histograms	Yes, data looks normally distributed
	Normal Q-Q Plots	Yes, data looks normally distributed
	Box Plots	Yes, data looks normally distributed
Skewness	Skewness Statistic	-0.062
	Skewness Standard Error	0.205
	Skewness Z Value	-0.30
Kurtosis	Kurtosis Statistic	-0.542
	Kurtosis Standard Error	0.407
	Kurtosis Z Value	-1.33
Kolomogrov-Smirnov	Statistic	0.095
	df	140

	Sig	0.003
Shapiro-Wilk	Statistic	0.975
	df	140
	Sig	0.012
Summary	Is Data Normally Distributed	Yes

Table 10 Completed data quality checks

As the survey was freely available online for anyone to complete, there was increased potential for receiving fictitious information versus more controlled methods of distributing surveys. As such, a Mahalanobis Distance Test was performed on the data to identify any possible multivariate outliers. This test assisted in identifying five multivariate outliers. Following a further review of all the answers given by these five respondents the researcher made the decision to remove these responses from the data set as data quality was either very poor throughout the entire survey or decreased substantially towards the end of the survey for these respondents.

5.3   Ideas for Further Research

The research identified that in vast majority of cases, respondent's motivation for using alternative recycling methods related either to convenience, kerbside collection not being available or landfill avoidance. The results also demonstrated a low level of awareness regarding many of the alternative recycling methods. It would therefore be beneficial for further research to explore the viability of broadening the range of materials collected through existing kerbside recycling scheme to include common items typically disposed of via alternative recycling methods (e.g. WEEE).

Alternative recycling methods are typically operated by the private or third sector with the goal of generating an income; this demonstrates in part that a market for these additional items already exists which is often a key consideration when local authorities are deciding which materials they are willing to collect via kerbside recycling. Expanding the range of materials collected via kerbside recycling schemes could lead to a significant increase in the recycling rates these more niche material through providing households with a greater level of convenience. The more centralised approach to collecting these materials could also lead to greater efficiencies in processing these materials.

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APPENDIX 1 Questionnaire

qualtrics. | FREE ACCOUNT

Block 1

Recycling in the UK

Thank you in advance for taking the time to complete the below questionnaire. The questionnaire should take approximately 10 minutes to complete and is to be completed by UK residents only. Please note that neither names nor contact details are collected and the answers to this questionnaire are anonymous.

The responses received from this questionnaire will form a crucial part of research into assessing recycling and waste habits in the UK.

If you have any queries regarding this questionnaire please feel free to contact the lead researcher via the contact details stated below.

Lead researcher: Mr Ross Evans
Email address: rossevans@gmx.co.uk

Q1. Please indicate your age, gender and highest level of education.

	Gender		Age	Highest level of education
	Male	Female		
Please select one answer from each column	○	○	⌄	⌄

Q2. Please indicate the number of children who reside in the household and if applicable the age range from youngest to eldest (if one child, enter same age in both age columns).

	Number of children (under 18 years of age) residing in the household	Age of youngest child	Age of eldest child
Please complete each column as appropriate	⌄	⌄	⌄

Q3. Please indicate your driving frequency, employment status and salary bracket below.

	Driving frequency	Employment status	Salary bracket
Please select one answer from each column	[dropdown]	[dropdown]	[dropdown]

Q4. Please indicate the approximate number of years you have resided in your current accommodation and the number of years you foresee yourself continuing to live in your current accommodation. Please also indicate whether you own the property you reside in and enter the name of the local authority.

	Years lived in current residence	Anticipated years remaining in current residence	Do you own the property in which you reside		Name of the local authority in which you reside
			Yes	No	
Please select one option from each column	[dropdown]	[dropdown]	O	O	[text field]

Q5. Please select the option below which best describes your current residence.

	Type of accommodation		Access to outside space		Includes at least one main room on the ground floor		Type of dwelling (please note, living with a partner or family member does not constitute a shared dwelling)	
	House / Bungalow	Apartment	Yes	No	Yes	No	Shared	Unshared / Private
Please select one option from each column	O	O	O	O	O	O	O	O

Q6. Who should bear the greatest responsibility for recycling? Please drag and drop the list below to rank in order of responsibility (1 - most responsibility, 7 - least responsibility).

Government

Consumers

All should be equally responsible

Retailers

No-one

Manufacturers

Q7. Please drag the sliders below to indicate your answer (0 - not at all / none, 10 - very / all / a lot).

	0	1	2	3	4	5	6	7	8	9	10

How environmentally conscious do you consider yourself to be

How worthwhile do you think recycling is

How convenient do you consider recycling to be

How much of your recyclable waste do you recycle

How much recyclable waste do you believe others recycle

How much communication do you receive from your local authority regarding recycling

Q8. Please place in order (drag and drop) the statements below according to how accurately they reflect your views on recycling (1 - most accurate reflection of my views, 12 - least accurate reflection of my views).

Recycling helps strengthen the economy and creates jobs

Recycling aids in portraying an image of a modern country at the forefront of addressing waste

I recycle because it offers a more frequent collection than my regular waste

I do not believe in climate change / global warming

I recycle to avoid warnings or fines from the council

I recycle because there isn't enough space for all of my waste in the regular bin alone

I do not trust that my recycling is correctly sorted and treated

I recycle because it's expected of me by family / friends / neighbours / local authority

Recycling reduces the amount of waste destined for landfill

There is no benefit to recycling

Recycling helps the environment, reduces our use of natural resources, cuts emissions and limits climate change

Recycling creates a better future for our children and grandchildren / next generation

Q9. Which of the factors below (if any) impact upon your ability to recycle via kerbside collection (tick all that apply).

☐ I do not possess a suitable recycling container
☐ I do not have the space required to store a recycling container
☐ I often find that I am too busy to separate materials into the recycling container
☐ It is not clear which material can and can not be placed into local authority recycling
☐ I often find it too messy to separate recyclable materials and non-recyclable materials
☐ I try to recycle but due to habit I often find myself forgetting
☐ I see little benefit in recycling
☐ None of the above

Q10. Please indicate which of the services below your local authority council offer and which ones you use.

	Please indicate which of the services below your local authority council offer and which ones you use			
	My local authority council do not offer this service	My local authority council offer this service but I do not use it	My local authority council offer this service and I use it	I don't know whether my local authority council offer this service
Kerbside dry recycling (e.g. metal cans, glass, paper, cardboard, plastic etc.)	○	○	○	○

	Please indicate which of the services below your local authority council offer and which ones you use			
	My local authority council do not offer this service	My local authority council offer this service but I do not use it	My local authority council offer this service and I use it	I don't know whether my local authority council offer this service
Kerbside waste food collection	○	○	○	○
Kerbside garden waste collection	○	○	○	○
Free or subsidised / discounted home compost bin	○	○	○	○
On request collection of bulky items (e.g. furniture, fridge, TV)	○	○	○	○
Nappy collection service	○	○	○	○

Q11. To the best of your knowledge, which materials does your local authority council collect via the kerbside recycling service?

	Which materials does your local authority collect via the kerbside recycling service		
	Yes	No	I don't know
Aerosol Cans	○	○	○
Cardboard	○	○	○
Cartons / Tetra Packs (e.g. fruit juice, milk)	○	○	○
Cling film	○	○	○
Crisp packets	○	○	○
Foil / foil containers / foil trays	○	○	○
Glass bottles and jars	○	○	○
Metal tins and cans	○	○	○
	Yes	No	I don't know
Mixed plastic (e.g. yoghurt pots, margarine tubs)	○	○	○
Other glassware (e.g. wine glasses, pint glasses, oven dishes, vases)	○	○	○
Paper (newspapers, magazines)	○	○	○
Plastic bags (e.g. carrier bags, bread bags, bin bags)	○	○	○

	Which materials does your local authority collect via the kerbside recycling service		
	Yes	No	I don't know
Plastic bottles	○	○	○
Polystyrene packaging	○	○	○
Textiles	○	○	○
Wallpaper	○	○	○

Q12. Please indicate whether you are aware of the service. If you are aware of the service please indicate how frequently you use it, what materials you recycle via that service and what your reasons for choosing that service are.

	Are you aware of the service and have you used the service			If applicable - Approximately how frequently do you use this service	If applicable - What material(s) did you recycle when using this service and why did you choose to use this service over an alternative service	
	Not aware	Aware but not used	Aware and used		Material(s)	Reason
Recycling banks (e.g. those often found in supermarket car parks)	○	○	○	⌄		
Civic amenity sites (council-run recycling sites)	○	○	○	⌄		
Store collection of bulky electrical items (e.g. washing machine, fridge, TV) when purchasing a new like for like electrical product	○	○	○	⌄		
Collection through a private company (e.g. skip hire, Hippo bag, man and van)	○	○	○	⌄		
Deposit at a charity shop, reuse organisation or as arranged via Freecycle	○	○	○	⌄		
Collection from your doorstep by a charity, reuse organisation or user of Freecycle	○	○	○	⌄		
	Not aware	Aware but not used	Aware and used		Material(s)	Reason
In-store deposit (e.g. containers in shops for depositing batteries, light bulbs, water filters etc.)	○	○	○	⌄		
Reverse vending machines (e.g. Tesco, IKEA)	○	○	○	⌄		
Return postage services (ink cartridge / mobile phone / batteries)	○	○	○	⌄		

	Are you aware of the service and have you used the service			If applicable - Approximately how frequently do you use this service	If applicable - What material(s) did you recycle when using this service and why did you choose to use this service over an alternative service	
	Not aware	Aware but not used	Aware and used		Material(s)	Reason
Exchange or sell used goods through a high street retailer (e.g. CDs, DVDs, games and mobile phones via shops such as Game and CDex)	○	○	○	⌄		
Selling used goods privately (e.g. via eBay, GumTree, AdTrader, car boot sale etc.)	○	○	○	⌄		
Give away to family or friends	○	○	○	⌄		

Q13. Please indicate how you choose to dispose of the materials listed below? (If other please select from the drop-down box)

	How do you dispose of the materials below							If other please select from the drop-down box below
	Regular rubbish collection	Kerbside Recycling	Kerbside waste food collection	Kerbside garden waste collection	Civic amenity site	Recycling Bank	Other	
Glass bottles and jars	○	○	○	○	○	○	○	⌄
Metal tins and cans	○	○	○	○	○	○	○	⌄
Paper (newspapers, magazines, junk mail)	○	○	○	○	○	○	○	⌄
Cardboard	○	○	○	○	○	○	○	⌄
Cartons / Tetra packs (e.g. fruit juice, milk)	○	○	○	○	○	○	○	⌄
Plastic bottles	○	○	○	○	○	○	○	⌄
Mixed plastic (e.g. yoghurt pots, margarine tubs)	○	○	○	○	○	○	○	⌄
Plastic bags (e.g. carrier bags, bread bags, bin bags)	○	○	○	○	○	○	○	⌄
Textiles	○	○	○	○	○	○	○	⌄
Batteries	○	○	○	○	○	○	○	⌄
Food waste	○	○	○	○	○	○	○	⌄

	How do you dispose of the materials below							If other please select from the drop-down box below
	Regular rubbish collection	Kerbside Recycling	Kerbside waste food collection	Kerbside garden waste collection	Civic amenity site	Recycling Bank	Other	
Green waste (e.g. hedge trimmings, cut grass)	○	○	○	○	○	○	○	[⌄]
Light bulbs	○	○	○	○	○	○	○	[⌄]
Working electrical goods	○	○	○	○	○	○	○	[⌄]
Non-working electrical goods	○	○	○	○	○	○	○	[⌄]
Paint	○	○	○	○	○	○	○	[⌄]
Bulky items (e.g. furniture)	○	○	○	○	○	○	○	[⌄]

Q14. Please indicate who is predominately responsible for handling your household waste and recycling.

	Please indicate who is predominately responsible for handling your household waste and recycling
Please select one answer from the drop-down menu	[⌄]

Comments. If you would like to add any additional information or expand upon any of the answers given above please feel free to do so in the text box below.

[   ]

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Please click the red box located to the lower right of this text to submit your survey