ABSTRACT This paper presents results from the action research project, where sustainability professionals, local businesses and academic researchers collaborated on exploring barriers for food waste recycling in SMEs food outlets in order to inform local policy and business practices in Bristol, UK.

The researchers conducted face-to-face, qualitative surveys of 79 catering businesses in three diverse areas of the city. The action research methodology was applied, where a range of co-researchers contributed towards study design and review. The research reveals the main barriers to recycling and how such perceptions differ depending on whether the respondents do or do not recycle, with "convenience" and "cost" being the main issue according to the already recycling participants. On the other hand, participants who do not recycle state that their main reason is "not enough waste" and "lack of space.

Participants recommended a range of measures, which could improve the current food waste services in Bristol. For example, they suggest that business engagement should address the barriers voiced by the participants applying the framings used by them, rather than assuming restaurants and cafes are not aware of the issue. By inviting a variety of non-academic stakeholders into the process of research design and analysis, the project addressed the imbalances in knowledge production and policy design. Despite the local and qualitative focus...
of this paper, the results and research methodology could act as a useful guide for conducting
food waste action research in the policy context.

1. Introduction

1.1. The landscape of food waste in the UK

Food waste is a complex problem. It arises from each stage of food handling; from
growing, processing, preparation, retail to consumption. There are no empirical national-scale
calculations of food waste alone, but it is estimated that the annual food waste in the UK totals
around 10 million tonnes (Mt). This quantity is associated with estimated emissions of 20 Mt
greenhouse gases (mostly through landfills releasing methane) and an economic cost £17 bn
(WRAP, 2017). Therefore, tackling food waste presents a significant policy opportunity to
tackle climate change, hunger and save money.

The UK is a signatory to the international frameworks dealing with food waste, such as
UN’s Sustainable Development Goals (UN, 2015) and EU Waste Framework Directive
(Papargyropoulou et al., 2014). Despite the commitments to the ambitious international
targets, there is little national legislation in place (Priestley, 2016).

Waste in the UK is managed by the devolved countries and the local authorities.
Currently, there are no mandatory food waste regulations in England (ibid.) and the government
favours voluntary approach, such as the Courtauld Commitment 2025, where its signatories
(nearly 100 retailers, local councils, and manufacturers) aim to decrease waste from food and
packaging by 20% between 2015 and 2025 (WRAP, 2018). Commercial waste is managed
privately, although businesses are under the Duty of Care, meaning that they have to “take all
reasonable steps to ensure that the waste is managed correctly throughout its complete journey
to disposal or recovery” (DEFRA, 2016). In practice, many do not choose to recycle or prevent
waste; with the catering and hospitality industry alone leaving 0.92 Mt (or 3.6 Mt CO₂eq)
annually in the UK (WRAP, 2017). According to House of Commons (2017), 41% of waste from hospitality sector\(^1\) is food waste and 43% of waste is sent for disposal.

In contrast, Scotland and Northern Ireland are ahead of England in terms of business waste legislation. Businesses in Scotland and Northern Ireland producing more than 5kg of food waste per week are obliged to set up a separate waste collection (Scottish Environmental Protection Agency, 2016; Department of Environment, Northern Ireland 2015).

1.2. Bristol’s answer to food waste issues

Bristol, a city in the southwest of England with some 442 000 residents, is the area of this study (BCC, 2016). The city aims to become carbon neutral by 2050 (BCC, 2015). It also published a Zero Waste strategy setting out a vision and objectives for significant diversion of waste from landfill by 2030 (BCC, 2016).

The city is home to over 1000 hospitality and catering businesses (Carey, 2011). There is no data on the food waste practices and quantities in the area, however, Carey (2011) presumes that:

“most shops, cafes, restaurants and large-scale kitchens are unlikely to separate out food waste and that it is therefore taken to landfill with all other waste through private contractors (...) more research is needed to establish the volume of food waste generated by the city, including commercial food waste, and to explore collaborative solutions that can serve the city as a whole”.

In the absence of mandatory recycling or mandatory edible surplus redistribution, cross-sectoral partnerships and charities play a significant role in food waste via prevention and recycling in the catering sector. There are no overarching data on redistributed or recycled

---

\(^1\) Defined by WRAP (2018) as pubs, restaurants, hotels and quick service restaurants.
food, however some notable examples are documented via case studies, such as FareShare and Sustainable Bishopston Traders’ Food Waste Recycling Service (BGCP, 2015; Resource Futures, 2013). FareShare redistributes surplus food from retailers, restaurants and manufacturers to the local groups working with vulnerable people. FareShare transfers 30-40 tonnes of food to the charities in the wider Bristol region, supporting 150 organisations in Bristol and neighbouring municipalities (BGCP, 2015). However, it can be argued that due to restrictions on redistribution (i.e. charities cannot accept warmed or cooked food, FareShare, 2018), catering sector is not able to work extensively with surplus food charities.

Another example of a local initiative is Sustainable Bishopston Traders’ Food Waste Service. In 2013, they trialled a co-ordinated food waste collection scheme (Resource Futures, 2013). The scheme conducted a survey of the local needs, secured a discounted deal, promoted it in the local media and organised a catering staff visit to the waste treatment site. The food waste scheme was well documented, however after the successful trial period, it ended due to issues with waste contractors.

1.3. Research aims and objectives

This research explores current food waste practices and barriers to food waste recycling in food outlets, with the aim of informing policies and business practices for improved waste management in Bristol, UK. In particular, this paper reports on the results of the qualitative survey of 79 catering businesses. In doing so, the paper answers the following research questions: What are the main barriers to participation in the commercial food waste recycling services? How can these barriers be addressed at the city and organisational levels? Therefore, the paper contributes to the debates on food waste management at the organisational and policy

---

2 Food waste recycling is defined here as the waste management processes diverting inedible wasted food from the landfill, e.g. composting of anaerobic digestion.

3 For the purposes of primary data collection, we define catering businesses as the following: cafes, restaurants, pubs, fast food takeaways and bakeries.
levels. The findings show how action research approach can address sustainability issues and contribute towards the knowledge creation.

2. Literature review

The literature on surplus food and food waste in the catering industry was reviewed according to three perspectives:

- reasons for food waste;
- proposed and implemented solutions;
- dominant discourses.

The academic literature on food waste in the catering industry tends to focus on conceptualising reasons for the problem (Goebel et al., 2015; Garrone et al., 2014; Priefer et al., 2016; Pirani and Arafat, 2016) and proposing systemic solutions (Priefer et al., 2016, Mourad, 2016). Emphasis is often put on the international comparisons (Mourad, 2016; Priefer et al., 2016, Sirieix et al., 2017) and quantitative investigations (Porpino et al., 2015; Silvennoinen et al., 2014, Pirani and Arafat, 2016). Only a few researchers show interest in reviewing waste management practices and discourses (Mourad, 2016; Thompson and Haigh, 2017).

Academics agree that food waste is a complex problem, which cannot be attributed to a single reason or sector (Goebel et al., 2015; Heikkilä et al., 2016). Waste occurs both at the pre-consumer (e.g. food preparation) and post-consumer (purchased, but not eaten leftovers) stages, which can make business choices highly contingent on the external factors, e.g. customers or suppliers (Pirani and Arafat, 2016). Food quality requirements, lack of co-operation along the supply chain, errors in forecasting customer demand, and portion sizes repeatedly appear as the main reasons for food waste within the catering industry (Goebel et al., 2015; Garrone et al., 2014; Priefer et al., 2016, Heikkilä et al., 2016, Pirani and Arafat,
2016). These studies predominantly used interviews and workshops with high-level professionals to reach the above conclusions.

Thus, the solutions proposed reflect the composition of the participants’ pool, i.e. managers, academic experts, and policymakers. They suggest interventions at high-level decision-making, e.g. “a multi-stakeholder dialogue” (Goebel et al., 2015; Priefer et al., 2016), “improving data availability and measurements by agreeing on the definitions of “food waste/surplus food” or “mandatory collection of food waste” (Priefer et al., 2016).

Nevertheless, interviews and workshops with food sector professionals yielded a few recommendations are the operational level – most of them concerned with food waste prevention. For example, recent studies suggested waste prevention ideas, such as offering individual portion sizes, careful menu planning and improvement of internal routines (Priefer et al., 2016; Silvennoinen et al., 2014). Duursma, et al., (2016) measured food waste in Dutch restaurants and concluded this is an appropriate way of raising awareness among the kitchen staff. Porpino et al., (2015) conducted laboratory experiments demonstrating smaller starter size outperforms persuading customers to reduce waste. Finally, Strotmann et al. (2017) conducted an intervention study, where a set of measures (e.g. staff training, poster, improved communication across the supply chain, change portion size, analysis of customer preferences) contributed to a decrease in food waste in a cafeteria and a residential home. Although the number of experimental and quantitative studies is growing, there is a gap in research investigating the organisational side of food waste recycling.

Despite the aforementioned research gap, academics argue that the catering industry as well as the policymakers are too focused on recycling rather than prevention and redistribution. Mourad (2016) critiqued French and the US municipalities and food companies for promoting predominantly recycling measures as an answer to food waste. She pointed out that this practice
is against the widely accepted hierarchy of waste, which seeks to prevent, then redistribute and then recycle waste (Papargyropoulou et al., 2014). As a result, surplus food turns into a waste commodity (Mourad, 2016).

However, even after reducing food production and redistributing surplus to people in need, there will be “unavoidable waste” left, e.g. cores, egg shells or bones. It is estimated that a quarter of food waste in catering is “unavoidable”, a category defined by WRAP (2017) as food not suitable for consumption. This fact alone justifies the need for research and policy on effective food waste recycling services. Yet, despite the wide encouragement from the policymakers, it is not clear how to introduce food waste recycling to the catering sector.

Food waste is a politicised issue. Mourad’s (2016) paper differentiated between various framings for food waste:

- **Social**, expressed as cooking collectively with surplus produce, Slow Food movement, food banks, national policies to track food losses and redistributing surplus to tackle ethical and food security concerns;
- **Environmental**, e.g. diversion from landfills by composting or anaerobic digestion;
- **Economic**, understood as either “resource efficiency” - managing losses and surplus to maximise economic efficiency OR “a protest against capitalism” through radical bottom-up organising (e.g. freeganism or Food Not Bombs).

Mourad (2016) critiqued the main discourses of waste management present in the French and US governments. She found that the authorities rely on technological improvements and large-scale optimisation of the existing supply chains, leaving the current modes of over-production and over-consumption unchallenged. In other words, they are underpinned by the “economic” discourse understood as “resource efficiency” rather than “protest against capitalism”. In turn,
Mourad (ibid.) suggests sustainability solutions, which challenge “over-industrialization,” and “homogenisation” of food production.

Thompson and Haigh (2017) explore food waste framings through media analysis. They describe a societal shift from arguing for “wartime resourcefulness” to contemporary concerns about “feeding global population with limited resources” (ibid). Furthermore, they argue that at the catering level, food waste is constructed as a moral issue and a matter of incompetency in business management and food handling (ibid).

In summary, the academic literature provides comprehensive reasons for food waste and suggests solutions at various levels of engagement. There are numerous empirical and quantitative studies demonstrating effectiveness of certain specific measures. However, academics have not focused sufficiently on addressing the organisational side of food waste recycling in the catering sector – perhaps due to prevailing engagement with the most senior staff. Research approaches exploring the barriers and practices together with the food waste practitioners and food outlet staff members are therefore critical for providing appropriate policy and managerial recommendations. The following section will elucidate why the approach presented in this paper, action research, is suitable for closing the gap in the literature.

3. Materials and methods

3.1. Methodology: Action Research

The findings reported in this paper contribute to co-designing policy and organisational recommendations related to food waste recycling in Bristol, UK. Hence, the overall methodology applied was action research. Action research is characterised by an emphasis on improving and informing practice while engaging with participants throughout the research design, analysis and dissemination stages (McNiff and Whitehead, 2011). Sequential methods design was applied in this project: the researchers started with the analysis of food waste.
discourses (summarised in section 2). Then, they facilitated a series of meetings with 9 local food waste practitioners (Appendix 1), who highlighted commercial food waste arisings as the key challenge and a tangible opportunity for the city-scale policy. Figure 1 (below) describes the research process: timescales, meetings and data collection.

[INSERT FIGURE 1 HERE]

The central point of the primary data collection was the qualitative survey, designed in collaboration with the practice-based co-researcher (Author 2). Following the data collection and preliminary analysis stage, co-researchers also contributed to the scrutiny of the results.

Action research is used in this study as it focuses on practical and applied knowledge, and it strives to break down the hierarchies and imbalances in knowledge production (Hawkins, 2015). It acts as a conduit between practitioners, policymakers, and researchers. Moreover, giving voice to the food waste practitioners and catering sector staff has important epistemological implications for research and policymaking. It invites questions like: who should design policies? Which questions should be researched? What constitutes as knowledge in complex and transdisciplinary social settings? (ibid.).

3.2. Qualitative surveys

The qualitative design was applied in this study to derive diversity and “richness” of answers and participants rather than statistical analysis of results (Jansen, 2010). Therefore, the results do not aim to represent the whole catering sector, but they act as an evidence for co-designing a policy specific to the local context. Qualitative face-to-face surveys are suitable for exploratory research, where not enough studies on the issue were undertaken and in-depth understanding is required to derive sound policy recommendations (ibid.).

3.3. Data collection
The researchers carried out 79 face-to-face surveys in January 2018. Businesses were purposively selected, so each business type and research area (see Table 1 for area characteristics) was adequately represented. Furthermore, the areas selected reflect the diversity of Bristol’s high streets. The sample size was determined so that the dataset achieves saturation (Morse, 2015), i.e. most opinions are covered, there are visible patterns in data and there is a considerable diversity within the sample itself.

TABLE 1 HERE

The majority of the interviews lasted between 5 and 10 minutes, however, in 8 cases they lasted 15-25 minutes (including 1 waste facilities tour). Answers were recorded in writing on a survey sheet. Two respondents opted for sending email responses instead of participating in a face-to-face survey. The interviews were conducted with the staff at the front of the house unless they specifically requested another staff member to contribute (e.g. an off-duty manager or a chef). Since the level of seniority was not a requirement for participation, the survey allowed to capture a more diverse range of experiences and opinions. Furthermore, the concise survey design contributed to a high response rate as the day-to-day work wasn’t disturbed, nor was a separate meeting was required as the willing participants were recruited using the door-knocking technique.

When distributing the survey, the researchers avoided prompting. They also took care to rephrase questions when a language barrier arose. The researchers used empathetic and non-judgemental language to encourage opinions from participants of all levels of seniority and build trust, which is essential to disclose sensitive information. The survey asked 5 open-ended questions about present food waste management practices (Q1), reasons for (not) recycling (Q2), perceived barriers (Q3), and suggestions for improvement (both for catering sector, waste companies and policymakers; Q4 and Q5). Finally, the survey included 3 demographic
questions (business type, location, membership in a traders’ group) and an option to be contacted in the future.

3.4. Data analysis

The researchers coded participants’ answers and analysed them using thematic-discourse analysis (Braun and Clarke, 2006). Thematic Analysis allows the capturing of patterns in the data in an inductive and systematic way (ibid.). The critical lens of analysis, and the comparison of the languages present in the dataset and the literature were drawn from the tradition of discourse analysis (Bax, 2011). Here discourse is understood as text or speech in a social context, analysed with the reference to ideologies, policies, and agendas (ibid.).

3.5. Limitations and advantages

The analysis of survey data should not be statistically relied upon since the sample size is not representative of the whole city. Seventy-nine participants and three neighbourhoods cannot reflect the participation rate for some 1000 catering outlets located across all 34 wards in the city. However, the nature of action research does not require results to be generalisable as the focus of the survey is the themes and discourses derived from the qualitative data.

Similarly, the recycling participation figure might be an overestimation, as participants who do not recycle could refuse taking part in the surveys or do not reveal its practices truthfully. However, a high response rate and a range of honest and detailed responses from non-recycling businesses encourage trust in the data.

The researchers encountered a language barrier in a few cases, which affected the “richness” of the dataset, particularly in Easton. The researcher used plain language and repetitions to encourage complete answers. For the future, the researchers recommend working with interpreters.
The length of the questionnaire (5 open-ended questions) could potentially affect the “richness” of data. However, a variety of answers, high response rate and the presence of forward-looking insights suggest that the data achieved saturation. The researchers decided to conduct a short survey, as this was more appropriate in busy, customer-facing environments.

4. Results

In total, 79 out of a population of 95 approached businesses responded to the survey (83% response rate). Table 2 outlines the demographic characteristics of survey respondents. The participating businesses were located in the following areas: city centre (39.2%), Gloucester Road (40.5%) and Easton (20.3%). The smaller sample size in Easton reflects the size of the area. They characterised themselves as the following: restaurants (29.1%), pubs (12.7%), cafes (30.4%), fast food takeaways (22.8%) and bakeries (5%).

[TABLE 2 HERE]

The researchers generated three themes described in sections 4.2-4.4. The themes are as follows: “Barriers or excuses?; “Need for top-down measures”; “Giving agency”. After the categorisation of answers in thematic patterns, the researchers investigated the language used by the participants. As a result, dominant, emerging, and conflicting discourses were identified and are described in section 4.5.

4.1. Characteristics of participants who recycle food waste

Out of 79 respondents, 42 (53%) confirmed that they already use food waste collection services. Table 3 outlines the response by area and business type. The recycling rate is not evenly distributed across the areas and business types, with Easton having much lower participation rate than other areas. While restaurants achieved high recycling participation rate (78%), takeaways and bakeries recycled the least (respectively 33% and 0% participation in recycling services). Although the results are not statistically significant, they indicate that
participation in recycling services may depend on the type of the business and the location of
the catering business. As such, improved waste services could target its recipients according to
businesses in needs and potential priority areas.

4.2. Barriers or Excuses?

Figure 2 summarises the main barriers to participation in food waste recycling, as voiced by
the food outlets employees.

According to the participants who don’t recycle food, the main barriers are:

- Not enough waste (recorded 18 times, e.g. “We have very little waste comparing to
  other restaurants” restaurant/Gloucester Road)
- Lack of space for bins (recorded 7 times, e.g. “It’s the practicalities of handling and
  storing food waste on site until collection” café/Gloucester Road)
- Cost (recorded 5 times, e.g. “We used to do it, no it’s too expensive for the amount of
  waste produced” café/City Centre)
- Convenience (recorded 5 times, e.g. “It takes too much work to arrange” restaurant/
  Easton)

However, the landscape changes once the answers of participants, who already recycle
included:

- Convenience (recorded 20 times, e.g. “It’s laziness – there should be no excuse!”
  Café/Gloucester Road)
- Cost (recorded 16 times, e.g. “I imagine it would be the price, it's easier for big
  businesses like ours” restaurant/ city centre)
- Lack of space (recorded 5 times, e.g. “I’d assume it would not be feasible in small
  spaces” pub/ Gloucester Road)
Knowledge gap (recorded 5 times, e.g. “Not many people have the knowledge of what can and cannot be recycled, for example biodegradable cups” restaurant/ Gloucester Road)

There is a clear discrepancy between the barriers mentioned by those who recycle and those, who do not. It is questionable whether the issues of space and small quantities are the complex, systemic barriers claimed or rather - are they “excuses”, which could be overcome with quality communication and simple measures? For example, a participant working in a café on Gloucester Road said: “we should emphasise how easy it is, for example, use myth busters”.

4.3. Need for top-down measures

Thirteen participants indicated that food waste recycling should be a legal requirement, e.g. “It should be done by the council, not waste companies” takeaway/ city centre. Notably, 12 out of 13 answers came from participants, who already recycle. This result should not be used as an extrapolation for the acceptance of compulsory food waste recycling policy. The survey did not explicitly ask: “are you in favour of compulsory food waste management?”.

Instead, the question was the following: “how could waste collection services be improved?”.

Another popular suggestion was “lower price”, mentioned by 12 participants. This solution could be implemented as either policy or market measures. Participants disagreed on whether recycling should be subsidised, e.g. “Everyone should do it; businesses shouldn’t be subsidised to do so” (café/Gloucester Road) vs “State should subsidise it to convert to energy” (restaurant/City Centre). Some other ideas proposed by the participants were “local targeting of areas in need” (takeaway/city centre or “tax relief for green businesses” (Restaurant/Easton). Finally, achieving better value for money could be facilitated using market measures, for example, a co-ordinated cost-efficient service for shopping centres, markets, areas w large concentration of businesses etc. (“Business Improvement Districts
should coordinate it” restaurant/Gloucester Road). Figure 3 summarises the policy measures recommended by the participants.

[FIGURE 3 HERE]

4.4. Giving agency

While large-scale and systemic measures are often preferable for addressing complex issues like food waste, they are usually challenging and timely to implement. Meanwhile, participants recommended a range of operational solutions, which could give the agency to both catering staff and waste companies.

First, waste companies could improve their service by responding to the varied needs of both smaller and bigger businesses (recorded 21 times). A staff member based in the city centre restaurant suggests: “They should offer different bag and bin sizes for small businesses”. Flexible collection times could mitigate the space issues; the owner of a café located in the city centre speculates “since we don’t have space to store an extra bin, we would appreciate daily or on-demand collection”.

Second, improving communication (recorded 17 times) between the researchers, waste companies, catering businesses, and customers could improve the food waste landscape. Participants emphasised that the quality of the communication, rather than the quantity is the key. In extreme cases, a lack of communication is the issue. For example, a manager of an Easton restaurant recalls “we’ve never even been offered recycling, only general waste!”.

Participants believe that business engagement should be meaningful and offer more than factual information. A staff member at a Gloucester Road restaurant concluded that “conversations are better than leaflets”, while a participant from a Gloucester Road café admitted “We only had one door-knocking so far. Now you got me thinking about waste”.

Researchers also have a role in communicating the value of food waste recycling. The owner
of a Gloucester Road restaurant said: “You need to demonstrate the undesirable effect of sending huge amounts of food waste to landfill when it could be converted into energy”.

The issue of recycling food waste is not communicated enough to the customers and between businesses. Meanwhile, participants suggested than championing the right attitude and pledges would create a social norm, for example, a staff member at an Easton café who recommends: “we should be championing businesses who already do it, so others follow”. Additionally, a staff member of a city centre café proposes “businesses should put a sign in the window, advertise it and make it a selling point”.

Finally, committing to food waste collection could result in co-benefits to the business (recorded 9 times). Participants, who already recycle shared that it helps them with stock management and saves money in the long term. For example, an owner of Gloucester Road café said: “it increases awareness of what’s happening in the kitchen and helps to manage stock”. A staff member of a Gloucester Road restaurant argues “separation keeps the general waste low, you can save money as a result”.

4.5. Dominant, emerging, and conflicting discourses

Discourse analysis of the arguments used by the participants reveals that the most common frames used are:

- Environment/sustainability – dominant frame for those, who already recycle (e.g. “We do not want our food waste to be sent to landfill when there is an opportunity for it to be recycled” restaurant/ Gloucester Road)

- “Not our problem” – dominant frame for participants, who don’t recycle, e.g. “We don’t have enough waste as we cook to order” restaurant/ Easton; “We have very little waste and donate all leftovers to neighbours and friends” bakery/ Easton
• Ethical and normative, (e.g. “it’s a good deed, no food should ever be wasted” restaurant/ Easton; “I haven’t thought much about it before but it’s a company policy – we just have to do it” Pub/ Gloucester Road)

• Competent business management - used both by recycling and non-recycling businesses (number), e.g. “We’re staying ahead of the law. It makes sense in the long term- it’s better to do it now before it’s enforced by law, it’s good for our reputation” restaurant/ city centre but also “Main barrier is the cost. However, our menu is devised to minimise food waste. Food waste is expensive for businesses just as unsold stock” café/Gloucester Road

Understanding the discourses used by non-recycling participants could help with effective engagement. The perception of “not having enough waste” ought to be tackled in the first place, for example, by referring to the regulations in Scotland and Northern Ireland. Second, applying “competency” framing could reach businesses who don’t recycle due to practical reasons, like cost or space. Business engagement should contain a mix of information and tailored persuasion. This way, the communication will close the environmental knowledge-gap and emphasise shared benefits.

5. Discussion

5.1. The unexpected and unprompted

Although the questionnaire asked specifically about food waste recycling, 23 participants were keen to mention food waste prevention measures, such as menu control or formal and informal donations. Such conversations were unexpected and unprompted and often occurred as a justification for not recycling food waste. In the UK, regulations around donating food are quite strict, e.g. businesses cannot donate warmed or buffer food (FareShare, 2018). Yet, participants would admit that they regularly donate food informally to other staff members, friends or the homeless. It is unclear whether recycling has a negative impact on the
actions further up the waste hierarchy. Mourad (2016) suggests that small-scale and informal donations get disrupted in favour of industrialised and formalised forms of exchange. However, further research is needed to provide evidence on the relationships between informal and formal waste conduits.

5.2. Discussing results with co-researchers

Following the action research protocol outlined in the section 3.1., the authors presented the survey results to the co-researchers who were able to provide comments and compare the findings with their up-to-date knowledge. Drawing from several years of experience in the sustainability sector, co-researchers signalled the following complexities, which might arise during the design of the improved food waste service:

- Whether food waste is charged by weight or volume (food waste is one of the heaviest recyclables)
- Whether such service would repurpose food waste to anaerobic digestion, compost, or animal feed.

Co-researchers agreed that sharing stories and discourses ought to help uptake. Traders groups could act as knowledge sharing spaces; areas lacking such way of self-organising should get help from the local authority with setting up such business community. They also agreed that lack of space is the major issue for small businesses. However, a group deal and discount could offer frequent collection, which would reduce the need for storage.

5.3. Assessing results against the literature

The paper presented a number of policy recommendations suggested by the food outlet employees. The ideas ranged from partnerships between council and waste companies, through targeting the non-participating and deprived areas to finally- mandatory food waste recycling.
Nevertheless, there is no agreement among the policymakers and academics about whether to treat food waste recycling as a matter of obligation or a voluntary business practice. The English Government currently favours voluntary measures and is reluctant to adopt compulsory food waste recycling since “there are more efficient options than restrictions in this area and evidence suggests that restrictions would likely impose additional costs on businesses, particularly SMEs” (EFRA Committee, 2015).

Similar concerns were expressed by the participants. Major barriers reflect the issue of scale – recycling is more challenging for independent, small, and budget eateries as it is less cost-effective and takes up too much space. This finding is in line with the literature on barriers to sustainable practices for SMEs, who argue that small businesses experience more barriers while engaging in sustainable actions (Lepoutre and Heene, 2006, Rizos et al., 2016). WRAP (2015) echoes the argument of cost-effectiveness, stating that “businesses need to be producing more than 40kg of food waste per week for a separate collection to be viable”.

Yet, a look at the existing practices in Scotland and Northern Ireland challenges the idea of “Not having enough waste”. Scottish and Northern Ireland businesses are obliged to separate food if they produce as little as 5kg of food waste. This approach is an example of the government taking responsibility to establish a code of environmental conduct (Lepoutre and Heene, 2006). At the moment, more research is needed to establish the effectiveness of the mandatory approaches (Pirani and Arafat, 2014).

6. Conclusions

This paper presented results of the exploratory action research project investigating commercial food waste collection services in Bristol. The aim of action research is finding out which policies and interventions would work in a particular context. By bringing together researchers and practitioners, the study can draw evidence for co-designed policies supported by democratic voices and academic theory.
This paper opens new avenues for policymaking by suggesting initiatives and discourses, which are likely to receive support within the catering sector. Such initiatives range from mandatory collections to co-ordinated services operated by the partnerships between traders’ organisations and waste companies. Most importantly, the research brought attention to the need of high-quality communication of the food waste information, which ought to be tailored towards the relevant framings (e.g. sustainability, social norm, competent business management). The researchers recommend that business engagement should address the barriers voiced by the participants applying the framings used by the catering sector, rather than assuming that restaurants and cafes are not aware of the issue. Participants recommended a range of measures, which could improve the current food waste landscape in Bristol. They emphasised that bottom-up and operational solutions will give agency to the catering sector.

The findings were grounded in a qualitative survey using sample size from a small geographical area. Further research on the effectiveness of recycling policies is therefore required. In particular, investigating recent food waste policies in Scotland and Northern Ireland ought to be a priority. Finally, a large-scale survey conducted across Bristol could yield recycling rate representative for the whole city.

**Abbreviations**

BCC – Bristol City Council  
BID – Business Improvement District  
BGCP – Bristol Green Capital Partnership  
CO$_2$eq – Carbon Dioxide Equivalent  
DEFRA – Department for Environment, Food, and Rural Affairs  
EFRA Committee – Environment, Food and Rural Affairs Committee  
EU – European Union
Mt- Megaton (10^9 kg)
SME- Small and Medium Enterprises
UN – United Nations
WRAP – Waste and Resources Action Programme

References

ACORN, (2012) CACI Acorn Segmentation. Map commissioned by the Bristol City Council. Online:
http://maps.bristol.gov.uk/instantatlas/Acorn/Map%20%20Acorn%20Segmentation%20(Bristol).pdf

Bax, S. (2011) *Discourse and Genre*. Macmillan International, London

Braun, V. and Clarke, V. (2006) Using thematic analysis in psychology. *Qualitative Research in Psychology*, 3 (2). pp. 77-101.

BCC - Bristol City Council (2015) Deprivation in Bristol. The mapping of deprivation within Bristol Local Authority Area. Online:
https://www.bristol.gov.uk/documents/20182/32951/Deprivation+in+Bristol+2015/429b2004-eef4-44c5-8044-9e7dcd002faf

BCC- Bristol City Council (2015) Our Resilient Future: A framework for climate and energy security, pp. 120- 198. Online
https://www2.bristol.gov.uk/committee/2015/ua/ua000/1103_binder.pdf

BCC - Bristol City Council (2016) Quality of Life in Bristol 2015-16. Results of 2015 survey. Online:
https://www.bristol.gov.uk/documents/20182/33896/Results+of+quality+of+life+in+Bristol+survey+2015+to+2016/2a83bda4-fed5-400d-b638-2d2c72f67507
BCC - Bristol City Council (2016) Towards a Zero Waste Bristol: Waste and Resource Management Strategy. Bristol, pp. 1-40. Online
http://www.bristol.gov.uk/documents/20182/33395/Towards+a+Zero+Waste+Bristol+-+Waste+and+Resource+Management+Strategy/102e90cb-f503-48c2-9c54-689683df6903

BCC - Bristol City Council (2017) Clean Streets Strategy. Online:
https://www.bristol.gov.uk/bins-recycling/clean-streets-campaign

BGCP - Bristol Green Capital Partnership (2015) Bristol Method: How to tackle food waste in cities. Online: https://bristolfoodpolicycouncil.org/the-bristol-method-and-food-how-we-do-it-here-in-bristol/

Cameron, R. (2009) A sequential mixed model research design: Design, analytical and display issues. International Journal of Multiple Research Approaches, 3 (2), pp.140-152.

Carey, J. (2011) Who feeds Bristol?: towards a resilient food plan: production: processing: distribution: communities: retail: catering: waste, Bristol City Council,
Bristol https://www.bristol.gov.uk/documents/20182/32619/Who-feeds-Bristol-report.pdf

DEFRA (2016) Waste Duty of Care Code of Practice. Online
https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/506917/waste-duty-care-code-practice-2016.pdf

Duursma, G., Vrenegoor, F. and Kobus, S. (2016) Food waste reduction at Restaurant De Pleats: Small steps for mankind. Research in Hospitality Management. 6(1): pp. 95–100

FareShare (2018) The food we take [online] http://fareshare.org.uk/giving-food/the-food-we-take/
Garrone, P., Melacini, M. and Perego, A. (2014) Opening the black box of food waste reduction. *Food Policy*. 46, pp.129-139.

Göbel, C., Langen, N., Blumenthal, A., Teitscheid, P. & Ritter, G. (2015), Cutting food waste through cooperation along the food supply chain, *Sustainability*, 7(2), pp. 1429-1445.

Hawkins, K.A. (2015) The complexities of participatory action research and the problems of power, identity and influence. *Educational Action Research*, 23 (4), pp.464-478.

Heikkila, L., Reinikainen, A., Katajajuuri, J.M., Silvennoinen, K. and Hartikainen, H. (2016) Elements affecting food waste in the food service sector. *Waste Management*, 56 pp.446-453.

House of Commons (2017) Food waste in England. Online: https://publications.parliament.uk/pa/cm201617/cmselect/cmmenvfru/429/429.pdf

Jansen, H. (2010) the Logic of Qualitative Survey Research and its Position in the Field of Social Research Methods. *Forum: Qualitative Social Research*. 11(2). Online: http://www.qualitative-research.net/index.php/fqs/article/view/1450/2946

Lepoutre, J., & Heene, A. (2006). Investigating the impact of firm size on small business social responsibility: A Critical Review. *Journal of Business Ethics*, 67, 257-273

McNiff, J. & Whitehead, J. (2011), *All you need to know about action research*, 2nd edn, SAGE, London

Morse, J.M. (2015) Critical Analysis of Strategies for Determining Rigor in Qualitative Inquiry. *Qualitative Health Research*, 25 (9), pp.1212-1222.
Mourad, M. (2016) Recycling, recovering and preventing "food waste": Competing solutions for food systems sustainability in the United States and France. *Journal of Cleaner Production*, 126 pp.461-477.

Papargyropoulou, E., Lozano, R., Steinberger, J.K. and Wright, N. (2014) The food waste hierarchy as a framework for the management of food surplus and food waste. *Journal of Cleaner Production*, 76 pp.106-115.

Pirani, S.I. & Arafat, H.A. (2014) "Solid waste management in the hospitality industry: A review", *Journal of Environmental Management*, vol. 146, pp. 320-336.

Pirani, S. I., & Arafat, H. A. (2016). Reduction of food waste generation in the hospitality industry. *Journal of Cleaner Production*, 132, 129–145.

Porpino, G., Wansink, B. and Cheek, K. (2015) Saving Food in Restaurants: Half-Sized Portions Outperform Persuasion on Mitigating Waste. *Journal of Nutrition Education and Behavior*, 47 (4), pp. S46.

Priefer, C., Jörissen, J. and Bräutigam, K. (2016) Food waste prevention in Europe – A cause-driven approach to identify the most relevant leverage points for action. *Resources, Conservation and Recycling*, pp. 155-165.

Resource Futures (2013) on the Sustainable Bishopston Traders’ Food Waste and Recycling Service. Online: [http://bristolfoodpolicycouncil.org/wp-content/uploads/2013/06/CCF-2062-Final-report-commercial-food-waste.pdf](http://bristolfoodpolicycouncil.org/wp-content/uploads/2013/06/CCF-2062-Final-report-commercial-food-waste.pdf)

Rizos, V., Behrens, A., van der Gaast, W., Hofman, E., Ioannou, A., Kafyeke, T., Flamos, A., Rinaldi, R., Papadelis, S., Hirschnitz-Garbers, M. & Topi, C. (2016) Implementation of
Circular Economy Business Models by Small and Medium-Sized Enterprises (SMEs):

Barriers and Enablers, *Sustainability*, vol. 8, no. 11, pp. 1212

Silvennoinen, K., Katajajuuri, J. M.; Hartikainen, H., Heikkilä, L. and Reinikainen, A. (2014)

Food waste volume and composition in Finnish households. *British Food Journal*, 116 (6), pp.1058-1068.

Sirieix, L., Lála, J. and Kocmanová, K. (2017) Understanding the antecedents of consumers’ attitudes towards doggy bags in restaurants: Concern about food waste, culture, norms and emotions. *Journal of Retailing and Consumer Services*, 34 pp.153-158.

Strotmann, C., Friedrich, S., Kreyenschmidt, J., Teitscheid, P. & Ritter, G. (2017) Comparing Food Provided and Wasted before and after Implementing Measures against Food Waste in Three Healthcare Food Service Facilities, *Sustainability*, 9, (8), pp. 1409

Thompson, K., and Haigh, L. (2017) Representations of Food Waste in Reality Food Television: An Exploratory Analysis of Ramsay’s Kitchen Nightmares. *Sustainability*, 9 (7), pp.1139.

Visit Bristol (2018) Gloucester Road and Stokes Croft [online]
https://visitbristol.co.uk/shopping/gloucester-road-and-stokes-croft

WRAP – Waste and Resource Action Programme (2015) Commercial food waste collections guide. Final report. Online:
http://www.wrap.org.uk/sites/files/wrap/Commercial_food_waste_collections_guide.pdf

WRAP - Waste and Resources Action Programme (2017) Household Food Waste in the UK, 2015. Final report. Online
TABLES

| Area  | Characteristics |
|-------|-----------------|
| Easton| • Mostly independent businesses – Numerous independent businesses southeast Asian and African food outlets  
      | • Higher than average social deprivation (BCC, 2015)  
      | • Area targeted for street cleaning (BCC, 2017)  
      | • 88% residents concerned about climate change (BCC, 2016)  
      | • 91% residents think litter is a problem (BCC, 2016)  
      | • No Business Improvement District present$^4$  
      | • Most common sociodemographic ACORN$^5$ categories:  
        Aspiring Singles, Starting Out, Blue Collar Roots (ACORN, 2012) |

$^4$ Business Improvement District (BID) - a defined area in which a levy is charged on all business rate payers in addition to the business rates bill. This levy is used to develop projects which will benefit businesses in the local area. (HM Government, 2014)

$^5$ ACORN- a UK population segmentation tool, which categorises neighborhoods in 18 groups according to a wide range of commercial and open data on age of residents, ethnicity profiles, benefits, population density and housing
| City Centre | High concentration and large variety of catering businesses, including both independents and high streets chains, shopping centre, food markets, budget eateries and fine dining  
|  | Most common sociodemographic categories: Educated urbanites, Aspiring Singles and High-Rise Hardship (ACORN, 2012)  
|  | Business Improvement District covering part of city centre  
| Gloucester Road | One of the UK’s longest high streets with independents shops (Visit Bristol, 2018)  
|  | 88% residents concerned about climate change (BCC, 2016)  
|  | Most common sociodemographic categories: Prosperous Professionals, Educated urbanites, Aspiring Singles (ACORN, 2012)  
|  | Traders’ Group and Business Improvement District covering part of Gloucester Road  

*Table 1. Key characteristics of the areas surveyed in the paper*
| Area          | Total count and percentage | Type     | Total count and percentage |
|--------------|---------------------------|----------|---------------------------|
| City Centre  | 32 (39.2%)                | Restaurant | 23 (29.1%)                |
| Gloucester Road | 31 (40.5%)             | Pub      | 10 (12.7%)                |
| Easton       | 16 (20.3%)                | Café     | 24 (30.4%)                |
|              |                           | Fast Food Takeaway | 18 (22.8%)                |
|              |                           | Bakery   | 4 (5%)                    |

*Table 2. Survey participants’ characteristics.*
| Area            | Count and percentage of participants recycling | Type     | Count and percentage of participants recycling |
|-----------------|-----------------------------------------------|----------|-----------------------------------------------|
| City Centre     | 18 (56%)                                      | Restaurant | 18 (78%)                                      |
| Gloucester Road | 19 (61%)                                      | Pub      | 5 (50%)                                       |
| Easton          | 5 (31%)                                       | Café     | 13 (54%)                                      |
|                 |                                               | Fast Food | 6 (33%)                                       |
|                 |                                               | Takeaway |                                             |
|                 |                                               | Bakery   | 0 (0%)                                        |

*Table 3. Proportion of participants already recycling food, outlined by area and type.*
Figure 1. Stages of the research process: timescales, meetings,

| Time          | Event Description                                                                 |
|--------------|-----------------------------------------------------------------------------------|
| Oct-Nov 2016 | Ethics Application Process                                                         |
| Jan 2017     | Discourse Analysis of food waste across policy and academia - Participants’ recruitment |
| Feb 2017     | Group discussion exploring local research priorities. Outcome: food waste in catering outlets selected |
| May-Jul 2017 | Monthly meetings with the Author 2 (practitioner) and other participants. Outcomes: agreed of the design of the qualitative survey, came up with questions exploring barriers and perceptions of food waste services |
| Oct-Dec 2017 | Additional ethical approval required – application process                          |
| Jan 2018     | Primary data collection: 79 qualitative surveys                                    |
| Feb-Mar 2018 | Discussing draft with Author 2. Outcomes: echoed the barriers emerging from the survey, pointed out at potential local audiences for dissemination, suggested further grey literature for review |
| Apr-Jun 2018 | Dissemination of the results: journal submissions, city strategy meetings with the policymakers and waste company |

Barriers to food waste recycling for catering sector:
- Not enough waste
- Knowledge gap
- Convenience
- Cost
- Lack of space for bins
Figure 2. Barriers to participation in food waste recycling according to the food outlets

- Legal requirement to recycle food waste
- Set up co-ordinated collection service in large concentrations of businesses
- Waste collection service subsidised by the government
- Tax relief for "green" businesses
- Targetting deprived areas

Figure 3. Policy measures recommended by the participants

- Policy measures
  - Legal requirement to recycle food waste
  - Set up co-ordinated collection service in large concentrations of businesses
  - Waste collection service subsidised by the government
  - Tax relief for "green" businesses
  - Targetting deprived areas

APPENDICES

Appendix 1. List of the research contributors and authors. Practitioners listed below contributed to the research design and the discussion of the results. NB. Table 2 and Section 3.3 describe the participants of the qualitative survey.

| Name         | Occupation                       | Contribution                                           |
|--------------|----------------------------------|--------------------------------------------------------|
| Author 1     | Academic Researcher             | Data collection, analysis, and write-up                |
| Author 2/ Co-researcher 1 | Civil servant and environmental consultant | Collaboration on research design and results |
| Author 3   | Academic Researcher                                  | Collaboration on each stage of the research |
|-----------|------------------------------------------------------|---------------------------------------------|
| Author 4  | Academic Researcher                                  | Collaboration on each stage of the research |
| Co-researcher 2 | Manager in municipally-owned waste company; oversees setting up of a commercial food waste collection service | Contribution towards research design and literature review |
| Co-researcher 3 | Officer in municipally-owned waste company           | Contribution towards research design and literature review |
| Co-researcher 4 | CEO of Food Redistribution Charity – works with shops and food outlets on donating edible surplus food | Contribution towards research design and literature review |
| Co-researcher 5 | Environmental Consultant- works on waste reduction in the commercial sector | Contribution towards research design and literature review |
| Co-researcher 6 | Sustainability manager of a science centre (an education charity) – works on reducing waste and energy use during events, catering and day-to-day activities | Contribution towards research design and literature review |
| Co-researcher 7 | Manager of the sustainable business network – offers tools and knowledge exchange for companies willing to reduce waste | Contribution towards research design and literature review |
| Co-researcher 8 | Officer in Anaerobic Digestion company               | Contribution towards research design and literature review |
| Co-researcher | Civil Servant in the Council Sustainability Team – manages long-term strategy and partnerships across the sectors | Review of the first draft |