Municipal Waste Management Policy and Strategy

Closing the loop on household food waste with kerbside collection, municipal and community composting

By Jade Clarke
Produced in collaboration with the University of Sheffield, Regather and ShefFood

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REGATHER
SHEF FOOD Sheffield's Food Partnership

The Institute for Sustainable Food

The Institute for Sustainable Food at the University of Sheffield finds dynamic solutions to the challenges of food security and sustainability. Our innovative research draws on the fields of science, engineering, social sciences, and arts and humanities.

Regather

Regather is a co-operative of local people working to improve food and build community in Sheffield. We run an organic farm, veg box scheme, and many other community projects.

ShefFood

ShefFood is a cross-sector partnership of organisations across the city formed of local public agencies, businesses, individuals, academic and community organisations committed to working together to create a more sustainable food system for Sheffield.

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Foreword

With food systems responsible for around one-third of global greenhouse gas emissions (Nature Food 2021) and with agriculture recognised as the biggest threat to the estimated 86% of plant and animal species at risk of extinction (Chatham House 2021), it is now clear that the way we produce our food urgently needs to change.

Despite this knowledge, government continues to fail at every level, from global to local, to establish the appropriate policy frameworks for food system transformation. For example, COP27 was billed as 'the food systems COP', but focused narrowly on supply side agriculture issues dominated by global agri-food corporations, and failed to adopt a holistic food systems approach to include issues such as food waste and loss, nutrition, sustainable diets and resilient supply chains. The UK Government's dismal response to Dimbleby's National Food Strategy report represents another missed opportunity, greeted with dismay and disappointment, failing to give the challenges of food security and sustainability the urgent response that is required if we are to provide affordable, safe and nutritious food for all while living within planetary limits.

The many examples of government failure, at home and abroad, reinforce the importance of local action and innovation if we are to make our food systems sustainable and fair. To achieve food security, "when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life"(FAO 2009), we all urgently need to reflect on what we can do as individuals and communities to lessen the impact of the food that we eat on the natural world, to allow us to exist within the constraints defined by our Planet's limited resources. The COVID-19 crisis revealed the vulnerability of our food system, plunging people who never imagined that it would affect them into food insecurity, almost overnight. The global supply chains on which our current food system is based are fragile and this realisation has highlighted the need to develop our local and regional food production capacity to help mitigate these risks.

In 2022, Regather teamed up with the University of Sheffield's Institute for Sustainable Food to create a 'Local Food Systems Policy Accelerator' to develop evidence-based food system policy change in Sheffield. As part of the project, eight students were recruited to conduct original research into food system issues affecting Sheffield. The student researchers were asked to identify the mechanisms or 'levers for change' that can hasten the development of more sustainable food systems and infrastructure throughout Sheffield. They were given access to the assessment frameworks created

by Sustainable Food Places (SFP), to provide them with an insight into the multi-faceted world of food systems. SFP has previously granted Sheffield a Bronze Award, recognising the standards already achieved with the city. The work to achieve a Silver Award is underway, supported by the creation of Working Groups on specific subject areas within ShefFood, Sheffield's food partnership, and the creation of a Food Action Plan for Sheffield. This important work has in various ways been informed by the research undertaken and the evidence collected by the 'Local Food System Policy Accelerator' team.

We hope you find this report interesting and informative, and that you will join us in commending the student researchers responsible for making their time and effort available, and for contributing their skills and intellectual resources to tackling the critically important challenge of food system transformation.

Gareth Roberts, Co-Founder & Director of Regather
Professor Peter Jackson, Director of the Institute for Sustainable Food at the University of Sheffield

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1.0 Executive Summary

This report aims to provide a comprehensive analysis of the current state of municipal waste management policy and practice in Sheffield, with a specific focus on food waste composting. By bringing together a selection of official policy publications and academic studies, the benefits and barriers surrounding the implementation of municipal and community-level composting schemes are presented, alongside some potential opportunities and realistic levers for change.

The composting of organic waste is an excellent example of nexus thinking in the integrated management of environmental resources. It both reduces the environmental impact of sending organic waste to landfill and brings economic gains as the end product can be put to use in the agricultural industry. Overall, it is clear that if carried out effectively, the municipal and community composting of food waste can provide positive environmental, social and economic outcomes on both a local and global scale.

Food waste composting should therefore be viewed as a key component of Sheffield's aim to become a 'Green City' which is more resilient to climate change and making the transition towards a clean, low carbon economy, in line with the objectives laid out in the 2015 UN Sustainable Development Goals, 2016 Sheffield Green City Strategy and 2009 Sheffield Development Framework. Implementing this transition will not be without challenges however. Ongoing debate surrounds the logistics of collecting and processing waste and the provision of adequate infrastructure and support for households and communities. As the rising price of fuel is putting pressure on Council budgets, investment into a food waste composting programme faces stiff competition from other spending priorities.

This report found that a socially-just scheme which learns from examples of best-practice to maximise the available resources and expertise demonstrates the highest chance of long-term success. The case studies detailed emphasise the need to bring stakeholders at every level together for long-lasting collaboration, adapt technology to the local conditions, and focus on education and targeted awareness-raising campaigns.

Although it will take concerted effort and ambition, Sheffield's waste management strategy has the potential to build on the innovation and radicalism that the city has shown in the past to lead the country towards a healthier and more sustainable future.

2.0 Definitions of key terms and processes

Term	Definition
Food waste	Food appropriate for human consumption being discarded or left to spoil at consumer level – regardless of the cause (HLPE, 2014)
Composting	Composting is defined by human intervention into the natural process of decomposition. Composting generates a soil-like substance in oxygenated conditions, from inputs of food and other biological materials, often called bio-waste or 'organic' waste materials. Micro-organisms use oxygen to transform food waste into compost by consumption and excretion.
Compost	Biologically processed, stabilised and sanitised (waste) organic matter with beneficial properties for plants and soil. (Community Compost network, 2006)
Anaerobic digestion	In anaerobic digestion, food waste is microbiologically broken down in enclosed containers in the near absence of oxygen. The outputs produced are digestate, which can be used instead of fossil fuel-intensive fertilisers, and biogas, which can be used to generate vehicle fuel, heat, electricity, or refined and directly injected into the gas grid.
In-vessel composting	In-vessel composting involves the use of naturally occurring aerobic processes which break down organic matter to produce an organic material suitable for use as a soil conditioner and a source of nutrients in agriculture and horticulture. In-vessel composting allows collected food waste to be composted on a large scale, with control over the compost conditions, such as temperature, pH (acidity and alkalinity) and moisture content.
Windrow composting	The aerobic production of compost by piling organic matter or biodegradable waste in long rows outdoors. Typically occurs on a large scale.

Home composting	Individual household-level composting in small garden bins. Not suitable for animal products or cooked food.
Community composting	Collective composting at the community level, for example composting activities taking place in schools, community gardens and allotment sites. Typically reliant on volunteers and composting activities are usually supplementary to the main focus of the group.
Municipal composting	Large-scale organic waste collection and composting carried out by local authorities.
Energy recovery	An alternative to landfill which involves incinerating waste to produce heat or electricity.

3.0 List of key organisations in the sector

Organisation	Description
Sheffield City Council	Sheffield City Council is the city council for the metropolitan borough of Sheffield in South Yorkshire, England. It consists of 84 councillors, elected to represent 28 wards, each with three councillors. It is currently under No Overall Control, with Labour, the Liberal Democrats and the Green Party each holding chair positions in a proportionate number of committees, with Labour chairing four Committees, the Liberal Democrats chairing three and the Greens chairing two. The council is in charge of coordinating the city's budget and waste management strategy.
Veolia	A French transnational company working in partnership with Sheffield City Council to manage all types of household waste disposal across the region. Owns the Veolia Energy Recovery Facility on Bernard Road.
ShefFood	A hub of local food partnership activity comprising key stakeholders at the city level, with a shared vision and strategic commitment to developing the environmental and economic benefits of a more resilient and sustainable food system for the Sheffield City Region.
The Institute for Sustainable Food at the University of Sheffield	A cross-disciplinary body of academics, researchers, industry experts and policy-makers aiming to achieve transformative and translational research across the entire agri-food system. 'Farm to fork' approach.
Regather	A community business aiming to grow the economy of Sheffield by developing a more productive landscape, with particular focus on urban food production, and to transform the resilience and sustainability of the wider local food system of Sheffield.
Heeley City Farm	An urban farm and environmental visitor centre in Heeley at the heart of Sheffield. Compost is made and sold on-site.

Food Works	An organisation which collects and shares surplus food from retailers and local producers. 'Hubs' consists of a community cafe and social space where local residents can access low-cost meals and groceries. Food Works also owns a farm on Green Estate's Manor Oaks site where food waste is composted or used as animal feed.
Foodhall Project	Sheffield's community centre and social eating project located in the city centre. Foodhall uses surplus food to bring everyone together, tackling social isolation, social inequality and food waste.
Love Food, Hate Waste	A nationwide campaign to reduce household food waste through education and awareness raising.
Olio	Olio is a mobile app for food-sharing, aiming to reduce food waste. It does this by connecting those with surplus food to those who need or wish to consume such food. The food must be edible; it can be raw or cooked, sealed or open
WRAP	WRAP is a British registered charity. It works with businesses, individuals and communities to achieve a circular economy, by helping them reduce waste, develop sustainable products and use resources in an efficient way.
GetComposting	An organisation working with Sheffield City Council to provide household compost bins to local residents.
Re-Food	A company which claims to be the UK's only fully integrated closed-loop food chain recycler. Food waste is made into a branded sustainable biofertiliser called Re-Grow which is used for crops. Currently contracted by the University of Sheffield to recycle food waste from its student accommodation.
Lili Waste	Private company specialising in food waste removal for restaurants, bars and cafes.
Waste Management Sheffield	Private company offering food waste collection alongside other waste collection services for businesses.
DJB Recycling	Private company offering food waste collection alongside other waste collection services for businesses.

4.0 Introduction

Commenting on the launch of new modelling published by the Renewable Energy Association, CEO Nina Skorupska said: "Separate food waste [collection] is a cost-effective policy that can help us hit our recycling target, reduce harmful greenhouse gas emissions, and improve our energy security in one fell swoop." At the household level, 30% of all residual household waste consisted of food waste, yet despite this, 45% of English local authorities offer no separate food waste facility (McDowall, 2016). As households make up 70% of all food waste in the UK (WRAP, 2021), targeting this sector is vital in reducing the negative environmental consequences of food waste and harnessing the beneficial outputs that correct recycling procedures can offer.

WRAP estimated that for 2018, annual post-farmgate food waste produced by UK households, the hospitality and food service, manufacturing of food, as well as retail and wholesale sectors amounted to 9.5 million tonnes. 70% of the food was intended to be consumed by people with 30% being 'inedible parts'. The monetary value was over £19 billion a year and the waste produced approximately 36 million tonnes of greenhouse gas emissions (WRAP, 2021).

The 2021 UK Environment Act, intended to 'fill the gap' in environmental legislation when the UK left the EU, made it mandatory for Local Authorities to ensure household food waste is collected separately from other forms of waste from 2023 onward. This ruling means that Sheffield City Council needs to be putting infrastructure in place that enables its citizens to comply with food waste legislation effectively and efficiently. This process however cannot be successfully achieved by the council alone, and requires multi-scalar cooperation between a number of public and private sector actors, community organisations and individual households.

Although many large and medium sized businesses already have measures in place to recycle their food waste through partnerships with privately run waste-disposal companies, there is currently no public provision in Sheffield for households to separately dispose of food residue. This report will consider the state of municipal waste management policy and strategy in Sheffield, presenting evidence to engage discussion on how the technique of composting can be employed to better utilise Sheffield's food waste. Beginning with an analysis of the current picture, this report will then outline a selection of relevant policy documents and academic literature. Case studies will be used to demonstrate successful projects in other cities, before moving on to a discussion of the key debates surrounding this topic and a brief assessment of the potential levers for change.

4.1 Why does this subject matter?

Food waste makes up around 30% of household residual waste, yet despite significant policy developments in Wales, Northern Ireland and Scotland, the UK as a whole currently recycles just 10% of household food waste, with the UK sending a total of 6,103 thousand tonnes of biodegradable municipal waste to landfill in 2020 (DEFRA, 2022) . When food is not correctly recycled it is not just the emissions from decomposition which have negative repercussions - the water, fuel and labour that went into the food's production is also wasted. The pressing issue of climate change and pollution has been brought to the top of the international agenda as a result of the recent COP-26 summit in Glasgow, while the recent repercussions from the Russian invasion of Ukraine has highlighted the imperative to decouple from our current fossil-fuel dependence. It is therefore the ideal time to capitalise on political momentum to restructure broken and outdated modes of operation and make our cities and countryside more environmentally just and sustainable.

The Sustainable Development Goals

The UN Sustainable Development Goals are an ambitious set of 17 global targets designed to be a "blueprint to achieve a better and more sustainable future for all". They were agreed upon in 2015 and are intended to be achieved by 2030. Each goal is made up of a series of outcome targets and indicators. The minimisation and correct recycling of food waste has a crucial part to play in the success of many of these goals, demonstrating the fundamental and cross-cutting importance of this issue on the global scale.

Goal	Target
2. Zero hunger	**2.4** Ensure sustainable food production systems and implement resilient agricultural practices that increase productivity and production, that help maintain ecosystems, that strengthen capacity for adaptation to climate change, extreme weather, drought, flooding and other disasters and that progressively improve land and soil quality
3. Good health and wellbeing	**3.9** Reduce illnesses and deaths from hazardous chemicals and pollution
7. Affordable and clean energy	**7.2** Increase substantially the share of renewable energy in the global energy mix **7.3** Double the global rate of improvement in energy efficiency **7.A** Enhance international cooperation to facilitate access to clean energy research and technology, including renewable energy, energy efficiency and advanced and cleaner fossil-fuel technology, and promote investment in energy infrastructure and clean energy technology

9. Industry, innovation and infrastructure	**9.4** Upgrade infrastructure and retrofit industries to make them sustainable, with increased resource-use efficiency and greater adoption of clean and environmentally sound technologies and industrial processes, with all countries taking action in accordance with their respective capabilities
11. Sustainable cities and communities	**11.6** Reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality and municipal and other waste management
12. Responsible consumption and production	**12.2** Achieve the sustainable management and efficient use of natural resources **12.3** Halve per capita global food waste at the retail and consumer levels and reduce food losses along production and supply chains, including post-harvest losses
13. Climate action	**13.2** Integrate climate change measures into national policies, strategies and planning
15. Life on land	**15.3** Combat desertification, restore degraded land and soil, including land affected by desertification, drought and floods, and strive to achieve a land degradation-neutral world. **15.5** Take urgent and significant action to reduce the degradation of natural habitats, halt the loss of biodiversity and, by 2020, protect and prevent the extinction of threatened species

4.2 Why compost?

In 2019 the city of Sheffield declared a 'Nature Emergency' in recognition of the damage done to ecosystems and wildlife from dominant society's current unsustainable approach to resource management. Composting food waste is one example of a sustainable waste management technique that offers great potential to address this ecological crisis. The use of compost is a crucial tool to achieve soil remediation which can enhance soil structure, mineral content, biodiversity, improve crop health and reduce the use of synthetic fertilisers and pesticides which can produce water pollution (Kawai et al., 2020; Cerda et al., 2018). Applying compost to soil can reduce greenhouse gas emissions associated with avoided production and application of artificial fertilisers, and increase carbon uptake in plants in the form of carbon sequestration. Compost amendments/additions to soil can also improve tillage and workability of soil, reducing the need to till the soil and thus reducing energy inputs associated with tilling (ibid).

The benefits also include reduced peat use which in turn preserves habitats and avoids harmful emissions (Sommerlad, 2021). The nutrient-rich substrate can also be used in urban parks, gardens and leisure spaces, cutting down on the need to purchase commercially-produced growing materials. Studies have shown that multi-scalar composting, including community composting and municipal scale composting, when combined, capture food waste effectively and can also offer more diverse forms of social value (Morrow and Davies, 2022; Slater and Aiken, 2015).

When the food waste collection legislation comes into action in 2023, Sheffield needs to be ready to channel food waste away from energy recovery, as the high moisture content in food waste means it is not best suited for combustion (DEFRA, 2011), and its nutritional value is not used effectively. Soil remediation is a beneficial result of the composting process which isn't captured when food waste is processed through energy recovery. Composting therefore provides a viable alternative that makes best use of this precious resource.

4.3 Current provision

Waste collection and recycling is managed by local councils and therefore varies significantly across the UK. The table below shows levels of food waste collections nationally:

	Separate food waste	Combined food and garden waste	Both scheme types	No food collection
England	31%	17%	6%	45%
Wales	86%	5%	9%	0%
Scotland	56%	19%	6%	19%

Waste disposal in Sheffield

	2021-22
Total household waste (tonnes)	**193,495**
Recycled	28.22%
Composted	5.15%
Sent for recovery	66.58%
Sent to landfill	0.05%

Findings from trials carried out by Veolia in Sheffield have revealed that the amount of food waste in domestic residual waste bins is 33%, slightly higher than average (Charters, 2022). Sheffield City Council does not offer free home compost bins to residents, but they do have a partnership with GetComposting, an initiative to reduce waste destined for landfill. The most basic model starts at £22.00, with prices rising to as much as £270 for a 100 litre HotBin.

Sheffield Energy Recovery Facility

This facility is owned by Veolia and processes 245,000 tonnes of household waste per year. It is a modern incinerator which not only provides electricity from the combustion of waste but also supplies heat to a local district heating scheme, making it one of the most advanced, energy efficient incineration plants in the UK. According to the Violia website the district heating network prevents 21,000 tonnes of CO2 from being released from buildings across the city, compared to energy derived from fossil fuels (Veolia dSheffield, n.d).

However the facility is not without controversy, with Sheffield Green Party claiming that the new incinerator is still responsible for 31,308 tonnes of greenhouse gas emissions per annum that would be prevented were the waste to be recycled, even taking into account that the incinerator recovers heat and power (The Green Party, 2007). To allow the incinerator to run at full capacity, waste from outside the catchment area and recyclable waste has previously been used to plug the shortfall in input material. There are also widespread concerns about air pollution caused by such facilities (Consonni et al, 2005).

The BDR Waste Treatment Facility

The BDR Waste Partnership is a collaboration between Barnsley, Doncaster and Rotherham Councils set up 20 years ago with the purpose to jointly manage waste generated in the three boroughs. The Mechanical Biological Treatment (MBT) plant is located in Mexborough, between Doncaster and Sheffield. There are two waste transfer stations in the area, Grange Lane Transfer Station in Barnsley which is operated by Renewi and Doncaster Waste Transfer Station in Kirk Sandall, Doncaster which is operated by Suez. MBT is a method of treating mixed household waste as well as commercial and industrial waste. In the biological part of the process, waste is shredded and dried before useful materials such as metals, plastics, glass and stone and fine organic material are removed in the mechanical part of the process and sent to specialist recycling re-processors where this material is sorted by material type and used to make new products. The remaining waste is classed as Solid Recovered Fuel (SRF).

Waste delivered to the transfer stations is bulked up and brought to the BDR Waste Treatment Facility. The fine organic material remains on site at the BDR Waste Treatment Facility and is taken to a dry Anaerobic Digestion Facility where it is mixed with woodchip and the moisture driven out of the waste during the drying process. This mix is placed into a fermenter where biogas is released from the waste as it breaks down. The bio-gas, a mixture of carbon dioxide and methane, is captured and used to generate a proportion of the electricity needed for the site. It also produces heat that is used in the AD process to warm the organic material and speed up the digestion process. The plant makes a compost-like output that is used on land reclamation and remediation projects.

At the end of the process a dried fuel is produced which is taken to Multi-fuel in Ferrybridge and burned in an electricity generation plant which produces low-carbon energy to power up to 160,000 homes (BDR Waste Partnership, n.d.)

5.0 Methods used in undertaking the review

This review relied primarily on Internet-based research. To gather information, search terms such as 'UK waste policy', 'waste disposal legislation', 'food waste', and 'Sheffield waste strategy' were used.

The national-level policy frameworks were accessed through the central government's website (gov.uk), while local frameworks and strategies were accessed through the Sheffield council's website (sheffield.gov.uk).

StarPlus, The University of Sheffield's online database search engine, was used to find the academic papers and books reviewed and cited in this review. The search terms used were: 'community composting', 'food waste composting', 'sustainable urban waste management', and 'sustainable cities' were used.

6.0 Literature review

6.1 Policies and frameworks

DEFRA (2018): Resources and Waste Strategy for England

Summary

This strategy sets out how the government plans to double resource productivity and eliminate avoidable waste of all kinds (including plastic waste) by 2050.

The strategy sets out a plan to:

- Preserve our stock of material resources by minimising waste, promoting resource efficiency and moving towards a circular economy
- Minimise the damage caused to our natural environment by reducing and managing waste safely and carefully
- Deal with waste crime

It combines immediate actions with firm commitments for the coming years and gives a clear longer-term policy direction in line with the 25 Year Environment Plan. Chapter 3 contains some highly relevant targets surrounding household food waste recycling and opens up the possibility for nexus thinking by advocating for an improvement in working arrangements between local authorities. However an emphasis is placed on Energy from Waste (EfW) plants rather than exploring the potential for community composting.

Chapter 7 acknowledges the need for research and innovation, both to developing novel solutions and improving the efficiency, cost and/or effectiveness of existing technologies.

Key points:

- Chapter 1 - Sustainable production
  - → Policies with the aim to avoid waste at the manufacturing and production level.
- Chapter 2 - Helping consumers take more considered actions
  - → Policies designed to help customers make sustainable choices and address barriers to reuse.

- **Chapter 3 - Resource recovery and waste management. Sets out guidelines for how local authorities can:**
  - → Improve recycling rates by ensuring a consistent set of dry recyclable materials is collected from all households and businesses
  - → Reduce greenhouse gas emissions from landfill by ensuring that every householder and appropriate businesses have a weekly separate food waste collection, subject to consultation
  - → Improve urban recycling rates, working with business and local authorities
  - → Improve working arrangements and performance between local authorities
  - → Drive greater efficiency of EfW plants
  - → Address information barriers to the use of secondary materials
  - → Encourage waste producers and managers to implement the waste hierarchy in respect to hazardous waste.
- **Chapter 4 - Tackling waste crime**
- **Chapter 5 - Cutting down on food waste**
  - → More effectively redistribute food before it can go to waste
- **Chapter 6 - International leadership**
- **Chapter 7 - Research and innovation**
- **Chapter 8 - Data, monitoring and evaluation**
  - → Move away from weight-based towards impact-based targets and reporting, focusing initially on carbon and natural capital accounting

Sheffield City Council (2009): Sheffield Development Framework - Core Strategy

Summary

The Core Strategy provides the overall spatial strategy for the City Council's Local Development Framework. It is intended to last until 2026 and sets out the overall spatial vision for the city and the relationships between areas within it, based around the recurring themes of transformation and sustainability. The Core Strategy contains policies that directly concern waste development and recycling, with a focus on reducing the amount of waste sent to landfill.

The Core Strategy is developed around five areas:

1. Strong economy
2. Successful neighbourhoods
3. Inclusive, healthy communities
4. Great place to grow up
5. Environmental excellence

Part 1 of the strategy outlines the history of Sheffield's development, and lists 15 key challenges for the future. The spatial vision is detailed, with each goal comprising several objectives. Part 2 contains the spatial policies which set out how the vision will be enacted for the city as a whole and areas within.

Key points:

CS68 Waste Development Objectives

11.27 Sheffield embraces the overall objective set out in national waste strategy and planning policy of making better use of waste as a resource through reduction and re-use of materials in the first place...The City Council, in its current Waste Strategy, is committed to its energy-from-waste policy for managing the majority of its municipal (mainly household) waste.

CS70 Provision for Recycling and Composting

11.35 Other provision for waste management in the city are more local but still significant for achieving the city-wide aim of increasing recycling.

11.36 The extension of composting will be required to meet Landfill Directive targets and is already the subject of action by the Council's waste contractor. Improvements to the waste recycling centres will be made in order to comply with forthcoming regulations about specific forms of waste. The proposed additional centre in the south-west will be subject to resources and a site being identified to serve the sector between the Manchester Road and the Chesterfield Road corridors.

Sheffield Green City Strategy (2016)

Summary

The final report of the Sheffield Green Commission – Sheffield's Green Commitment – was published in 2016, and set out a vision for how, working together as a city, Sheffield could become a smarter, more sustainable, more competitive 'future city'. The Green City Strategy aims to reduce the city's impact on the climate by becoming a zero-carbon city by 2050, taking steps to move to a low-carbon economy.

The report is split into 6 key sections:

1. Reducing Our Impact On The Climate
2. A Climate-Resilient City
3. Sustainable and Affordable Energy for Residents and Businesses
4. Modern, Reliable and Clean Journeys for Everyone
5. Clean Air for All
6. A Green and Innovative Economy

The report has laudable intentions, but is conspicuously lacking targets and policies explicitly concerning recycling and composting. However many of the other targets such as those surrounding climate and the green economy are relevant here.

Key points:

- The report promised that the City Council will establish a Green City Partnership Board composed of representation from across the city.
- The report also stated that the Council will also aim to establish an Office for Climate Change, which could be a collaboration between the Council and business, industry our educational establishments and public agencies and will work to coordinate the delivery of projects and programmes across the city, as well as working with the City region and national Government to secure resources and investment from national and international programmes.

South Yorkshire Municipal Waste Partnership Highlight Report April 2021 – February 2022

Summary

This report outlines the progress made over the last year in achieving 5 strategic priorities surrounding waste and recycling in Sheffield, Rotherham, Barnsley and Doncaster. Each strategic priority encampasses a number of targets which are reviewed according to available data for the period. Key activities for the next period are also highlighted.

From the data included in the report it is clear that the pandemic has detrimentally affected the achievement of many recycling targets. For example, residual household waste in Sheffield rose from 490.585kg per year in 2018/19 to 538.863kg per year in 2020/21.

Furthermore, the work streams of several strategic priorities have been placed on hold in anticipation of a new and emerging Resource and Waste Strategy for England, limiting scope for immediate progress.

Key points:

Strategic priorities:

1. To encourage and inspire children and adults across South Yorkshire to make less waste by reducing, reusing, and recycling more.
2. To deliver and maintain a dependable and reliable service
3. For all four councils to work together more closely to deliver value for money services
4. To continue exploring how waste technology can be used to improve recycling and waste services.
5. To be proactive to influence decision making on waste at a European, national, and local level and to drive investment in infrastructure within South Yorkshire.

6.2 Academic literature

Machado, C.R., Hettiarachchi, H. (2020). Composting as a Municipal Solid Waste Management Strategy: Lessons Learned from Cajicá, Colombia.

Summary

This chapter uses the example of a successful municipal waste composting scheme in Colombia which has become a world-leader in organic waste composting, as recognised by the UN in 2017.

It uses the term 'nexus thinking' to describe how cross-sectoral collaboration was employed through the development of the municipality's Integrated Solid Waste Management Plan (PGIRS), which improved the security of resources by integrating management and governance across sectors and scales, thus reducing trade-offs and building synergies with the overall intention of promoting sustainability (Hoff 2011).

Key points:

- Cajicá launched a source separation and composting initiative called Green Containers Program (GCP) in 2008, based on a successful pilot project conducted in 2005. The organic waste separated at source collected from households, commercial entities, schools, and universities are brought to a privately operated composting plant chosen by the city to produce compost.
- The composting facility has the capacity to treat 1000 tons of organic waste each month. The current technology uses the Aeromaster PT-120 (pull-type) compost windrow turner, which works on three aspects concurrently: windrow turning and watering, addition of inoculants, and reshaping of the windrow. The average process time is around 10 weeks for the mesophyll and thermophile phases.
- The compost plant sells compost to the agricultural sector which is closely monitored to ensure that it meets stringent environmental standards. The participants in the GCP could also receive a bag of compost every 2 months as a token of appreciation.
- The municipality's Integrated Solid Waste Management Plan (PGIRS) is very important in shaping waste management activities. Finding the correct business model and structure was also crucial, as was the establishment of strong working relationships with external agents who could provide technical, commercial, financial and research support.
- Environmental education among the public (especially schools) has played an important role in the process of development and maintenance of GCP. The programme employs 18 full-time trainers.

Keng, Z.X. et al. (2020). Community-scale composting for food waste: A life-cycle assessment-supported case study.

Summary

The authors of this paper conducted a life-cycle assessment for community composting, which involves looking at long term impacts of operations, using the University of Nottingham Malaysia as the case study. It concluded that the presented community-scale composting method for food waste is 'technically feasible and socially desirable' (p.10).

The study acknowledged that multi-actor partnerships of government sectors, city councils, community organisations and households are essential to the success of such schemes, especially in educating the community on how food waste should be sorted, how to collect it efficiently and appropriate monitoring and recording practices.

Key points:

- Using composting to replace landfill for food waste alongside the application of chemical fertilisers with the organic compost produced, can greatly reduce the environmental impacts, especially on global warming, ecotoxicity, eutrophication and fossil fuel depletion.
- The quality of the finished compost met the Malaysian organic fertiliser standard, with organic matter, C/N ratio, W, TKN, P, and K at respectively 52.5%, 12, 21%, 2.62%, 3.39%, and 0.58%.
- The assessment found that community composting has the potential to be more economically feasible than anaerobic digestion because AD requires technicians and linking the plant to the energy grid.
- Rewards such as compost, seeds and discounted grocery vouchers could be implemented as incentives to proper sorting of food waste.

Morrow, O. and Davies, A. (2022) Creating careful circularities : Community composting in New York City.

Summary

The researchers highlight that care is central and features strongly evidenced circularities that exist beyond the economic realm, with gifting, sharing, donating of labour, time, material and non-material e.g. energetic 'things', such as listening. This suggests that food waste can initiate emotional, visceral, affective and embodied level changes and that when researching and implementing food waste collection, these personal elements should not be ignored.

This case study shows there is scope for co-ordinating well organised multi-scalar and city-wide composting that is both centralised and decentralised, with kerbside, drop-off and home composting systems functioning in combination

Key points:

- In this study it is argued that 'care' is an often under-appreciated yet highly valuable element involved in community composting where relationships are built both between people and between the place they dwell, including their relations to nature. The authors highlights the benefits of community composting including:
  1. Social empowerment
  2. Greener neighbourhoods
  3. Improved local soils
  4. Enhanced food security and fewer food deserts
  5. More local jobs
  6. Increased composting know-how and skills within the local workforce that are reinforced in the next generation.
- The authors maintain that community composting creates time and space for cultivating an ethics of care toward organic waste, human and more-than-human others, shifting perspectives as well as everyday waste practices. They studied the New York City Compost Project (NYCCP) which is presently threatened by funding cuts and is receiving strong public campaigning to support its continuation and expansion.
- The NYCCP was founded by the Department of Sanitation in 1993 with an ambition of 'rebuilding New York's soils and providing every New Yorker with access to composting'. The project is administered by and given funding from the Dept of Sanitation Bureau of Recycling and Sustainability which also supports the project by inspiring 'passion and skill' to build a network of innovative methods of delivery.

- Residents were provided with knowledge, skills, and opportunities needed to produce and use compost locally. Two organisations provide education, complemented by open-source learning materials. The Master Composter Training Programme is the official training. It encourages people to set up, support and use composting systems in their local area. It offers an in-depth understanding of soil microorganisms and organisms and the making and uses of compost.
- There are 24 paid positions dedicated to compost outreach, education, and food waste collection. A system of Food waste collection is performed by Local Organic Food Recovery Programmes (LORP). There are 7 community composting demonstration sites across the city's 5 boroughs. Each Borough has a Resident-Led Solid Waste Advisory Board. This geographical breakdown of regional representation and responsibility offers interesting prospects for how a city region might disperse a decentralised food waste composting network.
- Existing allotments, urban farms and food charities put on educational and spatial activities, such as events and campaigns, to build composting teaching, collection, production and distribution. All the NYCCP compost sites are run by non-profit organisations and, as a condition of funding, all NYCCP compost produced must remain as public good. The NYCCP supports by providing training and assistance at community gardens. In 2013, nearly 2500 people took part in composting workshops and keeping the compost product as a public good is found to motivate involvement.
- The structure of the NYCCP also includes the banning of commercial businesses from making organic food waste and an investment in residential kerbside collection. Kerbside collection of food waste began in 2014.

Carvalho Machado, R. and Kindl Da Cunha, S. (2022). From urban waste to urban farmers: Can we close the agriculture loop within the city bounds?

Summary

The authors conducted a case study of a decentralised composting scheme in Curitiba, a city in Brazil. Community gardens were identified as appropriate spaces for composting because they generate organic materials and consume fertilisers and compost, whilst also being in close proximity to communities. The aim of the decentralised system was to build a social practice, a routine activity embodied by people, where people bring their food waste to a collection point in a community garden and generate compost. However, whilst the rest of the scheme showed positive results, the composting element of the programme experienced several barriers that offer insights for successful decentralised composting.

It appears that if decentralised composting is to be successful, some form of standardised training and checking-in must be adopted. This is despite clear efforts to provide adequate locations to carry out composting, revealing the importance of communications and relationships between people in the composting network. A clear motivation for composting needs to exist alongside clear rules for maintenance which are enforced and maintained by a person who has sufficient energy to give focus to this aspect of a garden.

Key points:

- The State policy and a central government branch, The Secretariat for Food Security and Nutrition, attempted to create a network of composting activities in community gardens. The state department provided seeds, seedlings, fertiliser, machinery, and fences to groups who wished to use empty urban spaces, both public and private, for urban agriculture to promote food security and sovereignty under the Urban Agriculture Programme.
- Through provision of some compulsory guidelines for cultivation and bed management, the scheme encouraged the production of fresh, pesticide free produce in spaces for social activity, with therapeutic and community values.
- It was found that the key to a garden functioning was the co-ordinator, who was a volunteer often mistaken by garden users as being employed by the city. Their responsibility was to keep relationships between gardeners friendly, to supervise and advise gardeners, keep records and accounts, and represent the community. The aim of the coordinator is to support gardeners in increasing their self-sufficiency.

- It was found that when gardeners were made aware that the co-ordinator was not employed by the state, the co-ordinator was deemed less trustworthy because their benevolence and impartiality was seen by gardeners as a vital component of the gardens functioning with fairness between gardeners. It was also found that more support for the co-ordinator, including from agronomists, would help them to implement composting, since composting training was given to the co-ordinator who passed it along to the gardeners, but people did not adopt the practice.
- The research found that there was insufficient attention paid to the learning process because alternative fertilisation to that given from the state was viewed with suspicion and gardeners did not see the value in compost as a fertiliser. Gardeners were found to have insufficient information about the composting process. The study found there was poor communication and poor coordination between the gardeners and government levels.
- With improper composting techniques the composting practice was quickly abandoned, due to actual and perceived risk of its smell, the concern and occasional reality of pests and the perception of diseases.

Brass, C., Bowden, F. and McGeevor, K. (2012) Can an urban community independently run its own waste services?

Summary

A case study of FOOD-LOOP explores an organisational structure of food waste collection and processes that continued functioning after it became independent of council funding and support. It shows how composting can operate a closed loop on a small scale, such as an estate, with learning being passed along through a culture of buddying and mentoring.

Key points:

- The SEED foundation, a London based social enterprise promoting sustainability began in 2008 to promote food waste and food growing activities through their FOOD-LOOP initiative. The SEED foundation worked in partnership with a Policy Studies Institute, was funded for its initial Two years by the London Borough of Camden as a pilot scheme and was also studied by DEFRA to identify barriers to success.
- The projects' goal was to transform resident's perceptions of food waste as a waste product, to instead view it as a resource. The programme engaged households in separating their food waste from other rubbish and putting this food out for collection.
- At Maiden Lane Estate in Camden, an In-Vessel Rocket Composter was installed in September 2009 and in 2011 a group of residents began to independently run a food waste collection service after convincing the council to allow the community to utilise the Rocket composter beyond the two-year trial period.
- The project was considered feasible due to high demands and difficulties for urban farming and professional horticulturalists to obtain reliable, good quality soil enhancement. This motivated the participation.
- The project was led by a team of residents who organised through the local community centre and an online scheduling platform called Doodle. TimeBank credits (where labour is paid for in alternative ways such as through exchanges) were received as a reward for volunteering in the project, which amounted to around 2-3 hours per week.
- New recruits were buddied with existing volunteers to enable efficient training to collect food waste, distribute information to residents and manage the Rocket Composter. Some volunteers supported with procuring funding through bids and marketing the compost product.

- 'Boostaplant', originally named Plantify, is the compost-like material produced from the collected food waste that has been processed by the Rocket composting unit in the Maiden Lane Estate. It is described as a 'crumbly, nitrogen rich, soil-like substance with a high concentration of elements and trace elements required for plant growth'. The programme claims that tests on allotments in spring 2011 showed improved vegetable growth. Boostaplant is being used on the estate itself to grow new food, and is also sold in gardening shops as an efficient slug-repelling fertiliser.
- The motivational and attitudinal considerations to composting are central to the activities of this project and the funding allowed the group to procure the Rocket Composter equipment necessary to both carry out the activities and recruit more people who became inspired to participate.

7.0 Discussion and debate

7.1 Type of composting

The closed form of composting known as in-vessel composting (IVC) is likely to be the most appropriate form of composting for a city-wide collection scheme. In-vessel composting promotes better odour control compared with open composting, and is suitable for the recycling of garden waste and mixed food waste containing animal by-products. This is because the composting process is contained, but also the system is better controlled, so the process is kept most efficient, with optimal aeration which also significantly reduces the production of Volatile Organic Compounds and Ammonia, removes the risk of encouraging vermin and is less affected by seasonal variation (Wei et al, 2017).

IVC however is more expensive to set up and run, and requires technical expertise to be managed correctly.

Stage 1

The food waste, either separate or already mixed with garden waste, as well as commercial and industrial sources, is delivered to an enclosed reception area.

It is then shredded to a uniform size and loaded into what is known as the first 'barrier', which will be a bay/tunnel etc depending on the system used.

The composting process is kick-started by naturally occurring microorganisms already in the waste. They break down the material, releasing the nutrients and in doing so increase the temperature to the 60-70ºC needed to kill pathogens and weed seeds, and meet the regulations for processing animal by-products (ABP) material.

Stage 2

After the first stage (which can take between seven days and three weeks), the material is transferred to the second 'barrier', where the composting process continues, usually for a similar duration.

Processing in 2 stages ensures that all parts of the composting mass reaches the required temperature. The oxygen level, moisture and temperature are carefully monitored and controlled during both composting stages to ensure the material is fully sanitised.

Stage 3

Once the sanitisation process is complete the compost is left to mature in an open windrow or an enclosed area for approximately 10-14 weeks to ensure stabilisation.

Due to the higher start-up costs and expertise required for IVC, open windrow composting is usually seen as more appropriate for decentralised community composting projects.

Stage 1

The feedstock is shredded, mixed and placed into windrows along a non permeable surface.

Stage 2

The windrows are turned on a regular basis to improve oxygen content, distribute heat to regulate temperature and to distribute moisture. The windrows are turned multiple times during the composting process, which takes on average sixteen weeks, depending on maturity requirements.

Stage 3

The last part of the process involves screening the compost to remove contaminants such as plastics and metals, and to also grade the compost for various end uses. Oversized materials are also removed and can be put back through the whole process until they have composted down sufficiently.

7.2 Funding

At present the main barrier towards the separation of food and domestic waste is funding concerns. As the rising price of fuel is putting pressure on Council budgets, investment into a food waste composting programme will face stiff competition from other spending priorities.

In an interview with the Sheffield Star in 2021, Councillor Paul Wood, the executive member for waste management, stated that:

> *"As a council we are clear we need the additional, new burdens, funding from Government to implement this service. Councils already providing food waste collections prior to 2023 will not stand to benefit from this additional funding and that is why we do not have any plans to introduce the service any earlier than the date prescribed by Government." (Williams, 2021)*

Insufficient funding was also identified as a key risk to the achievement of the strategic priorities in the South Yorkshire Municipal Waste Highlight Report.

7.3 Public attitudes and participation

The higher the participation in kerbside collection schemes, the higher the yield. Research has shown that well-run food waste collections can generate high levels of participation; they can capture ~20%-50% of available food waste; and can be widely supported by residents. However, the results of a WRAP trial scheme revealed that despite householders being provided with a collection each week, a fairly high percentage of service users choose not to present their food waste for collection at each collection, with participation rates ranging from 76% to just 21% (WRAP, 2009) .

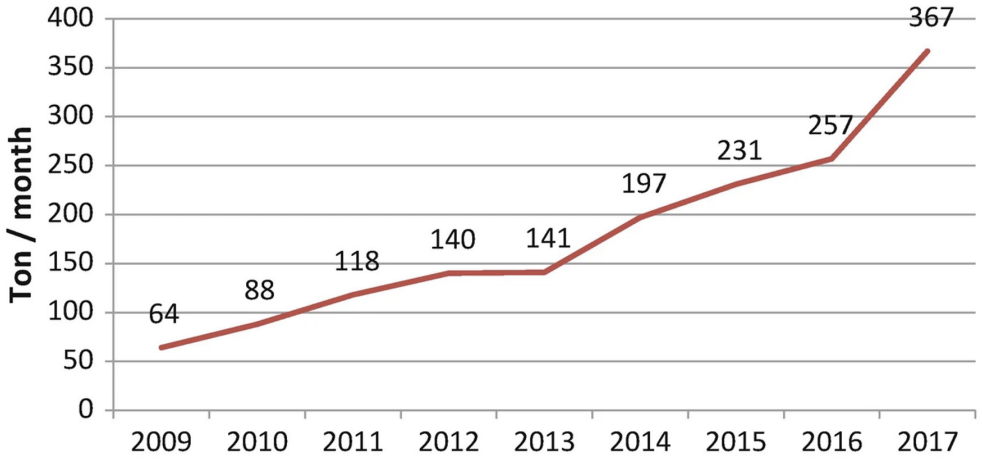
The most common reasons given by respondents for not participating in the food waste collections were related to concerns about potential hygiene, odour or vermin issues (24% of non-participants combined). However these issues were considered less important by residents who actually participated in the collections (6% of participants), indicating that these are often perceived issues rather than problems experienced in reality.

The single main reason stated for non-participation was not producing enough food waste (21% of nonparticipants). For most households this is also likely to be an issue of perception rather than reality; WRAP has shown in The Food We Waste study that even households that claim to generate no food waste at all produce on average 2.9kg per week (p.209)

The Department for Environment Food and Rural Affairs suggests legislation changes to UK wide food waste separation and composting will require an intensive, national level campaign to motivate people to see value in the practice. Avoidance of engagement with food waste because it is seen as being unpleasant is one of barriers to food waste separation for collection (Defra, 2010).

According to a 2017 composting feasibility study, conducted by RRS and commissioned by the District of Columbia Department of Public Works, high participation occurs in communities that place significant value on waste reduction and diversion and understand the full circle benefits of composting. Generating a community culture focused on these factors would involve continuous education on the reasons for and benefits of composting, a sense of trust and commitment in the Council leadership, and, more than likely, time.

Looking at evidence from the case study of Cajicá, a town with a population of roughly 10% the size of Sheffield which implemented a food waste collection scheme in 2005, we can see how the amount of waste collected over time can be expected to increase due to rising participation.



7.4 Infrastructure/ logistics

The legislation in the Environment Act states that food waste also must be collected weekly. This ensures that the quality of food waste is less degraded than it would be if collected fortnightly. It also means that if a household misses a collection, the food waste is not left for four weeks until collected, by which time it will be spoiled. This will prove an additional logistical problem in the Sheffield city region where at present just one type of bin is collected per week.

The physical characteristics of a property can limit the options for the storage and presentation for collection of external food waste containers. In the case of high-rise flats, the collection options available to a local authority are also limited.

Flats generally present lower food waste yields and lower participation rates. This can be due to the challenge of moving food waste to a collection point. In one trial where food waste bring-to containers were located near to the entrance of several estates and high-rise properties, alongside dry recycling bring containers and householders were provided with 7 litre caddies and liners, the average yield per household served was 0.32 kg per week. In two similar trials for high-rise properties food waste collection was a little higher but all were lower than that attained through door-to-door collections. In Sheffield, results from the 2011 census showed that purpose-built flats account for around 9% of dwellings with as many as 63% in Central ward. It is therefore essential that a robust strategy is put in place to ensure appropriate solutions for food waste collection in such conditions.

Participation rates for collections from multi-occupancy properties were found to be much lower. The average participation rate achieved across all trial rounds collecting from multi-occupancy properties was 25% (WRAP, 2009).

Levels of deprivation were also found to be significant in affecting the food waste yields achieved in the trials, with trials in more affluent areas tending to achieve higher yields in comparison to trials operating in less affluent areas.

7.5 Quality control considerations

A number of factors must be achieved to produce high quality compost that is suitable for commercial use. For example optimum temperature and pH levels must be maintained and risk of chemical and physical contamination must be managed. This requires highly specialist skills and knowledge.

The British Standards Institution's 'Publicly Available Specification for Composted Materials' (PAS 100) requires compost producers to:

- Establish quality policy and management system to ensure compost that is fit for purpose;
- Perform Hazard Analysis and Critical Control Point planning must be carried;
- Restrict inputs to source-segregated biodegradable materials;
- Ensure materials composted and the resulting composts must be traceable;
- Provided customers with information about where the compost was made and guidance on storing, handling and using the compost.

If involving animal waste products, composting at all scales must comply with the Animal By-Products Regulations (ABPR) or else a penalty is enforced.

These stringent and complex guidelines may discourage composting at the community level and suppress small-scale start ups. However DEFRA are currently reforming and reviewing the waste legislation framework in the UK. The consultation on the changes closed on 15th April 2022.

7.6 Additional requirements

When food waste and other biodegradable matter goes into the composting process (can be referred to as the feedstock or inputs), the carbon to nitrogen ratio must be balanced. This means food high in nitrogen must be balanced with ingredients that are high in carbon, such as cereal husks, straw, woodchip and cardboard. These are often called 'Bulking Agents' but may be described as 'Balancing Agents' (BAs). An adequate supply of these materials must therefore be secured if the composting process is to be scaled up.

In the case of Cajica, a medium called bokashi (a mix of effective microorganisms and wheat bran which prevents odours and catalyses the composting process) was used by households to combine with food waste. Therefore the sourcing and distribution of this medium should be considered.

7.7 Liners

Liners for bins are an important part of the system for collecting food waste. Surveys and focus groups suggest that residents prefer to use liners to: keep their internal kitchen caddy and external container clean and hygienic; and transfer food waste from the kitchen caddy to the external container securely. Householder surveys carried out as part of WRAP food waste collections trials in

2008- 09 suggested that participation would be significantly affected if supplies of free liners were removed and residents were then required to purchase liners from retail outlets (WRAP, 2009).

Further WRAP research on barriers to participation found that households without an ongoing or adequate liner supply tended to stop participating with difficulties in re-recruiting these households onto the scheme later. Some local authorities that launched food waste collections schemes without any liner provision from the start (advising residents to use newspaper to line their kitchen caddies) have reported satisfactory participation and yield. But despite the option of wrapping in newspaper, large proportions of presented food waste is contained in caddy liners which means residents are preferring to use liners and are purchasing them. Financial pressures on local government may limit the ability of councils to provide sufficient liners or indeed any liners as part of the service. Similarly, households may be unwilling or have insufficient disposable income to purchase their own supplies of liners. The reduced access to liners may well result in lower levels of scheme participation, with adverse impacts on local authority costs, including: increased refuse disposal costs due to lower diversion of food waste; increased communications costs in trying to re-engage residents, and a loss of capital as the containers provided to non-participating households are not being used (WRAP, 2014).

7.8 Co-mingling of food and garden waste

On the municipal level, a feasibility study carried out by RRS on behalf of the District of Columbia concluded that it can be more cost effective to collect food waste in a circumstance where the council is already collecting similar garden waste materials and can easily integrate the smaller amount of food waste into the existing container (RRS, 2017). At present, households in Sheffield which purchase a green bin for £29 and pay the yearly service cost of £49.65 can have their garden waste collected once a fortnight between March and November. This waste is then composted in an open system, meaning that food waste is not currently permitted. If the current amount of garden waste collected by the council was added to food waste and transferred to a closed system, an extra 400 - 800 tonnes of material per month (on average during collection season) would be available to compost. This figure increases by another 89 (December) to 819 (June) tonnes per month if green waste currently taken to Sheffield's Household Waste Recycling Centres is taken into account (Sheffield City Council, 2022).

8.0 Levers for change

8.1 Education and employment

Evidence from case studies has emphasised the need for a strong commitment towards public education. As the success of an organic waste composting programme depends on the quality of material received, the local authority must make a commitment to raise awareness in organic waste source separation amongst all stakeholders including households, commerce, industry, schools and colleges.

Social media could be more effectively utilised as a tool to communicate information and encourage correct procedure around the disposal of food waste to individual households. At present @ SheffCouncil on Twitter has 114,100 followers, the Sheffield City Council Facebook page has a total of 22,000 followers, and @sheffieldcitycouncil has 11,400 followers on Instagram. This method could be especially effective at targeting younger residents.

Visits to local schools and colleges could be utilised to engage children and help to dispel negative connotations surrounding food waste.

It is also important to capitalise on the employment opportunities that municipal composting could provide. In Priority 12 of the Green City Strategy, the Council states its commitment to "working with businesses, educational and knowledge institutions including our Universities and Sheffield College and our community and third sector organisations, we will explore and develop a programme for new low carbon jobs for local people" (p.31). It also claims that "we will explore the potential for programmes such as new vocational training and skills for school leavers, apprenticeship schemes or support for innovative low carbon entrepreneurs" (ibid). This commitment must be harnessed to support new composting initiatives.

8.2 Increased support for local-level schemes

Many community compost schemes rely on the work of volunteers, which can limit their long-term sustainability. As studies have shown that community level compost schemes are among the most efficient methods of recycling food waste, a programme of more comprehensive support for community organisations is needed to train participants and help these schemes comply with official guidelines and specifications. It is within these schemes that many of the social benefits of collective composting can be realised.

8.3 Prevention is better than cure

Although food waste composting has many beneficial outcomes, surplus food interception and redistribution actions which help to prevent edible food from becoming waste are essential. CO2 emissions saved from preventing food waste amount to 4.5 tonnes per tonne of avoided food waste compared to 0.45 tonnes per tonne of food waste recycled through in-vessel composting, for example (WRAP, 2009). Therefore organisations such as Food Works and Foodhall and alternative distribution networks such as Olio have a key role to play in the council's overall strategy.

8.4 Public - private cooperation

Evidence from the Cajicá case study shows that a programme which depends too heavily on one private facility poses significant risk, therefore plans should be made to spread dependence across a number of institutions. At present the city's own waste disposal is contracted to Violia, a private company. There are also a number of private food waste collection companies operational in Sheffield which recycle food from businesses. The council should investigate the possibility of partnering with these local companies which already possess significant resources and expertise in the area.

The Green City Partnership Board established as a response to the 2016 Green City Strategy has an important role to play in facilitating this cooperation, and the capacity of the board should be fully exploited

9.0 Conclusion

This review concludes that if carried out effectively, the municipal composting of food waste can provide positive environmental, social and economic outcomes on both a local and global scale. Food waste composting has been proven to reduce greenhouse gas emissions, combat pollution, lower dependence on fossil fuels and improve soil health, themes which are highly pertinent to the human population in the 21st century.

At present, the city of Sheffield composts just 5.15% of its total waste and does not collect food waste separately from other domestic waste. Both the Sheffield Green City Strategy and Development Framework Core Strategy demonstrate a clear commitment to working towards more sustainable forms of waste management, yet predominantly advocate for energy recovery as a means of managing the majority of its organic municipal waste. The Core Strategy does acknowledge that 'the extension of composting will be required to meet Landfill Directive targets', but does not offer a clear path to achieve this.

With the introduction of mandatory food waste collection in 2023, an overhaul of the waste disposal system is required to ensure that this change can be implemented in a sustainable way that benefits not just the environment but also local people. It is therefore essential that the City Council employs 'nexus thinking', drawing on examples of best practice to implement a scheme that is both environmentally and socially just. Nexus thinking can improve the security of resources by integrating management and governance across sectors and scales, thus reducing trade-offs and building synergies with the overall intention of promoting sustainability.

There is potential to integrate food waste collection with existing collection of garden waste to increase overall compost volume and collection efficiency, and the feasibility of this proposal should be explored further. As collection costs can comprise 60-70 percent of total program costs (RRS, 2017), selecting the best approach is a critical element which must be carefully considered.

Findings from the literature indicate that to be successful, a municipal and community-level waste composting scheme must:

- Change attitudes surrounding food waste among local residents so that it is viewed as a valuable resource.
- Place an emphasis on education and awareness-raising, starting from an early age.
- Establish a strong motivation and incentive for participation across all sectors of the population.
- Ensure that local communities feel a sense of ownership of the programme and are able see tangible benefit from the compost created through the scheme.
- Adapt available technology to meet local needs and conditions.
- Put measures in place to dissuade fears about potential hygiene, odour or vermin issues.
- Subsidise the provision of food bin liners and caddies to increase participation rates.
- Adequately support and train volunteers and community organisations involved in administering the scheme.

Sheffield City Council has a pivotal role in providing civic leadership, inspiring and facilitating across all sectors and parts of the city to help to create a low carbon future. It is therefore imperative that the City Council invests money into education and training, and works on building effective communication channels with local households. This is best achieved through the formation of strong multi-agency partnerships between the public and private sector, community organisations, volunteers, education providers and households. The ShefFood network has a significant role to play here, as it is composed of key stakeholders with significant knowledge and expertise.

While public-private partnerships are an essential part of the scheme, it will be important to establish clear guidelines to prevent a composting scheme becoming co-opted by business interests and monetised. Overall, the scheme is most likely to be successful if the profits and products are reinvested back into the local community and benefit local people.

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