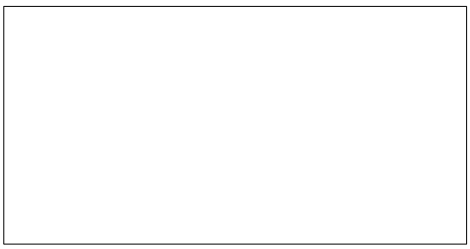

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Impact of food hubs on food security and sustainability: Food hubs perspectives from Leeds, UK

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ABSTRACT

In the context of rising food insecurity, food hubs such as food pantries, food banks, community agriculture supported schemes, social supermarkets, community kitchens and cafes, have proliferated both in number and in the roles they perform. Food hubs have a range of benefits in the communities that they serve as well as the wider food system. However, more empirical evidence is required to build a compelling case for policy support. Using the area of Leeds, UK as a case study, and taking a mixed methods approach (i.e. evidence synthesis, mapping, survey and interviews) we present the food hubs' perspectives on the benefits that they offer to food security, sustainability, resilience and food justice. Food hubs reflect on how their activities enhance sustainability, strengthen local food systems, support local economies, and improve the health, wellbeing and agency of their communities. In doing so, food hubs contribute to regional, national and global priorities on food security, health, sustainability, justice and resilience. However, to scale *up or out* their positive impact, food hubs require support to transition away from emergency food provision to longer-term, holistic and financially viable models that focus on community wellbeing and empowerment, healthy diets, local economies and environmental sustainability.

1. Introduction

Despite extensive efforts globally, food insecurity is still on the rise. Nearly one in three people in the world (2.37 billion) did not have access to adequate food in 2020 (FAO, 2021). Increasing food demand, climate variability and extremes, competition for depleting resources, as well as conflict and economic downturns (exacerbated by the COVID-19 pandemic and the war in Ukraine) are major drivers of food insecurity and malnutrition that continue to increase in both frequency and intensity.

In response to increasing food insecurity, particularly in urban contexts, food hubs have proliferated both in number and in the roles they perform. Although there is not a universal definition for food hubs, their primary function is to gather food from growers and suppliers, and distribute it to consumers, often operating within an explicit set of ethical priorities (Guzman, Reynolds, and Sharpe, 2019). Food hubs perform various activities such as food aid/food pantries or surplus food redistribution, social supermarkets, food skills training, or community engagement via cafés. Some food hubs aim to offer a local and/or more sustainable food supply chain, and redistribute food surplus hence prevent food waste. Others aim to improve access to food in deprived communities, provide market access to small food growers and producers, offer skills training, employment and volunteering opportunities, or advocate for policy change. Most food hubs do a combination of the above and deliver wider social, economic and environmental benefits (Nelson and Landman, 2020).

Although the benefits food hubs bring to the communities they serve and the broader food system are increasingly recognised, there is still limited evidence to build a convincing case for policy support (Neumann and Sharpe, 2023). This study aims to present the food hubs' perspectives on their impact on the food system and the communities they serve in the UK and make policy recommendations on how food hubs can be

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supported to deliver healthier, more sustainable, resilient, and just food systems.

2. Literature review

Food insecurity is the limited or uncertain access to adequate and safe food for an active and healthy life, which can lead to hunger and malnutrition (FAO, 2018a). According to Coleman-Jensen et al. (2020), food insecurity is a complex issue that affects millions of people worldwide, particularly those who are on low-income, homeless, or live in food deserts. Food insecurity negatively affects the wellbeing of individuals, increasing the risk of a range of chronic diseases and poor mental health (Gundersen et al., 2020). Such evidence indicates that addressing food insecurity could be an important strategy for improving health outcomes, particularly amongst vulnerable populations. Climate change has further exacerbated the problem of food insecurity by disrupting agricultural production, reducing crop yields in some geographic locations, and increasing the prevalence of extreme weather events such as floods, droughts, and heatwaves (FAO, 2018b). Rising temperatures and changes in precipitation patterns also lead to the spread of pests and diseases, further jeopardizing crop production and food security (FAO, 2018b). Moreover, climate change affects the availability and quality of water resources, which are critical for agricultural production. According to the Intergovernmental Panel on Climate Change (IPCC, 2019), climate change poses a significant threat to food security and nutrition, particularly in low-income and vulnerable populations (FAO, 2020).

To reduce food insecurity, food systems need to become more sustainable, just and resilient (FAO, 2020). A sustainable food system delivers food and nutrition security for all in such a way that does not compromise future generations' food security and nutrition (FAO, 2014). Achieving sustainable food systems requires a multifaceted approach that encompasses environmental, economic, and social aspects, such as promoting agroecological practices that enhance biodiversity, soil health, and water conservation; reducing food waste and losses along the supply chain; improving food distribution systems to reduce food deserts; and ensuring fair and equitable access to food for all (FAO, 2014, 2020). According to the FAO (2018b), sustainable food systems also require greater policy coherence and stakeholder engagement, as well as supportive regulatory frameworks and investment in innovation and research.

Closely linked to sustainable food systems is the concept of food systems resilience. Food system resilience can be defined as the ability of a food system to cope with disturbances and continue functioning effectively (Neumann and Sharpe, 2023). Tendall et al. (2015) propose that food system resilience consists of four dimensions: ecological, economic, social, and institutional factors, and suggest that food system resilience requires a holistic and adaptive approach, involving multiple stakeholders and strategies that build capacity for coping with shocks and stresses.

Finally, it is imperative to consider food justice when developing plans and policies to improve food system resilience and sustainability. Food justice seeks to address injustices within the food system based on income, class, race and gender (Borghini, 2023). Food justice aims to empower food actors, supporting their right to food, sharing of food systems benefits and risks across class, race and gender, and create new business models for underserved communities (Food Ethics Council, 2020).

2.1 Food hubs and their social, environmental and economic impact

In the context of growing food insecurity, food hubs have proliferated both in number and in the roles they perform (Colasanti et al., 2018). This is particularly true in the UK where one in five households were severely or moderately food insecure in 2023 (Food Foundation, 2023), and food banks reported an 89 % increase in usage between 2022 and 2023 (IFAN, 2023). There is no agreed formal definition of a food hub, as they are diverse, serve different purposes and populations, and take different approaches to achieve their goals (Berti and Mulligan, 2016; Blay-Palmer et al., 2013). Whilst, a uniform definition of food hubs is challenging, there are two broad approaches to food hub work: values-based agri-food supply chain management, and sustainable food community development (Berti and Mulligan, 2016). The values-based supply chain model is dominated by for-profit businesses and aligns with the United States Department of Agriculture (USDA) definition of a food hub, as "*a business or organisation that actively manages the aggregation, distribution and marketing of source-identified food products primarily from local and regional producers to strengthen their ability to satisfy wholesale, retail and institutional demand*" (USDA, 2019). On the other hand, the sustainable community development approach is dominated by non-profit organisations and could be defined as "*networks and intersections of grassroots, community based organisations that work together to build increasingly socially just, economically robust and ecologically sound food systems that connect farmers with consumers as directly as possible*" (Blay-Palmer et al, 2013). Other definitions aim to capture the range of food hub types but at the same time are prescriptive enough to indicate what roles food hubs play. For example, Guzman and Reynolds (2019) described food hubs more broadly as "*entities that sit between people who produce food and people who use it, gathering food from growers and distributing it either to commercial customers or directly to consumers – often working with an explicit set of ethical priorities*." Other key aspects of hubs include their multidimensional nature (Rose, 2017) and place-based focus (Fischer, Pirog and Hamm, 2015).

Food hubs are often grouped according to what sector is responsible for overseeing them. For example, food hubs can be described as retail-driven, whereby they are like a traditional wholesaler but also perform other functions such as directly connecting producers and consumers (Morley et al., 2008). Food hubs can be non-profit-driven, when they focus on working toward broader goals related to social justice and ecological sustainability (Clark et al., 2019), for instance promoting human health, improving racial equity and advocating for fair wages (Colasanti et al., 2018). On the other hand, food hubs can be producer-driven, when they are developed as an alternative business option or to solve a producer's own distribution issues. Such hubs may be led by cooperatives, which are bound by decentralised decision making and risk sharing.

In practice there is often a substantial degree of overlap between these models (LeBlanc et al., 2014; Morley et al., 2008), and this typology may be refined further. For instance, food hubs could be grouped according to the population they serve, according to their main motivation for operating, where they source their food or according to their food distribution approach (Morley et al., 2008). Alternatively, food hubs could be grouped according to a variety of the aforementioned factors, and as such it is likely that a more holistic grouping of hubs may be needed to ensure a more expansive understanding of their work (Horst et al., 2011).

Regardless of where food hubs fit within a typology, they create a range of economic, social, and environmental benefits to the communities they serve and the broader food system (Levkoe et al. 2018). Nelson and Landman (2020) highlighted several economic benefits of food hubs, including the creation of jobs, increased investment in local food businesses, and an increased diversity in the customer base. Research also suggests that food hubs can contribute to the economy by acting as intermediaries between market actors in the aggregation and distribution of local food thereby supporting small and medium scale farmers in accessing markets and securing fair prices (Colasanti et al., 2018; LeBlanc et al., 2014). Examples of such economic benefits were summarised in a series of case studies from the US (Barham et al., 2012).

Nelson and Landman (2020) also highlighted several environmental benefits of food hubs including increased use of renewable energy, planting of trees and reduced greenhouse gas emissions. In support, other research indicates that food hubs can promote the adoption or use

of sustainable or environmentally sound agricultural production practices (Barham et al., 2012). Improving sustainability of the food system is one of the main spheres in which food hubs have generated the most notable benefits; helping to reduce food waste by repurposing food, acting as community educators on the ways that food can be more efficiently used in the home, helping producers implement practices which decrease waste in processing, and encouraging retailers to develop programmes to reduce waste in their shops (Shirvell, 2020). By promoting greater food system sustainability in the aforementioned ways, food hubs are helping to reduce the environmental impact of the food system. According to a report by the Global Food Banking Network (GFN), food banks operating in 57 countries across the world help to prevent 10.5 billion kilograms of CO2 emissions from entering the atmosphere each year, equivalent to the output of nearly 2.2 million passenger vehicles (Leung, 2019). Food hubs can also help to build food system resilience, i.e. the system's capacity to deliver desired outcomes when exposed to stresses and shocks (Neumann and Sharpe, 2023). This was particularly evident during the COVID-19 pandemic, when supermarkets experienced food shortages due to panic buying and supply chain issues, whereas for example local food pantries were more agile in adjusting their food supply chain and keeping up with the growing demand (Resilience of the UK Food System, 2020).

Food hubs can also offer several social benefits, by improving equitable access to affordable, healthy food, rebuilding local food economies and delivery capacity building to producers and consumers (Martinez et al., 2010). Sharpe et all (2020) suggest that food hubs can support improved access to healthy food and lead to increased consumption of fruit and vegetables. A survey conducted by Michigan State University in 2015, reported that more than 87 % of food hubs focus on increasing access to healthy and fresh food, and more than 95 % of food hubs focus on improving human health in their communities as part of daily operations and programs (Hardy et al., 2016). Other research indicates that food hubs can lead to improved local resilience (Blake, 2019) and food security (Fawcett-Atkinson, 2021; Greenberg et al., 2010) by supporting the triple bottom line and increasing food access, particularly for marginalised populations (Colasanti et al., 2018). Food hubs also offer training and mentoring opportunities for producers for example in the form of crop planning and post-harvest handling training (Barham et al., 2012). They also work with consumers to increase food literacy and awareness of healthy local food, improve emotional wellbeing and lobby for policies supportive of sustainable local foods (Nelson and Landman, 2020).

Although, the significant positive impact food hubs have on communities and food systems is increasingly recognised, stronger empirical evidence is needed to build a compelling case for policy support and funding. This research builds on the small but growing body of academic and practitioner knowledge on food hubs and aims to present the food hubs' perspectives on their impact on the food system and the communities they serve in the UK and make policy recommendations on how food hubs can be supported to deliver healthier, more sustainable, resilient and just food systems.

3. Methods

3.1 Research design

This research aims to (i) examine the perspectives of food hubs on their impact on food systems and communities in terms of food security, sustainability, resilience, food justice and healthy diets, and (ii) make policy recommendations on how food hubs can be better supported.

A mixed methods research design was developed to address this aim (Fig. 1), comprising an evidence synthesis, a food hub mapping exercise, a survey, semi-structured interviews, and policy recommendations formulation.

Leeds in the UK, was selected as an ideal case study for complex, socio-economically and culturally diverse urban food systems of under 1 million population in the global north (Jensen and Orfila, 2021). The research was co-designed and co-produced in collaboration with FoodWise[1] and Leeds City Council's Public Health, Sustainability, and Financial Inclusion teams. FoodWise formed in 2017 as the city's food partnership to create a healthy, sustainable, and fair food system for everyone in Leeds. FoodWise consists of representatives from the third sector,[2] academia, business, and the council. FoodWise and Leeds City Council co-developed the Leeds Food Strategy and will oversee its delivery.

An ethical review was completed before commencing data collection, in accordance with the University Research Ethics and Integrity Framework. In line with this framework, the identity of the research participants was kept anonymous and participant consent protocols were followed. The research team comprised the Principal Investigator and a Postdoctoral Researcher who were involved in all the stages of the research.

3.2 Evidence synthesis

A literature review collated existing evidence of food hubs in the UK and globally and informed the design of the survey and interviews (in particular Nelson and Landman, 2015). Academic and grey literature was reviewed to better understand the function food hubs perform and existing evidence on the benefits food hubs bring to communities they serve and the wider food system.

3.3 Food hubs mapping exercise

Following the evidence synthesis, a mapping exercise was conducted to identify food hubs in and around Leeds. For the purposes of this study, an organisation was deemed to be running a food hub in Leeds, and in turn were eligible for inclusion in the study, if they produced, collated, provided or distributed food in the form of fresh fruits and/or vegetables, other groceries or prepared meals and snacks. Food hubs included, but were not limited to, food banks, food pantries, community kitchens, community supported agriculture schemes, community care hubs, community cafes. To explore how many food hubs were in operation in Leeds at the time of the study (February 2022- February 2023), a comprehensive list of food hubs was compiled. The list was developed by sourcing and collating food hubs listed in locally available records, such as on the Leeds Food Aid Network website and in local council membership lists and cross-checking with experts working in the food hub space in and around Leeds. In total, 58 food hubs were identified at the time of the study across Leeds.

3.4 Survey

The evidence collected via the literature review on the function and impacts of food hubs, informed the development of the survey. The survey aimed to capture the breadth of food hubs operating in and around Leeds, and it supported the recruitment of interview participants. It focused on the function food hubs perform in the food system and enquired about the provision of services, motivations, impact, aspirations for future and support needed by the food hubs. The survey was developed and uploaded to Qualtrics, an online survey platform, consisted of 30 questions with multiple choice answers and free text space (the survey template is presented in Appendix A). The first section of the survey focused on background information such as location, size, types of services/provision offered, population served, source of food,

[1] https://leedsfoodpartnership.org.uk/.

[2] In the UK the 'third sector' is an umbrella term that covers a range of organisations belonging neither to the public sector (i.e., the state) nor to the private sector (profit-making private enterprise). They could include charities, social enterprises and community groups.

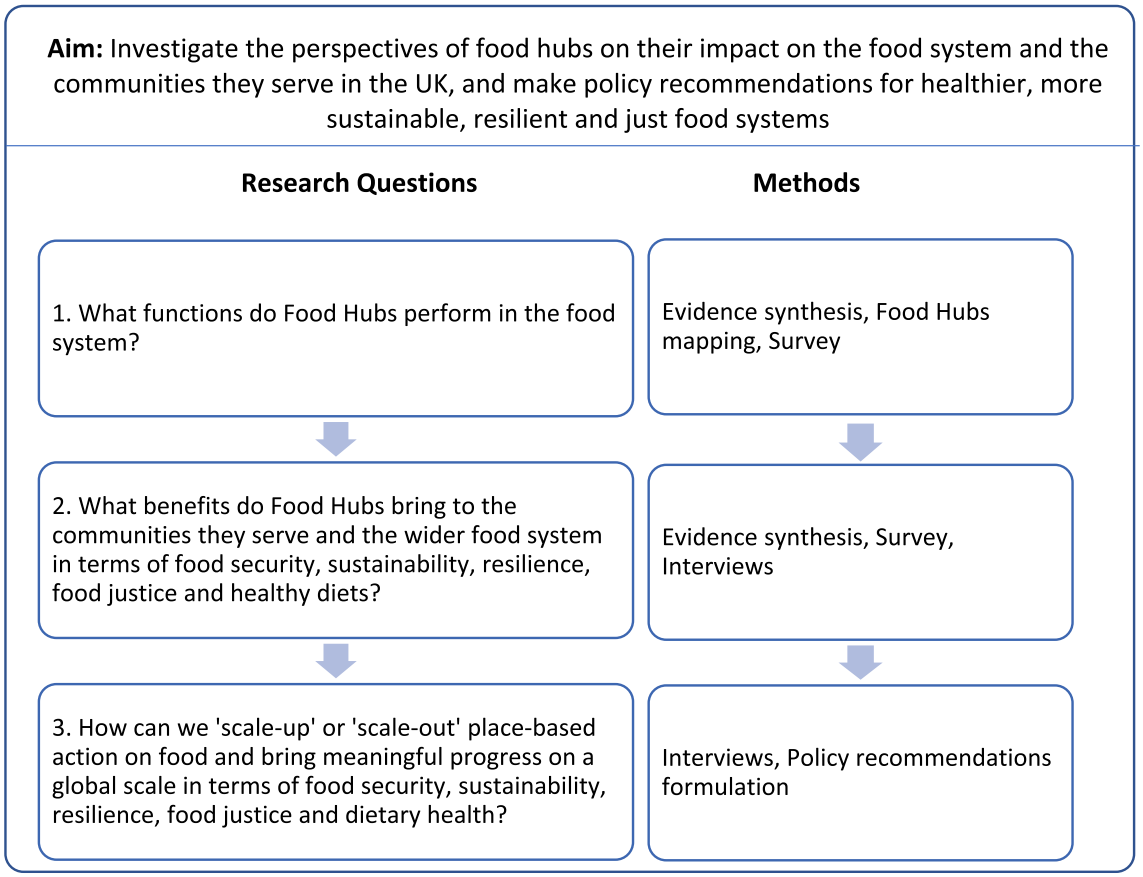

Fig. 1. Research design.

motivation, and the impact COVID-19 has had on the food hub. The second section explored the benefits food hubs bring to the communities they serve and the broader food system, particularly their impact on economic development, environmental sustainability, access and demand of local healthy food, personal and community wellbeing. The final survey section, focused on the direction the food hubs would like to take in the future and the type of support they would need. The survey data was saved in and analysed statistically with use of MS Excel software.

The survey was distributed to the 58 Leeds-based food hubs identified in the mapping exercise (e.g. food hubs managers, coordinators, employees, volunteers) and other relevant food actors in February and March 2022 via social media and email amongst food aid networks within Leeds. In total, 37 participants started the survey, but only 22 provided complete responses, representing 18 food hubs across Leeds. The survey participants represented a mix of food hubs across Leeds, offering a diverse array of services and support (Table 1).

3.5 Interviews

Evidence from the literature review and the survey guided the formulation of the interviews. The semi-structured interviews aimed to gain more depth and context on the impact food hubs have on food security, sustainability, resilience, food justice and healthy diets, by collecting 'rich' qualitative accounts from food hub managers/coordinators across food hubs and other relevant stakeholders. The interviews also gained a better understanding of the wider food system in Leeds, and how food hubs were connected to other food actors (e.g. local food producers supplying food to hubs, and other organisations and entities that work with food hubs) and communities in the city.

Interview participants were recruited by approaching the 58 food hubs identified in the mapping exercise and requesting the food hub manager (or a person of similar role and responsibility) to take part in the interviews. Eleven food hub managers agreed to participate in the semi-structured interviews which were conducted online (e.g. MS Teams or Zoom platforms) or face to face during March and April 2022. Demographic details of the interviewees is presented in Appendix C. In total, 25 food hubs (40 % of food hubs in Leeds at the time of the research) participated (Table 1). Four out of 25 food hubs participated in both the survey and the interviews (16 % of participating food hubs). The interviews lasted approximately 1hr, were audio recorded and transcribed verbatim by the research team. The interview template is presented in Appendix B.

The interview transcripts were then thematically analysed to identify patterns in meaning across the data and to derive themes. The thematic analysis broadly followed the six stages for analysis suggested by Braun and Clarke, (2006), i.e., familiarisation with the data, codes formulation, generation of themes, themes review, defining and naming themes, and reporting. The thematic analysis involved an inductive coding process of the transcripts' data into clusters of similar conceptual categories and the identification of consistent patterns and relationships between themes, to provide insights on the impact food hubs have on food security, sustainability, resilience, food justice and healthy diets.

3.6 Policy recommendations formulation

Data collected via the evidence synthesis, survey, and interviews, provided the evidence base to make the case for policy support and funding for food hubs. Although the impact food hubs have is context specific, this research focused on the replicable and scalable lessons that would be useful across the UK food system and globally. The policy recommendations drew links with the UK's National Food Strategy

Table 1
Research participants.

Food Hub/Food Actors	Description	Survey	Interview
1 Barca Leeds	Community-based charity that aims to care, listen and respond to the needs of the people in the communities and work with them to deliver outstanding services that improve their wellbeing. Community care hub for Bramley and Stanningley areas in Leeds.		x
2 Bramley Care Bears	Community-based charity run by community volunteers aiming to develop community spirit, trust and support across the area.	x	
3 Butcher Hill Food Pantry	Community Food Pantry set up by KVDT to provide people with an affordable, sustainable and dignified option when accessing food support.	x	
4 Feed Leeds	A sustainable food growing network, encouraging and connecting individuals, communities and organisations in Leeds.		x
5 Grace and Care	A multicultural group of people aiming to encourage and support community and social projects. Providing a community café and support service.		x
6 Hamara Healthy living centre	Community-based charity focussed on providing support for people from ethnic minority backgrounds. Community Care Hub for Middleton Park, Beeston and Holbeck, as for cultural food support in west, north and south Leeds.	x	x
7 Harehills Foodbank	Food bank offering free food items to be taken home to cook.	x	
8 Holbeck Foodbank	A food bank and distribution service providing crisis food parcels to individuals and families in Holbeck, Leeds.	x	
9 Incredible Edible Garforth	Urban gardening project that aims to bring people together through actions around local food, helping to change behaviour towards the environment.		x
10 InterACT Pantry Meanwood	A membership food club with a store at Meanwood Community Centre, offering local people the support of a reliable and good quality food resource at minimal cost.	x	
11 Kirkstall Valley Development Trust/ Kirkstall Valley Farm	Community development social enterprise and community owned farm. Part of the Community Supported Agriculture network. Community Care Hub for Kirkstall, Leeds.		x
12 Leeds Allotment Federation	The voice for allotment and leisure gardeners in the greater Leeds area. Aims to promote and support allotment gardening.		x
13 Leeds North And West Foodbank	Food bank that supports people in the area that are in need of food.	x	
14 Love in a Box	A halal foodbank that provides food parcels to hungry people struggling to afford enough food and once a week delivers 60 home cooked hot meals and essential warm clothes and toiletries to the homeless in Leeds city centre.	x	
15 Middleton Elderly Aid	A charitable organisation and a Neighbourhood Network scheme aiming to promote independence amongst the over 60 s population in the Middleton and surrounding area through a range of activities and services.	x	
16 Neruka's Soul Food Kitchen	A community organisation that aims to attend to the need of people struggling in many areas of their lives.	x	
17 New Wortley Community Centre	A community-owned and community-led centre aiming to improve the area of and lives of residents living in LS12. Community Care Hub for Armley, Leeds.	x	x
18 Oblong	Community development charity aiming to help people and communities flourish. Community Care Hub for Little London and Woodhouse areas in Leeds.		x
19 Otley Action for Older People	A charity that is supporting independent living in Otley, Arthington and Pool-in-Wharfedale. Community Care Hub for Otley and Yeadon areas.	x	
20 Positive Action for Refugees and Asylum Seekers (PAFRAS)	A community centre, food hub and support space for refugees and asylum seekers in Leeds.	x	
21 Rainbow Junktion	As a community cafe on Mondays and Thursdays, a food share on Fridays and a support and advice centre. Supported Community Care Hubs working in Woodhouse and Headingly areas in Leeds.	x	x
22 Salvation Army – Leeds Central	A community café serving weekly hot meals to those in need.	x	
23 Soup and More Foodbank	A community café and foodbank.	X	
24 Wetherby & District Foodbank	A community food bank also offering support and advice to those in need.	x	x
25 Zarach Food Club	A charity focussed on providing beds and basics to children in poverty. Provided food and supplies during COVID-19 by converting their vans into basic pantries.	x	

Independent Review (Dimbleby et al. 2021), the Leeds Food Strategy and other local relevant strategies e.g. on climate action, public health, equality and inclusion. The policy recommendations formulation process focused on ways to 'scale-up' or 'scale-out' place-based action on food and bring meaningful progress on a global scale in terms of food security, resilience, sustainability & food justice.

4. Findings

4.1 Typology of food hubs and their function in the food system

The food hubs mapping exercise identified 58 food hubs across Leeds (Fig. 2). Participating food hubs indicated that their primary function was that of a food bank (38 %), community café (24 %), food pantry (14 %), community care hub (10 %), community/advice/support centre (10 %), social supermarket/cooperative (4 %). Food hubs came in various forms and served different, often multiple purposes, depending on local needs and resources (See Table 2).

Most food hubs offered a range of services beyond their primary provision (e.g. a community centre could also operate a food pantry a few days a week, or a foodbank that also gives advice and support on debt relief, housing, addiction, domestic violence etc.) and the diversity in their offering was a strength and supported their long-term viability. Additional services provided by the food hubs included fruit and vegetable boxes, food growing and community gardens, cooking classes, recipe bags, education and advice on heathy eating, support, and signposting to other services about mental health, debt, employment, housing, addiction, and domestic abuse.

Whilst there was big diversity observed in the participating food hubs, they all aligned closely with the sustainable community development model, discussed in the literature review above (see Blay-Palmer, 2013). The food hubs landscape in Leeds is dominated by non-profit organisations including networks and intersections of grassroots, community-based organisations, working collaboratively towards a more socially just, economically viable and sustainable local food.

The food hubs served differing populations. Thirteen of the food hubs (52 %) were open to serving anyone regardless of where they live or their background, whilst 12 food hubs (48 %) served people living in specific wards or areas. Two of these 12 food hubs indicated that they focused on serving particular subgroups of the population such as the elderly or asylum seekers.

Food hubs secured their food from a range of sources. However, the majority (22 out of 25, 92 %) relied on food surplus redistribution charities or organisations such as Fareshare,[3] Too Good To Go,[4] Rethink Food,[5] and Surplus to Purpose.[6] Fifteen of the food hubs (60 %) also got food donations by supermarkets and the public, or they purchased their food directly from retailers or wholesalers at normal or discounted price. Five food hubs (20 %) indicated that they get at least some of their food directly from local farms. For example, Rainbow Junk-tion received donations of fresh food from Meanwood Valley Urban Farm and from surplus from allotment holders.

When asked about their motivation for launching initially most food hubs (30 %) stated that it was to provide affordable food to their community and fight poverty. One quarter indicated that their primary motivation was environmental protection such as to reduce food waste or to use green spaces for food production, whereas (20 %) their main motivation was to collect and distribute food aid. Other motivations for initially launching the food hubs were to provide support and advice for the community and development opportunities (15 %), and as a crisis response to homeless and vulnerable groups or specifically due to COVID-19 (10 %).

Regardless of the initial motivation of launching the food hubs, the COVID-19 pandemic resulted in a change of provision for the majority (90 %) of the food hubs. Many food hubs expanded the services offered to support the changing needs of their communities and in response to funding made available by the local authority for COVID-19 related emergency food provision. One food hub only launched during the pandemic, in response to growing need for emergence food aid provision. Changes in the food hubs provision due to COVID-19 included providing emergency food parcels to those in urgent need or those self-isolating, setting up a foodbank, food pantry, a telephone befriending service, and delivering home cooked meals.

4.2 Perceptions of food hubs on their impact

Survey and interview participants (e.g. food hubs managers, co-ordinators, employees, volunteers) identified and discussed a wide range of impacts food hubs have on their communities and the wider food system. These were thematically grouped under four main categories, informed by the survey and interview data: supporting local economy, enhancing sustainability, strengthening local food systems, and improving wellbeing (Fig. 3).

Fig. 4 summarises the survey and interview responses representing the 25 participating food hubs, highlighting aspects food hubs had a significant impact on. Most food hubs contributed predominantly towards improving personal and community wellbeing and reducing food waste. This reflects the primary motivations for the food hubs operation, which as discussed in the previous section centred on environmental protection and community support. Food hubs contributed less to aspects of strengthening economic viability, and supply and demand for healthy and local food, although interviews revealed these being areas food hubs aspire to further develop in the future (see sections 4.2.3 and 4.2.4). All participating food hubs benefited their communities and the food system in multiple ways simultaneously, as reflected by the many functions they perform and roles they play (section 4.1).

4.2.1 Personal and community wellbeing

Food hubs reported that the greatest positive impact they have on the communities they serve was in terms of personal and community wellbeing. The interviews revealed that building social connections around food have significant benefits in terms of mental health, tackling isolation, giving a sense of purpose and belonging.

> "It's not about the food. It's about people. And it's about the fact that you can bring people together, create an intergenerational activity, create an opportunity to bring people together from different backgrounds. And you've all got food in common. (Incredible Edible)
>
> "It's so important to create cohesion within a community in times like these and our business, schools and the arts are so important for resilience in incredibly difficult times." (Testimonial from member of the public about Incredible Edible)
>
> "Food is almost like the carrier for bringing people in. Food really brings people through the doors in a way that nothing else does. The motivation was around providing resources to the community" (Oblong)
>
> "We've got a community growing project and a gardening group that brings all the older men together. We try to get people's connection with nature, connection with a food source and connect with each other." (Hamara)
>
> "The café provides that space where people can come and talk because that's the whole thing about what we call the cup of tea theory at the community centre. You know, people come in, they have a cup of tea with us and we just see where that conversation goes." (New Wortley)

[3] https://fareshare.org.uk/.
[4] https://toogoodtogo.co.uk/en-gb/.
[5] https://www.rethinkfood.co.uk/.
[6] https://surplus2purpose.com/.

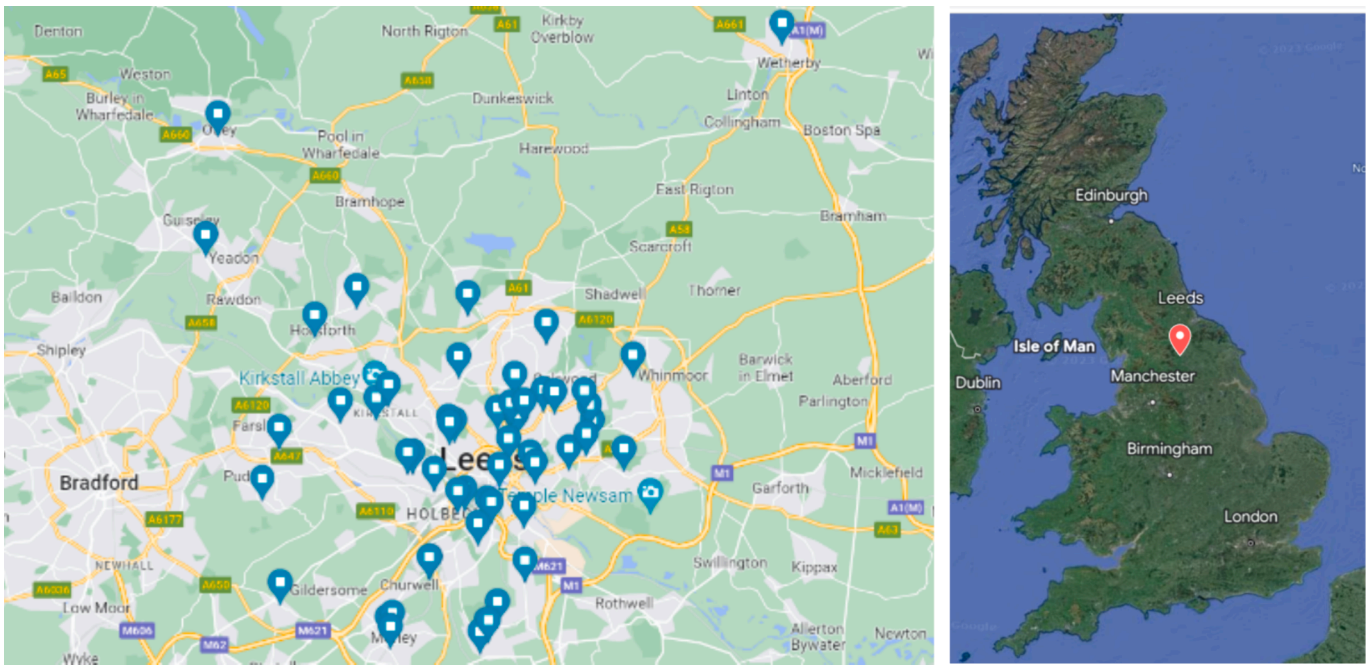

Fig. 2. Map of food hubs in Leeds.

Table 2
Types of food hubs and definitions.

Type of food hub	Definition
Food banks	Non-profit organisations that store and distribute non-perishable food and basic items free of charge to people in need.
Community cafés	Spaces that provide members of the community with a place to meet, socialise and eat. The food offered at an affordable price, on a pay as you feel basis or is free of charge.
Food pantry	People in the community join as members and pay a small subscription fee annually or on a regular basis, and in return they can purchase groceries at a reduced cost.
Community care hubs	Set up by local authorities in England in response to the COVID-19 pandemic and resultant food crisis. The care hubs provided pastoral support and food parcels for members of the community that were in need.
Social supermarkets	Run by voluntary organisations in collaboration with local food producers and suppliers to provide food products at a lower price than traditional supermarkets. Shoppers typically must become members and pay a small subscription fee in order to purchase items.
Community kitchens	Set up by community members to offer food parcels and/or cooked meals to those most in need.

> "We're bringing together people from different parts of the community. They're all sitting together over a table. We're making friends with each other and learning a lot." (Rainbow Junk-tion)

Food growing and gardening projects provided opportunities for people to connect with nature as well as socially, having a positive mental health impact.

> "Community gardening program] tends to be with people with mild to moderate mental health problems. We do get people sent to us quite often from the social prescribing team from the local care partnership as well. People who go to the doctors and who not feeling great with low mood… And if they say they're interested in anything outdoors or gardening, then we are a route into support within the community for those two groups." (New Wortley)
> "To me it's completely fundamental to be outside, to be in the open air, to hear the birds, to see the insects… The way that people, that individuals come together and we have a common interest. We have maybe nothing else in common at all. But it brings people with different backgrounds together in an incredibly constructive way." (Leeds AF)

Some food hubs designed activities and projects explicitly with wellbeing in mind:

> "Every project that we run at Hamara, we will use the five ways to wellbeing.[7] Every sentence revolves around hitting all those targets. We use the city council's wellbeing wheel at the end of every session, regardless of who the session was with. Just the way that we work, everything that we work for towards is communities." (Hamara)
> "We work in partnership with 'Leeds Mind[8]' and we've developed a bit of a program with them, which is called 'Cook together'. So that is a session that people can come to and cook." (New Wortley)
> "We try to improve people's health and wellbeing and increase their access to health and wellbeing opportunities." (Barca)

4.2.2 Environmental sustainability

The biggest sustainability benefit was in food waste reduction by diverting surplus food to people affected by household food insecurity. This not only reduced the environmental impact of food production and consumption, but also provided a temporary relief from household food insecurity. Although surplus food redistribution was identified as beneficial from an environmental point of view, the contentious nature of using surplus food to feed people effected by food insecure was recognised (see section 5.1.1 for more on this).

> "Rainbow Junk-tion is one of many cafes that intercepts food that would otherwise go to waste from supermarkets, restaurants and a number of other sources, and turns it into healthy, nutritious meals

[7] NHS strategy on how to improve your mental health and wellbeing: connect with people, be physically active, learn new skills, give to others, and be mindful: https://www.nhs.uk/mental-health/self-help/guides-tools-and-activities/five-steps-to-mental-wellbeing/.
[8] Charity promoting positive mental health and wellbeing: https://www.leedsmind.org.uk/.

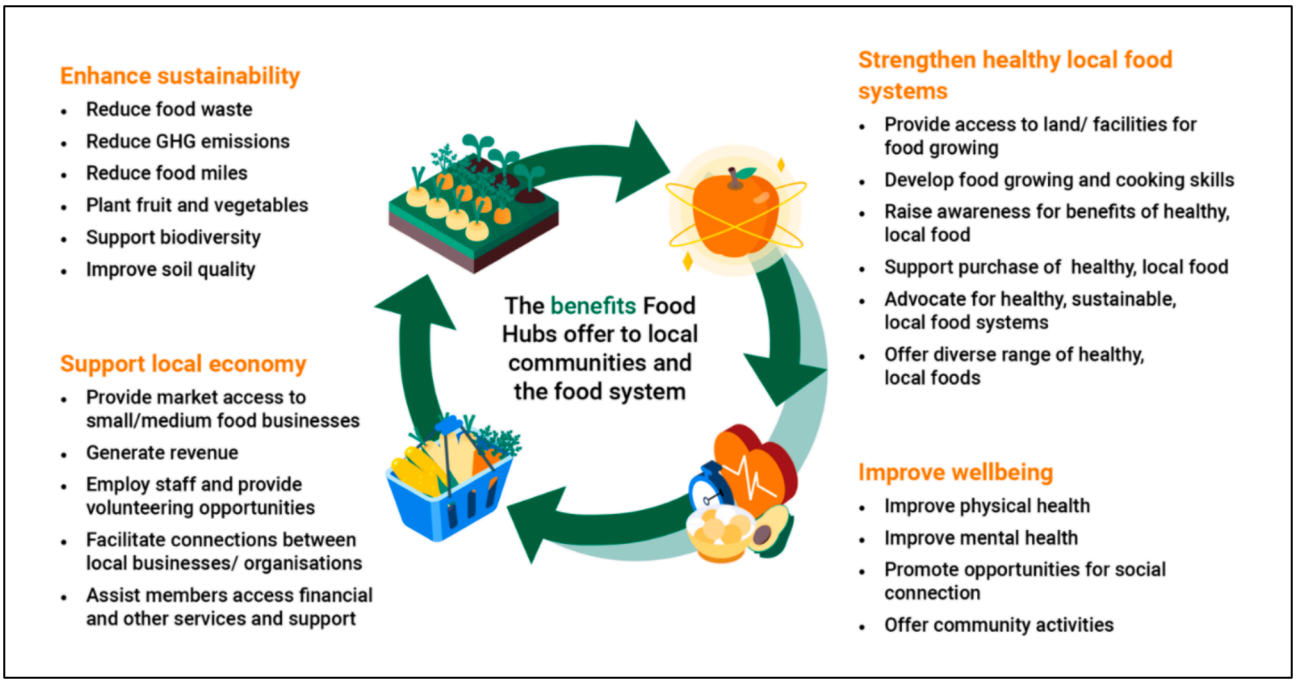

Fig. 3. Impacts of food hubs on communities and the food system, as identified by the food hubs themselves (Design by Research Retold) Note: GHG stands for Greenhouse gases.

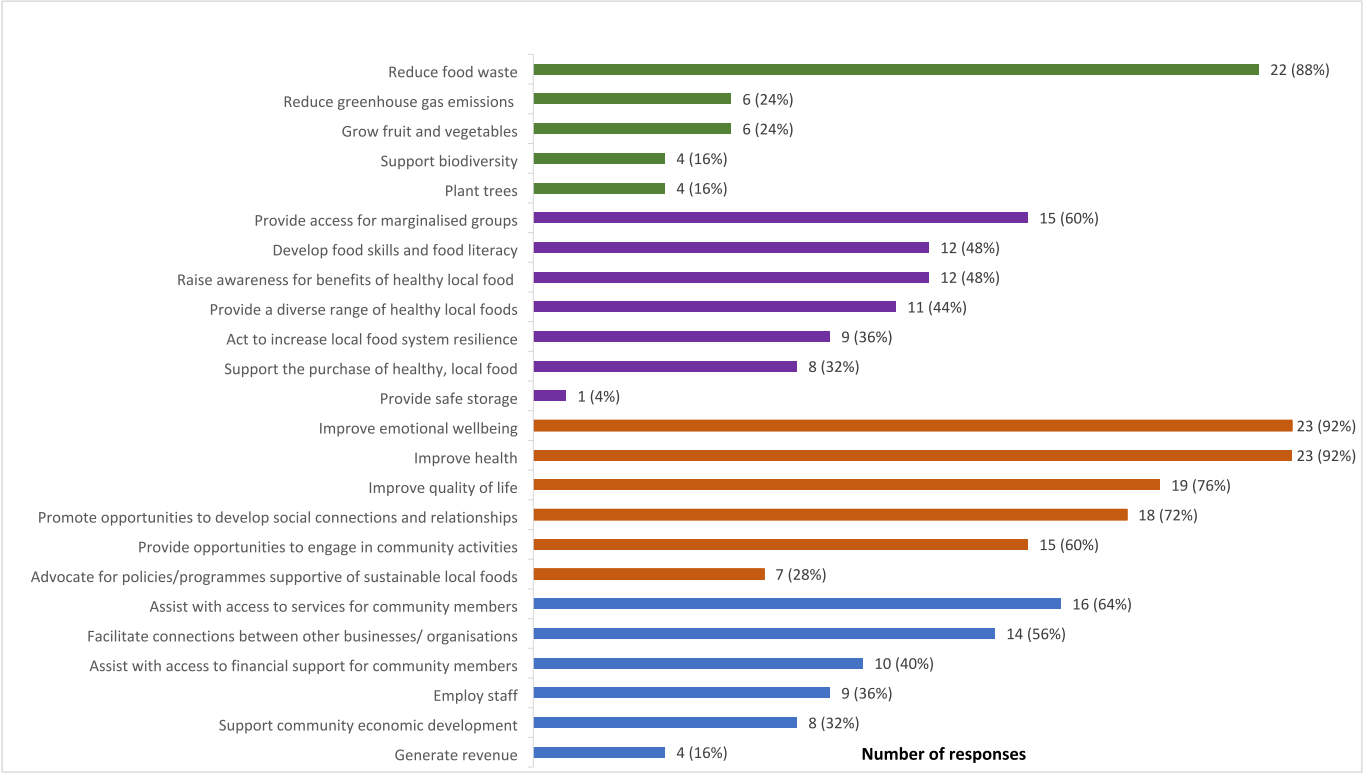

Fig. 4. Survey and interview responses on the impacts of food hubs of the 25 participating food hubs.

for anyone and everyone on a pay-as-you-feel donation basis." (Rainbow Junk-tion)

Using land to plant and grow fruit and vegetables in consideration to biodiversity, the soil, wildlife and the environment was another sustainability benefit of the food hubs. Local food production, and the shortening of the food supply chain by bringing food production and consumption closer, also reduced food miles and resulted in less food waste, reducing greenhouse gas emissions.

> "A lot of the things that we do, we plan with biodiversity in mind. We will avoid pesticides. We will work with other community groups and other people that have that knowledge to know what to plant.

How to boost vegetable growth with other flowers." (Incredible Edible)
"We're not an organic farm, but we do try and follow organic standards. At the same time, we're very respectful of the wildlife and trying to always achieve a balance between the community aspect of the farm, the growing aspect of the farm and the wildlife." (KVDT)

Having environmental motivations at the core of their operation also meant that food hubs were involved in climate activism and awareness raising.

"The staff team are a lot more educated around sustainability, around food. And as a result, we've now got a climate change champion. It is a staff member and that person promotes benefits, which is how to get food sustainability." (New Wortley)
"We have a climate action notice board within the community centre as well. So we put lots of information on there, around sustainable things. So not necessarily food related, but that's a feature that's very popular with people. We've had Joy from Armley climate action. She's been coming in on a Friday and talking to people about food sustainability through the climate tea trolley." (New Wortley)

4.2.3 Economic viability

Food hubs reflected on the multiple ways their activities help communities access affordable food and more broadly benefit the local economy. Food hubs recognised that one of the most important ways they contributed to the communities they serve was supporting them to become more food secure.

"It's the fact that we were supporting them with food. And even for those that come to the food pantry, you know, it, it makes a big difference. People tell us it makes a big difference to how that pop in financially, you know, and, and if that means putting the heating on, because the food is cheaper." (KVDT)

They also recognised that they support the local economy for example by supporting and partnering up with local farmers, food businesses, food producers, and greengrocers.

"We're sourcing food from the farmer's market. So we'll be bringing in local suppliers in our area." (Hamara)
"We managed to get a bit more funding from the council…to get fruit and vegetables from local green grocers." (Oblong)
"There's a third aspect of Incredible Edible, which is around business and the concept of a local economy. And the fact that if you spend one pound in your local green grocers, then that one pound will stay in that community. So we try and support that if we can." (Incredible Edible)
"We also work with local businesses. Coffee on the Crescent is a local coffee shop. They raise money for us. They sell our cookbooks, which we produce." (Rainbow Junk-tion)
"When we need to buy stuff, it's going to local supermarkets, cash and carry type places and buying. So normally when we buy something it's in reasonable quantities. A local shop benefited from us buying those things. So I think that's a knock on effect. So economy-wise, saving food, saving things that could be wasted and also spending a little bit of money on local produce." (Grace and Care)

Many food hubs set up social enterprises generating revenue to fund their operations and activities, employ staff, and secure their longer-term financial viability.

"The cafe also obviously drives income for us as an organisation. The cafe is, I mean, nobody makes millions from cups of tea and curry and rice, but it is a sustainable social enterprise and provides volunteer opportunities." (New Wortley)

Food hubs also act as a local employer, albeit in a modest scale. Many actively train and develop the skills of volunteers and support them into securing employment.

"Hamara is an employer…and people are getting those skills and experience." (Hamara)
"We have 10 staff and many volunteers. We also do an employability course in collaboration with Askham Bryan College in York. So that's been really good because we've managed to move a lot of our food hub and food volunteers on to education and work. And they get a bursary with that." (KVDT)
"We have a big volunteering program…supporting the food provision. So we have volunteer drivers and volunteers who come in and sort through the food deliveries. So loosely speaking, the end goal of that is always to get somebody from volunteering into a job." (New Wortley)
"I think volunteers also get a lot out of it. I write references all the time. I have many volunteers who have gone off to work in the third sector or in the food sector or in anything else really who have definitely got a lot from their time volunteering here." (Rainbow Junk-tion)

Food hubs also supported their communities by signposting −people to services and providers that can offer financial and employment support.

"We signpost people to services that could link up people, to help them know how they can secure what they need economically." (Hamara)
"We have lots of relationships with providers. On Wednesday mornings we're setting up an information café in the centre. We have a guy who comes from Leeds city council, and people can drop in and get help finding a job. Others will go to the job centre website with them [Leeds City Council representative] and help with CV writing and things like that." (New Wortley)

4.2.4 Supply and demand for healthy and local food

Food hubs activities improved both the supply and the demand for healthy and local food. Some food hubs were involved in growing fruit and vegetables and providing the fresh produce to their customers/users via their pantries and social supermarkets for example.

"There is a distinct lack of access to, to fresh produce that is outside of the big supermarket… we offer recipe station bags, they're all vegetarian. Promoting meatless recipes, which are inclusive and safe to cook." (Barca)

Cutting the cost and increasing affordability of fruit and vegetables in the food pantries and social supermarkets, removed one of the biggest barriers to consumption of fresh and healthy food.

"We created recipe pack and a selection of 12 recipes. They [food hub users] get a bag of ingredients for £1.50. They get all the ingredients in the bag and you get the recipe card. If you want to learn how to cook that recipe, you can join one of our cooking sessions, which go on a bit of a carousel. You can also access 10 other items from the food bank for £3." (New Wortley)
"People can come along and they're given a bag with ingredients for a vegetarian recipe, which will be healthy and low cost and easy to create." (Barca)

Food hubs also provided heathy cooked meals in their cafes.

"I am conscious of how much oil we use. We're conscious of the ingredients we use, we're conscious of being as healthy as we can, and keeping the meal nutritious. If we can, we will put in extra vegetables to supplement it out." (Grace and Care)
"So we try and make our food as healthy as we can. We do a lot of veggie and vegan stuff, for many reasons. Most people could eat it." (Rainbow Junk-tion)

Other food hubs worked on awareness-raising and education about

local, healthy and sustainable diets, about growing your own food, cooking skills, and recipes.

> "I think it's really important that people learn about food miles and that the food they get from us is grown here. So it's got very little food miles attached to it and people just learning about growing their own stuff. (KVDT)
> "We've got quite a big Facebook following. We starting to share videos about how to grow food and get involved… We're starting to do something else on YouTube, showing people what vegetables we can grow and what we can do with them, how to cook them." (KVDT)
> "We're doing a show garden at the Harrogate spring show. I thought it would be fun to set up a garden, which was the size of a backyard, a terrace back to back backyard about five meters by five meters. And we're going to plant it up as a backyard allotment. As an idea for how you can do it at home." (Leeds AF)
> "We're working with targeted families, doing a growing and cooking project. We'll be working with Hollybush Conservation Centre to support the growing element. Then there'll be our team that are doing the cooking sessions with the families. So making sure the whole family is involved in cooking." (Barca)
> "Incredible Edible helped us kick-start a proper allotment area in our school. By sharing knowledge and expertise, we have been able to introduce the children to some different edible foods – including flowers!" (Quote from Incredible Edible user)

4.3 Reflections on food hubs' impact on food security, sustainability, resilience and justice

Participating food hubs reflected on the wider implications of their activities for the food system in terms of food security, sustainability, resilience and justice.

4.3.1 Food security

One of the main roles food hubs played was to provide access to nutritious and affordable food to people affected by household food insecurity.

> "For me a food hub is a community asset that people can come to an access either free food or subsidised food that has been sourced predominantly from a food provider." (New Wortley)

This was in the form of food pantries, social supermarkets, community cafes, food bank parcels, cooked meals, fruit and vegetable boxes. As these forms of food provision were often developed and offered through community based and grassroots organisations, the food provision was in most cases culturally appropriate too. The focus on promoting and improving supply and demand for diverse, healthy foods also increased the uptake of healthier diets.

Although this food provision responded to household food insecurity, all participating food hubs were concerned with the increased demand for their services. The increased demand for emergency food provision and the deteriorating future outlook due to anticipated food and energy price increases, point towards deeper poverty and inequality as the root cause of household insecurity.

> "I think that food hubs will get more work in coming 2 years. We need to set up something permanent to prevent families and people suffering." (Love in a Box)

Food hubs such as food banks aspired to move away from emergency food provision (such as food parcels), towards more long-term, sustainable and comprehensive food provision models contributing to food and nutrition security (such as food pantries, cafes, and social supermarkets).

> "We're looking at being a community anchor. So that would be everything from growing to teaching people how to cook, it's vast… It's the education. It's the well-balanced food. It's the emergency provisions and the practical support to reduce the reliance." (Hamara)

4.3.2 Food systems sustainability

Food waste reduction was the main environmental motivation for many food hubs. However, broader environmental benefits were identified in this research such as reducing greenhouse gases by shortening food supply chains, and growing fruit and vegetables with consideration to biodiversity, the soil, and wildlife. By delivering food and nutrition security in a way that does not compromise future generations' food security and nutrition, food hubs play a broader role in building sustainable food systems.

> "We're not an organic farm, but we do grow organically. We're not certified, but we do try and follow organic standards. At the same time, we're very respectful of the wildlife and trying to always achieve a balance between the community aspect of the farm, the growing aspect of the farm and the wildlife." (KVDT)

4.3.3 Food systems resilience

The way food hubs responded to the COVID-19 pandemic and corresponding shocks to the food systems, demonstrated how food hubs increase food systems resilience. While mainstream food provision struggled with food shortages, empty supermarket shelves, panic buying, and price hikes, food hubs reorganised themselves, innovated and quickly adapted to the needs of the communities they served.

> "We started the food bank in March 2020, and that was purely due to coronavirus that we picked that up. We've done over 35,000 food parcels to over 170,000 beneficiaries." (Hamara)

Food hubs were agile, innovative, and adaptable, due to their shorter and more localised supply chains, the diversity in their offering (e.g. they could change from one focus to another when they needed to), their embeddedness within their communities, and their strong collaborations within their networks of local food actors based on trust and common values.

> "Working with partners is really key to what we do. When the pandemic hit, we acted as a community anchor organisation, and we have a very positive relationships with local counsellors and other local organisations." (Barca)
> "It's so important to create cohesion within a community in times like these and our business, schools and the arts are so important for resilience in incredibly difficult times." (Quote from Incredible Edible user)

By enhancing the capacity of the food system to provide food security to all in the face of shocks, food hubs contribute to food systems resilience.

4.3.4 Food justice and equality

The participating food hubs contributed to food and nutrition security for all, but more importantly specifically targeted deprived communities and vulnerable groups. Often these communities and groups are disproportionally affected by lack of access (physical or financial) to sufficient and nutritious food, and adverse health impacts due to poor diets.

> "When the food bank started, we already had a really big name within the groups that we've worked with, for the BAME community, those with learning disabilities, older women, older men, they knew about all the activities that we put on." (Hamara)

Food hubs that participated in farming or enabled groups to grow their own food (such as Incredible Edible and Leeds Allotment Federation) also supported food self-sufficiency, a key principle of the Right to

Food approach. Many food hubs that grew food, used to make meals in their cafes, or offered it in their pantries etc., practicing circular economy models.

> "We have two gardening groups as well based at the community centre. We have an allotment. One of the sessions each week is on the allotment and up there, we grow fruit and vegetables, which will eventually be used in the cafe." (New Wortley)

By tackling inequalities in the food system and empowering local food actors (from local producers to consumers) food hubs make the food system more just and equitable.

> "We need to connect the local farms directly with the local city." (Feed Leeds)

5. The future of food hubs in the UK

The final part of the study focused on ways to 'scale-up' (e.g. increase the size) or 'scale-out' (e.g. replicate in more areas) place-based food initiatives such as food hubs. The section below presents recommendations by the hubs on how UK policy and food actors can support them in this and bring meaningful progress on a national and global scale in terms of food security, sustainability, resilience, food justice and dietary health. These recommendations are aligned with the future aspirations of food hubs themselves and are aimed at various actors across various governance levels.

The diverse and dynamic nature of food hubs meant that there was a wide range of directions food hubs aspired to move towards in the future. Some common themes included the desire to move away from ad-hoc, emergency food provision to more long-term, holistic, sustainable, and financially viable models, to grow in response to increasing demand, to develop a more coherent and organised food hub network, and to promote change in the food system. When asked what support they needed to realise their future objectives, funding (e.g. to cover premises costs, buying food produce, training staff), resources (e.g. staff, fixed work space, equipment), coordination and knowledge sharing were highlighted by many of the food hubs.

5.1 Move away from emergency food provision

Participating food hubs aspired to gradually move away from emergency food provision to more long term, sustainable, and holistic provision models. Although food hubs recognised the vital role they play in supporting food insecure households, they were acutely aware of the need to address the root causes of food poverty rather than just deal with its symptoms (Papargyropoulou et al, 2022).

> "We need to move away from emergency provision and support people with sourcing healthy low cost foods or grow their own." (Hamara)
>
> "It definitely felt like firefighting the whole time, like just doing the emergency crisis support for people. And I think that while that is very valuable and something that I think that we should still be doing, we still need to try to move into a more sustainable model of food provision. Setting up this food cafe as a pay as you feel, basically free food cafe where people are able to come into the community centre and then be able to have access to so much more support, I think will be like very important." (Oblong)

5.2 Expand services and reach

Many food hubs aspired to expand the services they offer and reach out to more people from larger catchment areas.

> "One of the really exciting things for us this year is expanding our youth provision and our youth cafe model where the kids cook for each other and they eat together. And it's a very informal peer to peer mental health support cafe. That's going to be expanding to two different locations across Armley." (New Wortley)
>
> "Have a community drop in, because at the moment nobody eats it's on the site. It's all packed…using the hub as a multi benefit place. That is to say, we give food. We give somewhere to chill, but also perhaps a place where people can learn or experience or get value from something else." (Grace and Care)
>
> "We're relocating our warehouse at the moment…move to a new site, which is purpose built, but also provides us with a space in addition to the warehouse room, which we can use as a community based multipurpose room." (Wetherby food bank)

5.3 Ensure sustainability and longevity

Plans for growth (e.g. expansion of services and/or reach) were coupled with the need for long-term viability and longevity. Depending on their nature, food hubs had different strategies on how to achieve this.

> "We're moving towards being as self-sustainable as we possibly can. That will be for our food provisions, our cafe, and our volunteer community café. We're going to hopefully be the community anchor for the whole of South Leeds across our sites." (Hamara)
>
> "The challenge for me is to pull back and make sure the organisation is able to carry on if I am not there. So it's now looking at how that is best structured… make sure it is structured appropriate to grow to sustain its size, but then continue to grow and have an impact." (Incredible Edible)
>
> "I would very much like to get either an asset transfer of the farm to the trust or a very long lease so that we can protect it for years to come." (KVDT)

5.4 Secure financial stability

Financial stability was a common goal amongst the food hubs. Securing sufficient and steady funds was considered fundamental to ensuring medium and long-term viability. It was apparent that food hubs were moving from charitable company status towards social enterprises, cooperatives, and Community Interest Companies operating models. This shift was driven by the need to become more self-sufficient following the termination of Local Authority funding aimed to support communities during the COVID-19 pandemic.

> "Looking at some small funding streams, that can help us just keep ticking over, in the long-term if we're having to do bigger, bigger numbers, and charities can just give us their surplus food we will need to be in a position that we can purchase our own as well." (Grace and Care)
>
> "We are aiming to continue our Food bank without Leeds City Council funding, and switching priority to transferring skills to smaller Cultural food hubs so they can apply for own funding, set up Community Interest Companies." (Hamara)
>
> "We need financial independence." (Butcher hill food pantry)
>
> "Provide more services for people in a place that they already trust, continue providing food for the community, make funding more sustainable." (Rainbow Junk-tion)
>
> "Running a Marketplace alongside the sessions." (Zarach Food Club)

5.5 Develop a food hubs' network

Participating food hubs expressed the need to develop a network of food hubs to improve communication, enhance collaboration and partnership formulation amongst similar organisations, and promote sharing of knowledge and resources.

"We want to extend our services to the public by giving advice or referring to the correct instances for proper help. Setting up a central main food hub to provide foods to local small foodbanks." (Love in a box)

"Desperate need for clear communication between community provision [actors] to create a network of support." (Zarach Food Club)

5.6 Advocate for wider change

Although food hubs were grappling with demand driven growth and its logistical and financial implications, they were acutely aware of the need for wider change. Particularly food hubs involved in food production, supported activism that promotes the right to food (as defined in the International Covenant on Economic, Social and Cultural Rights) and food sovereignty. In this context food sovereignty was defined as the right of people to healthy and culturally appropriate food produced through ecologically sound and sustainable methods, and their right to define their own food and agriculture systems (Patel, 2009). These food hubs recognised that food production and consumption operate within broader governance and socio-economic structures, and that there is need for political change to bring about food systems transformation.

"What the Leeds Allotment Federation would like to do would be in some way to be able to influence planning so that new builds of housing estates had to have within their green space planning room for growing and that could be allocated. However, we don't have any legal teeth, we're volunteers" (Leeds AF)

"I think we need all to be speaking with one voice. I think we need to be political with a small 'p', raising awareness and saying that this just isn't acceptable… It's awful [talking about food insecurity]. So I think we need to be as a collective challenging the status quo and say, no, this just isn't right." (KVDT)

"Our motivation is to change the landscape, to take an unused and an unloved space and do something incredible with it. We didn't want our project to be a flash in the pan or a COVID-19 project. We wanted it to be a catalyst for change and it is." (Incredible Edible)

5.7 Policy recommendations

Local authorities have a crucial role to play in supporting the development and operation of food hubs that promote sustainable food systems and improve access to healthy, locally sourced food, in line with public health, sustainability and inclusive growth local agendas (e.g. in line the local Food Strategy in the case of Leeds). Local government can do this by providing funding, technical assistance, and regulatory support for food hubs. Local authorities can also create policies and programs that support local food systems and incentivise the purchase of locally produced food by public institutions, supporting local food and farmers, and high production standards and sustainable produce. They can also foster partnerships and networks between different stakeholders in the community, such as farmers, food businesses, and consumers, to facilitate capacity building, knowledge sharing and coordination. Research has emphasised the importance of local government leadership in promoting sustainable food systems (Stein and Santini, 2022).

Food hubs themselves can build the evidence base on the significant positive impacts they have on communities and the food system. Food hubs can gather evidence of their activities and evaluate the impact they have across several key national and regional priorities and related policies on food security, public health, net zero, and inclusive growth. Compelling evidence of this impact could leverage policy support and unlock funding.

Finally, national level governance is required to address the fundamental causes of food insecurity, such as structural poverty and inequality, and support key actors along the food system to increase affordability, accessibility, and acceptability of healthy diets. An example of such policy is the National Food Strategy, which was commissioned by the UK government and published in 2021 by Henry Dimbleby.

6. Conclusion

Food hubs recognise that they bring significant social, environmental and economic benefits to local communities and the wider food system in terms of food security, sustainability, health, resilience and food justice. These benefits include enhancing sustainability, supporting local economies, strengthening healthy local food systems and improving health and wellbeing of their communities, in line with local and national priorities on food and other domains. However, as food hubs point out, to fully realise these benefits and scale *up* or *out* their positive impact across all these domains, they require more support from local and national governing bodies and food system stakeholders. This support can take the form of secure funding, resources, coordination, and knowledge sharing that enables a transition away from emergency food provision to more long-term, holistic and financially viable models that focus on community wellbeing and empowerment, healthy diets, local economies and environmental sustainability.

This research contributes to the growing literature investigating the impacts of food hubs and exploring their role in delivering progress on food, health, environmental and economic agendas. It is hoped that the findings of this research will stimulate further research and practice in this area.

CRediT authorship contribution statement

Effie Papargyropoulou: Writing – review & editing, Writing – original draft, Supervision, Resources, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization. **Gemma Bridge:** Writing – review & editing, Writing – original draft, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation. **Sonja Woodcock:** Writing – review & editing, Investigation. **Emma Strachan:** Writing – review & editing, Investigation. **Joanna Rowlands:** Writing – review & editing, Investigation. **Elizabeth Boniface:** Writing – review & editing, Investigation.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A:. Leeds food hubs survey

Information and informed consent

Welcome to the Leeds Food Hub survey! In partnership, the University of –removed for double blind review purposes-, Leeds City Council and FoodWise Leeds are running a project to identify and evaluate the benefits that food hubs (including food banks, food pantries, food clubs and community kitchens) across the city offer. The outputs of the project will be available to food hubs to support future strategy and funding bids and to

enable an assessment and monitoring of their benefits in the community. The work will also feed into the development of the Leeds Food Strategy (due Autumn 2022). You are invited to take part in the survey because you work, volunteer at, or manage a food hub in Leeds. If you choose to take part in the survey, you will be asked to answer some questions about your food hub. Your responses will be kept confidential. The survey should take you around 10 min to complete. Your participation in this project is voluntary. You have the right to withdraw at any point during the survey. If you have any questions about the project, please contact Gemma Bridge: XXXXX. By clicking the button below, you acknowledge: Your participation in the study is voluntary. You are aware that you may choose to withdraw at any time for any reason.

o I consent, begin the study
o I do not consent, I do not wish to participate

About your food hub

Q2 The following section asks you questions about the food hub that you work, manage or volunteer at.
Q3 What is the postcode of the food hub?

- Please type the full postcode of the food hub e.g. LS16 5LL

Q4 What is the name of the food hub?
Q5 What population does the food hub serve? Please select all that apply

- Anyone
- People living in a specific ward/area
- Children and/or schools
- Refugees/migrants
- Older people
- Referral only
- People experiencing homelessness
- Other, please state

Q6 Where do you source your food from? Please select all that apply

- Fareshare/Good To Go/Rethink Food or similar
- Donations from retail/supermarkets
- Donations from the community
- Direct from farm(s)
- Retail – purchased at a discount price
- Retail – purchased at normal retail price
- Other, please state

Focus of work

Q7 This section asks about the focus of the food hub and if/how COVID-19 altered that focus
Q8 What is the main focus of work for your food hub currently?

- Foodbank
- Food pantry
- Social supermarket
- Community cafe
- Community centre
- Community care hub
- Support/advice
- Farm or food growing
- Fruit and/or vegetable boxes
- Food processing
- Other

Q9 Beyond the main focus of work, what other services does the food hub provide? Please select all that apply

- Foodbank
- Food pantry
- Social supermarket/cooperative
- Community cafe
- Community centre
- Community care hub
- Support/advice
- Farm or food growing
- Fruit and/or vegetable boxes

- Food processing
- Other

Q10 Did the provision of the food hub change as a result of COVID-19?

- Yes
- No

Display question 11 if did the provision of the food hub change as a result of COVID-19? = yes

Q11 How did your provision change as a result of COVID-19? Select all that apply.

- Moved to providing emergency food parcels
- Moved to become a community care hub/foodbank
- Added a food pantry
- Offered support/advice
- Stopped face to face activities
- Changed the sourcing of food
- Other, please state

Display question 12 if did the provision of the food hub change as a result of COVID-19? = yes

Q12 What was the reason behind the change in provision? Select all that apply

- Increased requests for emergency food provision from the community
- Increased requests for advice/support from the community
- Reduced funding
- Available funding for emergency food provision
- Change of venue
- Other, please state

Benefits of the food hub

Q13 This section asks questions about the benefits of the food hub to the food system e.g. the communities you serve, businesses you collaborate with, farmers, other actors in the food system, the planet, the economy.

Q14 How does the food hub benefit economic development and viability in Leeds? Select all benefits that apply

- Generate revenue
- Employ staff
- Provide access to market for local businesses
- Enable investment in local food businesses
- Facilitate connections between other businesses/organisations
- Assist with access to financial support for community members
- Assist with access to services for community members
- Support community economic development
- Other, please state

Q15 How does the food hub benefit ecological sustainability in Leeds? Select all benefits that apply

- Reduce food waste
- Reduce greenhouse gas emissions
- Plant trees
- Grow fruit and vegetables
- Increased use of renewable energy
- Support biodiversity
- Other, please state

Q16 How does the food hub benefit access to and demand for healthy, local food? Select all benefits that apply

- Raise awareness of healthy, local food and its benefits
- Support the purchase of healthy, local food
- Provide a diverse range of healthy local foods
- Act to increase local food system resilience
- Develop food skills and food literacy
- Provide access for marginalised groups
- Provide safe food storage

- Other, please state

Q17 How does the food hub benefit personal community wellbeing in Leeds? Select all benefits that apply

- Improve health
- Improve emotional wellbeing
- Provide opportunities to engage in community activities
- Promote opportunities to develop social connections and relationships
- Improve quality of life
- Advocate for policies/programmes supportive of sustainable local foods
- Other, please state

The beginning

This section includes questions about the launch of the food hub
Q19 What was the main motivation for launching the food hub?

- To collect and distribute food aid
- To provide affordable food to the community
- To improve dietary health for the community
- To provide a way to market for local farms
- To promote local food
- To provide support/advice for the community
- To increase environmental sustainability of food systems
- To reduce food waste
- Other, please state

Q20 What was the main provision when the food hub was launched?

- Foodbank
- Food pantry
- Social supermarket/cooperative
- Community cafe
- Community centre
- Community care hub
- Support/advice
- Farm or food growing
- Fruit and/or vegetable boxes
- Food processing
- Other

SWOT analysis

The questions in this section ask about the strengths, weaknesses, opportunities, and threats for the food hub.
Q22 What are the strengths of the food hub? Select all that apply

- Multiple sources of food
- Part of a network across Leeds/the
- Sustainable source of funding
- Team of reliable staff and/or volunteers
- Embedded in the community
- Other, please state

Q23 What are the weaknesses of the food hub? Select all that apply

- Food is from only one source
- Work independently – not connected to other organisations
- No sustainable source of funding
- Limited human resources
- Other, please state

Q24 What are the opportunities for the food hub? Select all that apply

- Diversification into other provisions (e.g. cooking classes)
- Work with other organisations
- Other, please state

Q25 What are the threats for the food hub? Select all that apply

- Loss of working/storage space
- Shocks to the food supply chain
- Limited control over what food is provided
- Funding is stopped
- Other, please state

Future plans

This section includes questions about plans for the future of the food hub.

Q27 What plans do you have for the future of your food hub? (e.g. expand capacity, provide more services, commercialise, become financially independent, more away from emergency food provision to other food/community/business/skills training etc services)

Q28 What support do you think the food hub will need in the future? Select all that apply and elaborate with text where possible

- Funding (please explain what kind of funding would be needed e.g. for cooking equipment)
- Human resources (please explain what human resources would be needed)
- Finding a fixed work/storage space (please explain what space you would need)
- Training (please explain what training would be needed e.g. staff training)
- Other, please state

Any other comments

Q29 Do you have any other comments about food hubs in Leeds?

Email

Q30 If you would you be happy to be contacted to take part in later aspects of this project (a short interview and/or site visit to identify and evaluate benefits of your food hub), please write your email below:

Appendix B:. Interview guide

Background

1. What population do you serve? (e.g. anyone/specific ward/only by referral)
2. Where do you source your food from? (e.g. donations/purchased from supermarket)
3. What is the main focus of your work currently? (e.g. food bank/food pantry/community larder)
4. Beyond your main focus of work, what other services do you provide? (e.g. support for community members/volunteer opportunities/food growing)
5. Did your provision change during COVID-19?
   a. If yes, how did your provision change?
   b. If yes, what was the reason behind the change? (e.g. change to funding/venue/requests for support)

Your organisation/group

6. What is the main work/provision of your organisation/group?
7. What was the motivation behind setting up your organisation/group?
8. What role do you think your group/organisation plays in the food system in Leeds/beyond?

Food hub definition

9. What do you understand by the term food hub?
10. Do you think there is a better way of describing ‘food hubs’?

Impacts of food hubs

11. What benefits do you think that your food hub provides? (e.g. to the communities you serve, farmers, the planet, the economy) in terms of:
    a. economic development and viability
    b. ecological sustainability
    c. access to and demand for healthy and local food
    d. personal and community wellbeing

SWOT analysis

12. What do you think are the strengths of your organisation/group currently?

13. What do you think are the weaknesses?
14. What opportunities are there for the organisation?
15. What threats face the organisation?

Future plans

16. What plans do you have for the future?
17. Do you think the provision you offer should remain indefinitely? If yes, why? If not, why not?
18. What support do you think you will need?
19. Any other comments related to food hubs in Leeds that you'd like to make?
20. Would you be interested in us coming for a site visit to identify and evaluate the impacts of your food hub?

Appendix C:. Interviewees demographic information

Food Hub/Food Actors	Role within organisation	Gender	Ethnicity
1 Barca Leeds	Food hub manager	Female	British White
2 Feed Leeds	Committee member	Male	British White
3 Grace and Care	Food hub manager	Male	British White
4 Hamara Healthy living centre	Food hub manager	Female	British Asian
5 Incredible Edible Garforth	Food Hub manager	Male	British White
6 Kirkstall Valley Development Trust/Kirkstall Valley Farm	Farm manager	Female	British White
7 Leeds Allotment Federation	Committee member	Female	British White
8 New Wortley Community Centre	Centre manager	Female	British White
9 Oblong	Centre coordinator	Female	British White
10 Rainbow Junktion	Manager	Female	British White
11 Wetherby & District Foodbank	Foodbank manager	Female	British White

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