



**TRANSFORMING
UK FOOD
SYSTEMS**
Strategic Priorities Fund

TUKFS Annual Conference

23-24 March 2026

**Edgbaston Park Hotel and Conference Centre,
University of Birmingham**

Programme & Abstracts

#TUKFS26



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Welcome from Martin White

A very warm welcome to Birmingham and to the last of four conferences hosted by the UKRI Transforming UK Food Systems Strategic Priorities Fund. We hope you will enjoy the event, which rounds off five years of work by a multitude of researchers across the diverse and interdisciplinary ‘food systems’ research community.

The conference showcases the very best research from the TUKFS initiative and includes presentations, posters, symposia and workshops from consortia, projects and cross-programme initiatives. We hope there is plenty to hold your interest, as well as opportunities to engage with colleagues, our stakeholders and research partners.

The TUKFS initiative aimed to ‘fundamentally transform the UK food system...’. We are still a long way from achieving this aim. The food system drives both climate and public health emergencies, due to its impacts on natural resources and on our diets. And despite many mitigations and much research, there is no sign that these global challenges are lessening. Yet, we hope the conference will give you cause for hope. The research we have undertaken and findings we have generated, although individually small pieces of the solution to this grand challenge, are all important contributions and represent vital steps forward. But much remains to be discovered and, of course, research findings need to be translated into policy and practice to make a difference. We hope that by bringing researchers together with stakeholders from civil society, commerce and government, we can catalyse this process.

With this in mind, we warmly welcome our **keynote speakers, Tim Benton and Theresa Marteau**. We asked them to respond to the central theme of the conference: the challenges of transforming the UK Food System. You can find brief biographies and outlines of their inspiring talks below.

We are also very excited to welcome **Dan Saladino**, author and broadcaster, who will give a talk during the conference dinner on Monday evening. Dan has promised to use story telling to illuminate the challenges and offer hope.

On Tuesday we have an **expert panel** from government and civil society who will debate the application of evidence generated by the TUKFS programme, and discuss the future of the UK food system – thank you for giving up your time to be with us.

Putting on such an event requires a huge amount of planning and hard work, and we offer our **heartfelt thanks** all those who have contributed in many different ways.

The conference is supported by the Transforming the UK Food System for Healthy People and a Healthy Environment Strategic Priorities Fund Programme, delivered by UKRI in partnership with the Global Food Security Programme, BBSRC, ESRC, MRC, NERC, Innovate UK, Defra, DHSC, OHID and FSA. We are grateful to the TUKFS team – Riaz Bhunnoo, Hannah Mitchell, Guy Poppy and Roya Shakroni – who have provided practical support and advice in over the last year.

The conference planning group included many volunteers from across the TUKFS research community: Jean Adams, Jane Bradbeer, Hannah Brinsden, Tracey Duncombe, Oliver Francis, Niamh Kelly, Marta Lonnie, Sundus Mahdi, Tracey McNeilly, Owen Nicholas, Kelly Parsons, Leticija Petrovic and Alexia Sawyer. Members of the planning group peer reviewed abstracts, as did: Martin Chadwick, Bob Doherty, Leona Lindberg, Rachel McCloy, Kyriaki Noussia, Christian Reynolds, Chittur Srinivasan and Michelle Thomas. We are hugely grateful to them all.

Many thanks are also due to all the session chairs, and to the following researchers from Cambridge who will ensure the smooth running of sessions and help with technical troubleshooting : Tom Burgoine, Elizabeth Eveleigh, Hiba Fatima, Sarah Mounsey and Struan Trait. Last, but by no means least, the planning of the conference was skilfully managed by the resourceful, extremely patient and thoroughly humoured Georgia Herbert – thank you for all your hard work.



Keynote speaker – Professor Tim Benton

Tim Benton is Professor of Population Ecology and Dean for Strategic Research Initiatives at the University of Leeds and a Distinguished Visiting Fellow at the Royal Institute of International Affairs, Chatham House. Over his distinguished career he studied zoology at the Universities of Oxford and Cambridge, and has held positions at Universities of East Anglia, Stirling and Aberdeen. Tim's research interests include global food security, food systems and resilience, ecology and natural resources, and impacts on climate change. From 2011-2016, he was UK Champion for Global Food Security, acting as ambassador and spokesperson for matters to do with food and food security, and coordinating work across this area between research councils and government departments. He is also as a Global Agenda Steward for the World Economic Forum, and an author for the IPCC's Special Report on Land, Food and Climate.



Tim will give his keynote talk on Monday 23 March at 11:00, entitled:

Implications of a volatile world on UK food systems and security

The multilateral world, based loosely on an agreed set of cooperative rules governing international affairs and trade, is arguably being replaced by a new geopolitical realpolitik based more overtly on national self-interest. At the same time, disruptions due to unsustainable growth are becoming more marked, whether for food or other land-based production, or supply chain logistical disruptions. Together, a new political and geopolitical reality is emerging. Given which, the political primacy of economic growth expectations is likely to result in unsustainable environmental impacts in any real sense; the feedback from a world under pressure is likely to enhance future disruptions, strengthen short-term economic needs, contestation and conflict and result in a vicious circle of further environmental degradation. Within this context, what are likely to be the drivers on UK agriculture and food systems and how might the notion of food security develop? What might this mean for the research agenda within the area of "food system transformation"?

Conference Dinner Speaker – Dan Saladino

Dan Saladino has been a food journalist for almost 20 years. As a broadcaster he presents and produces editions of BBC Radio 4's The Food Programme. His first book, *Eating to Extinction: The World's Rarest Foods and Why We Need to Save Them*, is an epic journey into the history, culture and future of food, and which involved 15 years of travel and story collecting.

Since its publication by Jonathan Cape in the UK and FSG in the United States, *Eating to Extinction* has been translated into more than ten languages and has won multiple awards, including: the prestigious Wainwright Prize for Conservation and Nature and the Fortnum & Mason Book of the Year. Dan is the recipient of a James Beard Awards (America's most high-profile award for food journalism).

His work in radio, which has won multiple awards, includes efforts to document the loss of food cultures and biodiversity, a subject on which he's considered to be one of the world's most influential storytellers.

His second book, *From the Sea*, a selection of Dan's stories about endangered biodiversity in the world's rivers and oceans, is being published by FSG in Spring 2025.



Keynote speaker – Professor Dame Theresa Marteau

Theresa Marteau is Research Professor Emerita in behavioural science in the Department of Public Health and Primary Care in the Clinical School at the University of Cambridge and Honorary Fellow of Christ's College, Cambridge. Her research interests include: development and evaluation of interventions to change behaviour (principally diet, tobacco and alcohol consumption) to improve population health equitably and sustainably, with a particular focus on targeting non-conscious processes; and acceptability to publics and policy makers of government intervention to change behaviour. In recognition of her contributions to population health and behavioural science, she was appointed Dame Commander of the Order of the British Empire (DBE) in 2017 in recognition of her contributions to population health and behavioural science. Her book *Pushback: How We Can Change Our Behaviour to Build a Thriving World* is due to be published by *The Bodley Head* in January 2027.



Theresa will give her keynote talk on Tuesday 24 March at 09:45, entitled:

Changing Behaviour Across Populations and Politicians

Plant-rich, minimally processed diets produced within planetary boundaries could prevent 15 million premature deaths annually and halve the 30% of greenhouse gas emissions from our food system. Achieving this requires interventions with the scale and reach to shift diets of entire populations.

The most effective interventions for changing behaviour at scale and equitably are low-agency measures that reshape food environments, rather than high-agency approaches that rely on individual motivation and other resources. Reducing the affordability, availability, and advertising of animal-sourced and ultra-processed foods – while simultaneously increasing these 'three As' for plant-rich alternatives – show consistent effects across populations and contexts. Soda taxes are reducing sugar consumption in the 117 countries and territories where they are now implemented. By making appealing plant-based meals the default, New York City's public hospitals cut their carbon emissions by 36%. Removing ads for foods high in fat, sugar and salt across London's transport network resulted in households spending 6.7 % less on these foods, with the biggest impact in the poorest neighbourhoods where obesity rates are highest.

Changing food environments at this scale often requires regulation to counter commercial interests in the status quo. For this, politicians need to change their behaviour. Three institutional reforms – 'three Ps' – could accelerate action. First, protect policymaking from industries whose commercial interests lie in maintaining the status quo, by adopting Article 5.3 from the UN Framework Convention on Tobacco Control which shields public health policy from commercial interference. Second, publish evidence underpinning food policies and outcome indicators tracked in real time. Third, enable participatory policymaking through permanent citizens' assemblies that generate recommendations aligning more closely with evidence than traditional policymaking.

Conference programme

Monday 23rd March 2026

Time	Session title	Details	Venue
10.00	Registration open	Refreshments available, put up posters and displays	Foyer
10.45	Opening plenary	Welcome, about the conference and housekeeping Martin White	Fry Suite
11.00	Keynote Speaker	Professor Tim Benton , Professor of Population Ecology and Dean for Strategic Research Initiatives, University of Leeds <i>Implications of a volatile world for UK food systems and security</i> (Chair: Martin White) Tim Benton argues that a shift from a cooperative multilateral world to one driven by national self-interest, combined with mounting environmental and supply-chain pressures, is creating a volatile global context for food and land-based systems. Within this instability, he explores how UK agriculture and food security may evolve and what this means for shaping future research on food-system transformation.	Fry Suite
11.45	Plenary talks from TUKFS (1)	TUKFS speakers (Chair: Prof David Barling) High scoring ECR abstracts Dr Albert Muleke , Cain M, Chapman P J, Wade R N, Smith K E, Burgess P J, Pexas G, Wiltshire C K, Harrison M T, Christie-Whitehead K M, de Voil P G, Liu K, Chapagain R (Fix Our Food) <i>Transforming UK agriculture: modelling the impact of regenerative farming in Yorkshire under a changing climate</i> Fleur ter Ellen , Parsons K, White M, Sawyer A (Mandala) <i>Unpacking the development and implementation of the Birmingham Food System Strategy: a Ripple Effects Mapping study</i>	Fry Suite
12.30	Buffet Lunch, posters and displays	See table below for poster programme	Foyer
13.30	Parallel session 1	See table below for parallel sessions	See table below
15.00	Refreshment break, posters and displays	Teas, coffees, water, snacks See table below for poster programme	Foyer
15.30	Parallel session 2	See table below for parallel sessions	See table below
17.00	Satellite meetings, interactive sessions or free time	1. Interactive session (60 mins): Let's play <i>Foodtopia</i> : co-producing policies, engaging communities in policy change, fostering impact. Led by Dr Katerina Psarikidou , Assistant Professor in Sustainable Development & FoodSEqual Policy Lead, University of Sussex 2. Next steps for the food systems map – ECR network. Led by Dr Marta Lonnie , Research Fellow, Rowett Institute, School of Medicine, Medical Sciences & Nutrition, University of Aberdeen	Lodge Corelli
19.00	Drinks reception, posters and displays	See Table below for poster programme	Foyer
19.30	Dinner	Guest speaker: Dan Saladino , Author ('Eating to Extinction') and Broadcaster ('The Food Programme', BBC Radio 4)	Fry Suite

Time	Session title	Details	Venue
09.00	Plenary talks from TUKFS (2)	<p>TUKFS speakers (Chair: Prof Peter Jackson)</p> <p>High scoring ECR abstracts</p> <p>Naomi Fallon, Yap C, Vogel C (TUKFS Centre for Doctoral Training, Centre for Food Policy, City St Georges, University of London)</p> <p><i>How does power shape UK free school meals policy? A critical discourse analysis of parliamentary debates 2015-2025</i></p> <p>Dr Sophie Hedges, Yau A, Parsons K, Sawyer A, White M, Cummins S (Mandala, LSHTM)</p> <p><i>Mapping the physical and digital food environment in Birmingham: A cross-sectional analysis of online food delivery platforms and point-of-interest data</i></p>	Fry Suite
09.45	Keynote speaker	<p>Prof Dame Theresa Marteau, Honorary Fellow, Christ's College, and Associate Fellow, Centre for Science and Policy, University of Cambridge.</p> <p><i>Changing Behaviour Across Populations and Politicians</i> (Chair: Martin White)</p> <p>Theresa Marteau argues that shifting entire populations toward healthier, plant-rich diets requires large scale, low agency changes to food environments alongside political reforms that protect policymaking from commercial influence and make it more transparent and participatory.</p>	Fry Suite
10.30	Refreshment break, posters and displays	<p>Teas, coffees, water, snacks</p> <p>See table below for poster programme</p>	Foyer
11.00	Parallel session 3	See table below for parallel sessions	See table below
12.30	Buffet lunch, posters and displays	See table below for poster programme	Foyer
13.30	Parallel session 4	See table below for parallel sessions	See table below
15.00	Refreshment break	Teas, coffees, water, snacks	Foyer

Time	Session title	Details	Venue
15.15	Plenary: panel discussion	<p>Representatives from government, industry and civil society debate the application of evidence generated by the TUKFS programme to policy, and discuss the future of the UK food system</p> <p><i>Chair:</i></p> <p>Prof Guy Poppy, Pro-Vice Chancellor for Research, University of Bristol. Former Chief Scientific Adviser, Food Standards Agency, TUKFS Programme Director</p> <p><i>Panellists:</i></p> <p>Tom George, Food Strategy Head of Policy, Food Security and Coordination Division, Agri-Food Chain Directorate, Department for Environment, Food and Rural Affairs</p> <p>Rob Kidd, Food system consultant to industry and civil society, Rubikon Consulting</p> <p>Prof Rick Mumford, Deputy Chief Scientific Advisor & Deputy Director of Science & Research, Science, Evidence and Research Division, Food Standards Agency</p> <p>Jenny Rosborough, Head of Nutrition Advice and Translation, Department of Health and Social Care</p> <p>Anna Taylor, Executive Director, The Food Foundation</p>	Fry Suite
16.00		<p>Reflections on TUKFS – Prof Guy Poppy</p> <p>Closing remarks and housekeeping announcements: Martin White</p>	
16.15	Close		

Parallel sessions

Day/Time	Fry Suite	Bantock	Elgar	Corelli	Lodge
Parallel 1 Monday 13.30-15.00	<p>Symposium 1.1</p> <p>Expanding free school meal provision in England: economic evidence, auto-enrolment, and implementation for scalable, equitable policy reform</p> <hr/> <p>Chair: Hannah Brinsden</p> <p>Discussant Myles Bremner</p> <hr/> <p><i>Paper 1:</i> Using cost-benefit analysis to estimate the economic value of a complex intervention: expanding provision of primary school meals in England</p> <p>Bisola Osifowora, Kesaita V, Yau A, Pokhilenko I, Loopstra R, Cummins S, White M, Frew E</p> <p><i>Paper 2:</i> Auto-enrolment of Free School Meals</p> <p>Maria Bryant, Mahdi S, Padgett L, Oxley R, Bremner M, Goudie S, Doherty B</p> <p><i>Paper 3:</i> Policy options to increase the provision of Free School Meals (FSMs) in England: a qualitative exploration of policy implementation challenges through stakeholder</p> <p>Emma Frew, Jones CP, Osifowora B, Kesaita V, Pokhilenko I, Cummins S, Loopstra R, Sawyer A, Yau A, White M</p>	<p>Symposium 1.2</p> <p>Enhancing TUKFS programme level impact via three collaborative ‘Synergy Projects’: a critical discussion of process and outcome</p> <hr/> <p>Chair: Tracey Duncombe</p> <p>Discussant: Rebecca Wells</p> <hr/> <p><i>Paper 1:</i> Interdisciplinary working in food systems research: lessons from the TUKFS programme</p> <p>Peter Jackson, Kelly Parsons, Wells R, Fletcher I, Lemos D</p> <p><i>Paper 2:</i> Bridging theory and practice for actionable change in transforming food systems (BRIDGE-ACT)</p> <p>Marta Lonnie, Hunter E, Didcock H, Puranik M, Norton V, Gardiner B, Bosseaux J, Edwards F, Mogeni B, Greatwood H, Johnstone A</p> <p><i>Paper 3:</i> TUKFS ‘co-production toolkit’ – maximising its reach beyond academics, to project beneficiaries and policymakers</p> <p>Clare Pettinger, Hardman C, Wells R, Ehgartner U, Morgans L, Boyle N, Shaw N, Howard L, Mumby H</p>	<p>Symposium 1.3</p> <p>From research to impact: using real-world supermarket transaction data to provide insights for policy and practice in the FIO and DIO food projects</p> <hr/> <p>Chair: Michelle Morris</p> <hr/> <p><i>Paper 1:</i> Learnings from working with industry partners – the Academic-Industry Partnership “AIP” framework</p> <p>Victoria Jenneson, Stone, RA, Ennis E, Naisbitt R, Lomax N., Morris M</p> <p><i>Paper 2:</i> The retailer perspective on implementing and evaluating interventions to support healthy sustainable food purchasing: challenges and opportunities</p> <p>Charlotte Hardman, Stone RA, Brown A, Douglas F, Greatwood H, Griffiths C, Hunter E, Johnstone A, Lonnie M, Morris M, Skeggs H</p> <p><i>Paper 3:</i> FIO Food: using supermarket transaction data to estimate environmental sustainability footprints of food and drink purchases, and their interplay with health, demographics and food and drink cost</p> <p>Emma Wilkins, Green M, Gilthorpe MS, Johnstone A, Morris M</p> <p><i>Paper 4:</i> DIO Food: using supermarket transaction data to</p>	<p>Symposium 1.4</p> <p>Environmental and socio-economic impacts of transitioning to regenerative agriculture</p> <hr/> <p>Chair: Pippa Chapman</p> <p>Discussant: Lynn Dicks</p> <hr/> <p><i>Paper 1:</i> Measuring effects of stacking regenerative agriculture principles on environmental and socio-economic outcomes: Results from a drought year.</p> <p>Kellie Smith, Wade R, Gilpin M, Armitage H, Collins L, Doherty B, Chapman P</p> <p><i>Paper 2:</i> The H3 Project: results of a four-year quasi-experiment measuring outcomes of regenerative agriculture transitions in England</p> <p>Katherine Berthon, Jaworski CC, Beacham JD, Jackson P, Leake J, McHugh NM, Capstick L, Daniell T, Zhao Y, Watt PJ, Dicks LV</p> <p><i>Paper 3:</i> Farmer perspectives on the transition to regenerative agriculture: barriers, opportunities and economic dimensions</p> <p>Jonathan Beacham, Jackson P, Berthon K, Blenkinsopp A, Dicks L, Rogers K, Chapman P, Wade R</p>	<p>Symposium 1.5</p> <p>Drivers, impact, variation, and redistribution of food donations, surplus and waste: insights to balance conflicting aims in the UK food system</p> <hr/> <p>Chair: Carol Wagstaff</p> <p>Discussant: Jag Srai</p> <hr/> <p><i>Paper 1:</i> Household spend on wasted food and environmental impact of food waste across household types: a cross-sectional analysis of data from an English consumer panel</p> <p>Amy Yau, Hedges S, Ball T, Balmford A, Dicks LV, Adeosun P, Fu L, Kesaita V, Parsons K, Sawyer A, White M, Cummins S, on behalf of the Mandala Consortium</p> <p><i>Paper 2:</i> The reliability of unsold fresh food as a source for redistribution: a case study by simulation comparing retail outlets by size and inventory level using data from British supermarkets</p> <p>Owen Nicholas on behalf of the Mandala Consortium</p> <p><i>Paper 3:</i> Managing fluctuations in UK fresh produce redistribution</p> <p>Michael Bourlakis, Chadwick M, Hadley P, Sawyerr E, Doherty B, Wagstaff C</p>

Day/Time	Fry Suite	Bantock	Elgar	Corelli	Lodge
			<p>evaluate the impact of the High in Fat, Sugar and Salt (HFSS) legislation on purchases of HFSS products and whether the legislation was equitable</p> <p>Alice Kininmonth, Jenneson VL, Wilkins E, Chukwu I, Eselebor O, Pontin F, Naisbitt R, Johnstone A, Fildes A, Morris M</p> <p><i>Paper 5: From research to action: cross-collaboration learnings</i></p> <p>Hannah Skeggs</p>		
Parallel 2 Monday 15.30-17.00	<p>Individual papers 2.1</p> <p>Consumer data Chair: Jean Adams</p> <hr/> <p>Leona Lindberg, Brereton P, Hutchinson G, Livingstone D, Thomas EL, Cheng S, Grigoriadis V, Nugent AP, Woodside JV, Smyth B, Vljajic J, Fu R, Collins O, Areal F, Frewer LJ</p> <p>The development and testing of the Sus-Health Index: a combined score which assesses and presents the nutritional content and environmental impact</p> <p>Amy Yau, Hedges S, Parsons K, Smith R, White M, Cummins S</p> <p>Overlap between healthiness, environmental impact and cost: a cross-sectional analysis of food and drink purchases made by an English consumer panel</p> <p>Lynn Frewer, Fu R, Collins O,</p>	<p>Individual papers 2.2</p> <p>System transformation Chair: Rich Smith</p> <hr/> <p>Fergus Lyon, Vickers I</p> <p>Open innovation for transforming food systems: social enterprise as a catalyst for bottom-up collaborative social innovation</p> <p>Umar Muhammad, Manning L</p> <p>Unequal resilience in UK-connected food systems: power, shock propagation, and the politics of food system adaptation</p> <p>Rebecca Newman, Fazey I, Buckton S, Om S, Crossland A, Everson R, Thompson J, Dordi T</p> <p>w transformative governance for food system transformation can be co-created with local actors</p> <p>Kyriaki Noussia, Hilson C, Riefa C</p> <p>Regulatory tools for a healthy and sustainable diet: the case of</p>	<p>Individual papers 2.3</p> <p>Food insecurity Chair: Charlotte Hardman</p> <hr/> <p>Rachel Loopstra, Sawyer A</p> <p>Evaluation of Birmingham City Council’s grant programmes for food aid organisations during the cost-of-living crisis, 2022-2024</p> <p>Bramble Gardiner, Zischka L, Lloyd-Evans S</p> <p>Neighbourhood food stories: a qualitative secondary analysis across 5 years of FoodSEqual data identifying food practices in a community facing financial constraints, contextual influences and participant proposals for change</p> <p>Alexia Sawyer, Adeosun KP, Kesaitte V, Yau A, Tait S, Jones CP, Smith R, Cummins S, Adams J, Loopstra R</p>	<p>Individual papers 2.4</p> <p>Production & Formulation Chair: Jag Srai</p> <hr/> <p>Esther Amayo, Baeghballi V, Acharya P, Winters A</p> <p>Red clover as a novel source of protein for human consumption: processing methods and potential pitfalls</p> <p>Apple Espino, Mead A, Haefele S, Po J, Wellard K</p> <p>Variations in iron, zinc and selenium content of UK bread-making wheat flours: implications for nutrition security</p> <p>Toby Evans, Nickles J, Selby M, Leake J: Validating Year-Round Leafy Green Production in the UK</p> <p>Using Low-Input passive polytunnel hydroponics: a biological and economic assessment</p> <p>Rebecca Lait</p>	<p>Individual papers 2.5</p> <p>Methods & Developments Chair: Katerina Psarikidou</p> <hr/> <p>Rosie Tsikritzi, Smith R, Methven L, Anderson J, Zischka L, Bennett T, Lloyd-Evans S, Fagan CC, Wagstaff C</p> <p>Co-Creating Pulse-Based Snacks: A UK Innovation Journey</p> <p>Kelly Parsons, Smith R, Frew E, Sawyer A, Kesaitte V, Nicholas O, Ball T, Tait S, Petrovic L, Adams J, White M</p> <p>Co-designing institutional catering interventions for food system change: developing a menu reformulation approach in a UK children’s hospital</p> <p>Louise Hunt, Pettinger C, Howard L, Gardiner B, Beggs J, Dunn L, and Hart J: Doing participatory data analysis: learnings from</p>

Day/Time	Fry Suite	Bantock	Elgar	Corelli	Lodge
	<p>Higgins K, Karbo RT, Clark B, Sari NH, Raley M, Jin A, Areal F, Thomas EL, Vlajic J, Smyth B, Livingstone D, Lindberg L, Hutchinson G, Thompson A, Woodside J, Nugent AP, Brereton P</p> <p>Consumer attitudes towards a combined nutrition and sustainability label developed from initial modelling and stakeholder coproduction of label design</p> <p>Michelle Thomas, Fisher D, Methven L, Wagstaff C</p> <p>Grocery purchasing and dietary patterning amongst households in the UK across social-economic-classifications: secondary data analysis using WorldPanel by Numerator and National Diet and Nutrition Survey (NDNS) data sets</p>	<p>command-and-control regulation, tariffs, and economic instruments</p>	<p>Mapping the evidence on impacts of the redistribution of surplus food through the community food aid sector: a systematic scoping review</p> <p>Manik Puranik, Kuhnle G, Anderson J, Sutton R, Bradbeer J, Howard L, Garg P, Taylor S, Hussain S, Miah S, Pettinger C, Wagstaff C</p> <p>Urinary and hair biomarkers as objective measures of dietary intake in disadvantaged UK communities</p>	<p>Investigating how power dynamics shape UK meat and livestock reduction: a multi-stakeholder study</p>	<p>FoodSEqual Plymouth, a community-based participatory research project.</p> <p>Gizem Acar, Frost R, Bhamra SK, Heinrich M</p> <p>Nutrition at the frontline: a systems approach to enhancing public health through pharmacy practice</p>
<p>Parallel 3</p> <p>Tuesday 11.00-12.30</p>	<p>Workshop 3.1</p> <p>Driving food system transformation: exploring legislative levers for change</p> <p>Convenor: Tracey Duncombe</p> <p>Parsons K, Brinsden H, Noussia K</p> <hr/> <p>Aims:</p> <ol style="list-style-type: none"> 1. Provide an overview of the UK Food Bill Campaign and to share insights on regulatory tools research, political narratives and framing, the need for improved governance, and lessons from other nations including Scotland. 2. Discuss the role of legislation in 	<p>Workshop 3.2</p> <p>Reframing legumes in UK food-system transformation: co-developing a research agenda for net zero, nature and nutrition</p> <p>Convenor: Jing Zhang</p> <p>Zurek M, Sykes R</p> <hr/> <p>Aims:</p> <ol style="list-style-type: none"> 1. To use emerging insights from the <i>UK Beans Roadmap (University of Oxford, Agile Science to Policy fund)</i>, building on <i>BeanMeals</i> and the <i>Legume Initiative (June 2025, Reading)</i>, to examine the food-system conditions under which 	<p>Workshop 3.3</p> <p>English school food provision as a public service at risk: exploring emerging economic and structural challenges and their implications for food system transformation</p> <p>Convenor: Clare Pettinger</p> <p>Michaels L; Pearce B, Fletcher G</p> <hr/> <p>Aims:</p> <ol style="list-style-type: none"> 1. Critically examine economic/other structural challenges in English school food provision and their implications for food systems research and intervention design. 	<p>Workshop 3.4</p> <p>Rapid evidence synthesis for the Food Standards Agency of regulatory interventions to improve food system outcomes in deprived communities</p> <p>Convenor: Bob Doherty</p> <p>Bryant M, Nixon N, Garnett P, Kapetanaki A, Hamilton S, Ball P</p> <p>Aims:</p> <ol style="list-style-type: none"> 1. Share findings and recommendations from our rapid evidence synthesis. 2. Interpret findings for sense making 	<p>Workshop 3.5</p> <p>Identifying critical components for food system change at scale</p> <p>Convenor: Sam Buckton</p> <p>Fazey I, Newman R, Bayoneta C, Everson R, Thompson J, Crossland A</p> <p>Aims:</p> <ol style="list-style-type: none"> 1. Build collective understanding of five critical components for aligning actors and action toward large-scale systems change 2. Identify priority areas of research and action that need to be strengthened for effective cohering

Day/Time	Fry Suite	Bantock	Elgar	Corelli	Lodge
	<p>enabling food system transformation.</p> <p>3. Identify legislative opportunities to strengthen research and policy impact across TUKFS projects.</p> <p>4. Co-create actionable recommendations for more effective legislative frameworks</p>	<p>legumes would most effectively contribute to UK food-system transformation.</p> <p>2. To engage the TUKFS community in identifying priority research gaps and system interactions linking land management, nature recovery, food-system coordination (e.g. production processing, procurement, etc.) and dietary change.</p> <p>3. To co-develop a shared, forward-looking food-systems research agenda that can inform the next phase of TUKFS research and collaboration</p>	<p>2. Share empirical insights from TUKFS research projects and delivery partners working with schools and caterers.</p> <p>3. Facilitate critical discussions on existing initiatives (incl. risk mitigation) and generate ideas for how researchers and stakeholders can design innovations and interventions that support healthy and sustainable school food, under conditions of system instability.</p>	<p>3. Review evidence gaps and rank recommended interventions based on APEASE criteria.</p>	<p>3. Generate actionable policy advice for food system transformation.</p>
<p>Parallel 4</p> <p>Tuesday 13.30-15.00</p>	<p>Symposium 4.1</p> <p>Methods to improve the sustainability and nutrition of school dinners for both planetary and population health</p> <p>Chair: Maria Bryant</p> <p>Discussant: Charlotte Hardman</p> <hr/> <p><i>Paper 1:</i> Co-designed menu swaps to improve nutrition and environmental sustainability of primary school meals in socioeconomically deprived settings: early findings from the FixOurFood intervention</p> <p>Zeynep Caferoglu Akin, Nixon N, Oxley R, Mahdi S, Bridle S, Kluczkowski A, Brunstrom J, Davison P, Harris N, Jemison A, Higginson P, Doherty B, Bryant M</p>	<p>Individual papers 4.2</p> <p>Model-informed interventions</p> <p>Chair: Thijs van Rens</p> <hr/> <p>Taro Takahashi, Flynn AN, Brunstrom JM</p> <p>Dish swap across a weekly menu can deliver health and sustainability gains: a new approach to improving menus in public procurement settings</p> <p>Annika Flynn, Takahashi T, Sim A, Reynolds C, Hardman C A, Brunstrom JM</p> <p>Using computational modelling to reset the concept of cuisine and to re-imagine healthy and sustainable meals</p> <p>Chittur Srinivasan, Balcombe KG,</p>	<p>Individual papers 4.3</p> <p>Supply chains</p> <p>Chair: Michael Bourlakis</p> <hr/> <p>Jessica Bosseaux, Mohareb E</p> <p>How allocation rules shape the environmental story: mass versus economic allocation in ELCA</p> <p>Ettore Settanni, Kazantsev N, Srai J S</p> <p>Keep your friends close and your enemies closer: exploring channel development opportunities between fresh produce wholesale markets and dark kitchens as two-sided B2B platforms</p> <p>Nikolai Kazantsev, Feng X, Settanni E, Srai JS</p> <p>Revitalising wholesale markets for</p>	<p>Workshop 4.4</p> <p>Developing the ‘Food Systems Flower’ framework to support food systems approaches post-TUKFS</p> <p>Convenor: Rebecca Wells</p> <p>Parsons K, Duncombe T, Fazey I, Gardiner B, Lonnie M</p> <hr/> <p>Aims:</p> <ol style="list-style-type: none"> 1. Hear from users of the tool about how it has supported a food systems approach in TUKFS projects; 2. Explore potential redesign, based on lessons from users and other participant input; 3. Identify what workshop materials and guidance could be developed to support wider usage 	<p>Workshop 4.5</p> <p>Insights from the making of the Synergy Co-Production Toolkit: using illustrations to support communication between collaborators in co-produced, community food systems transformation research</p> <p>Convenor: Lisa Howard</p> <hr/> <p>Mumby H, Pettinger C</p> <p>Aims:</p> <ol style="list-style-type: none"> 1. Workshop participants will learn how the TUKFS Synergy Project research team worked with an illustrator, integrating unique visual imagery in the development of a toolkit to support co-produced community research 2. The team will gather feedback

Day/Time	Fry Suite	Bantock	Elgar	Corelli	Lodge
	<p><i>Paper 2:</i> Acceptability of new school menus for population and planetary health: a proof-of-concept study</p> <p>Sundus Mahdi, Caferoglu Akin Z, Nixon N, Padgett L, Doherty B, Bryant M</p> <p><i>Paper 3:</i> Children’s acceptance and liking of novel UK-grown beans in primary schools: a quasi-experimental evaluation of the BeanMeals intervention</p> <p>Charlotte A Hardman, Bayes N, Didier L, & Ingram J</p>	<p>Sherry E, Law C</p> <p>Estimating Food Consumption Changes for Transition to Healthy Diets in the UK</p> <p>Erin Sherry, Binfield J, Caskie P</p> <p>International Trade and the Environmental Benefits of Diet Change in the United Kingdom</p>	<p>resilient food systems: a model-based approach to evaluate strategy interventions</p> <p>Kehinde Paul Adeosun, Sawyer A, White M, Loopstra R</p> <p>Coordinating surplus food redistribution hub in a wholesale food market setting in the UK: a Social Practice Theory perspective</p>		<p>and views about the resource, using this intelligence to inform future use and dissemination of the toolkit</p>

Posters and Films (Foyer)

Posters

Poster authors are asked to stand by their poster and be prepared to give a short (<3 min) introduction to their poster from 15:00-15:30 on Monday 23rd March and 10:30-11:00 on Tuesday 24th March. Posters will remain on view throughout the conference and can be viewed during other breaks.

Poster #	Presenter	Title
1	Andrea Zick	Alternative proteins in culinary education: understanding knowledge, attitudes, and barriers among chef trainees and educators
2	Lorna Zischka, Bramble Gardiner, Sally Lloyd-Evans	Social connectivity and diet: a quantitative study of 137 interviewees in Whitley, Reading, exploring ways in which their social connections, including community group connections, correlate to self-reported diets and wellbeing
3	Charlotte Hardman, Lisa Didier	“Food is not rubbish!” Tackling food waste in UK primary schools via collaboration and codesign
4	Jennifer Griffiths	Seaweed on my lunch tray: challenges and opportunities of including macroalgae in Welsh school meals
5	Thomas Ball	Food impacts on species extinction risks can vary by three orders of magnitude
6	Vandy Butcher, Patricia Doughlin, Lisa Howard	So, you're thinking about becoming a community researcher? A handbook of insights and learning (including case studies), co-created by 19 community researchers and 2 community coordinators from FoodSEqual
7	Rosie Tsikritzi	Co-creating pulse-based snacks: a UK innovation journey
8	Behrouz Arabi, Sonal Choudhary	Introducing a comprehensive AI-enabled food data catalogue: leveraging data infrastructure to address the challenge of feeding all people well
9	Andrew Westby	Update on UK Food Systems Centre for Doctoral Training
10	Jessica Bosseaux, Eugene Mohareb	Towards a comprehensive stakeholders and hotspots categorisation: a Delphi Method contribution to post-productivist social life cycle assessment
11	Rob Oxley	Mapping Influences on School Food Consumption Across Deprivation Levels: Relational Content Analysis of Pupil and School Leadership Perspectives
12	Owen Nicholas	Estimating global and UK uncertainty in GHG and land use impacts of substituting pulses for poultry for beef, from Poore & Nemecek LCA data
13	Marta Lonie	Bridging Theory and practice for actionable change in transforming food systems (BRIDGE-ACT): Impact Planner Toolkit

TUKFS Films

There will be a large TV screen in the foyer area, on which you can view films made by TUKFS projects. These are on a continuous reel. Here is a list of the running order:

Number	TUKFS Project	Film title or topic	Contact
1	Mandala Consortium	The Mandal Consortium – Transforming Urban Food Systems for Public and Planetary Health	Martin White martin.white@ims.cam.ac.uk
2	Fix Our Food	Yorkshire Stories of Sustainability – Yorkshire Rapeseed Oil	Belinda Morris belinda.morris@york.ac.uk
3	Mandala Consortium	Stories from a Changing Food System: Change Kitchen	Jean Adams jean.adams@ims.cam.ac.uk
4	Fix Our Food	Yorkshire Grain Alliance – Leeds Bread Co-op	Belinda Morris belinda.morris@york.ac.uk
5	Mandala Consortium	Stories from a Changing Food System: Pathways to Universal Free School Meals	Emma Frew e.frew@bham.ac.uk
6	H3	H3: Healthy Soil, Healthy Food, Healthy People	Tracey McNeilly t.mcneilly@sheffield.ac.uk
7	Mandala Consortium	Stories from a Changing Food System: Evaluating a food hub model to redirect food to communities	Alexia Sawyer alexia.sawyer@ims.cam.ac.uk
8	H3	Deep Seed: Prof Lynn Dicks talks about regenerative farming	Lynn Dicks lvd22@cam.ac.uk
9	FoodSEqual	FIO Food Project	Marta Lonnie marta.lonnie3@abdn.ac.uk
10	Mandala Consortium	Stories from a Changing Food System: Designing more environmentally sustainable hospital menus	Kelly Parsons kelly.parsons@ims.cam.ac.uk
11	FoodSEqual	Bridge-Act project	Marta Lonnie marta.lonnie3@abdn.ac.uk

Plenary talks from TUKFS 1

Submitting Author: Dr Albert Muleke

Email: albert.muleke@cranfield.ac.uk

Department and Institution: Cranfield Environment Centre and Cranfield University

TUKFS Investment: FixOurFood

All Authors: Albert Muleke, Michelle Cain, Pippa J. Chapman, Ruth N. Wade, Kellie E. Smith, Paul J. Burgess, Georgios Pexas, Catherine Katy Wiltshire, Matthew T. Harrison, Karen M. Christie-Whitehead, Peter G. de Voil, Ke Liu, Ranju Chapagain

Title

Transforming UK agriculture: modelling the impact of regenerative farming in Yorkshire under a changing climate

Abstract

The global food system faces growing vulnerabilities due to shocks and the existential threat of climate change, underscoring the need for a fundamental shift toward sustainable, regenerative food systems that ensure nutritional security, align with climate and biodiversity goals, and promote a healthier population.

Here, we evaluated how transitions to regenerative agricultural systems influence crop productivity and soil organic carbon (SOC) accumulation in Yorkshire. Simulations were conducted under historical (1993–2023) and future (2030–2060) climates using the Agricultural Production Systems sIMulator next generation (APSIM Next Gen) to assess implications of key regenerative practices, including crop diversification, livestock integration, reduced synthetic fertiliser use, and the introduction of herbal leys. Each regenerative practice was integrated individually into a Baseline rotation.

Compared with historical conditions, projected global warming under a high-emissions climate scenario substantially reduced both long-term crop yields and SOC accrual in the topsoil (0–30 cm) by up to 15% across all regenerative strategies. Integration of herbal leys—implemented through inclusion of a four-year phase of perennial ryegrass, red clover, and lucerne within the Baseline rotation (wheat-barley-oilseed rape)—was the most conducive to increasing SOC stocks under both historical and future climates (24 and 19.5 t C/ha, respectively), followed by crop diversification via grain legumes. In most cases, regenerative practices that improved SOC gains relative to the Baseline had little impact on crop productivity. Reducing synthetic fertiliser use resulted in the lowest yields and SOC stocks.

We conclude that (1) left unabated, burgeoning global warming will constrain long-term performance of regenerative agrifood systems; (2) regenerative systems incorporating resilient components such as herbal leys and crop diversity offer greater potential to enhance SOC while sustaining productivity; and (3) regenerative interventions primarily influence SOC in the soil surface (0–30 cm) with negligible impacts on deep SOC stocks (30–100 cm). Our findings indicate that regenerative practices alone cannot offset climate change and must be supported by additional interventions, including new technologies, dietary changes, and policy innovations.

Plenary talks from TUKFS 1

Submitting Author: Miss Fleur ter Ellen

Email: f.terellen@erasmusmc.nl

Department and Institution: Visiting student, Mandala Consortium, Erasmus MC, the Netherlands.

TUKFS Investment: Mandala

All Authors: Fleur ter Ellen, Kelly Parsons, Martin White, Alexia Sawyer.

Title

Unpacking the development and implementation of the Birmingham food system strategy: a ripple effect mapping study

Abstract

Background: Many cities worldwide have adopted food strategies to transform urban food systems, yet little is known about how those involved perceive their impacts in practice. Birmingham's 2022–2030 Food System Strategy (FSS) aims to create a "sustainable, healthy, and thriving" food system. Coordinated by the Council's Food System (FS) Team, the strategy applies a whole-systems approach developed through collaboration with local stakeholders. This study explored the perceived impacts of the strategy and identified key mechanisms that have enabled progress so far.

Methods: We employed Ripple Effect Mapping (REM), a participatory qualitative evaluation method that captures perceived intended and unintended impacts. Data were collected through five separate REM sessions: three with six FS Team members and two with a group of eight stakeholders actively involved in the strategy's delivery. Impacts were mapped along a timeline from the FS Team's establishment onwards. The impacts were grouped into impact pathways (chains of events and impacts), and thematically analysed to identify clusters of impacts and enabling mechanisms.

Results: From the stakeholder perspective, 17 impact pathways were identified, grouped into two clusters: 1) How co-production shaped an inclusive FSS, drawing on existing stakeholder networks, 2) How FSS funding and support enabled aligned stakeholder-led action and a broader movement in a context of funding precarity. From the FS Team perspective, 26 pathways were grouped into four clusters: 1) How the FS Team established their role and drove collaboration across the food system, 2) How the FSS funding enabled aligned stakeholder action, but created dependency risks, 3) How procurement became a systemic lever, 4) How the FS Team navigated emotional strain and institutional barriers

Conclusions: Using REM allowed us to identify perceived impacts, enabling mechanisms, and important strategic processes that are difficult to capture with traditional evaluation methods. Inclusive co-production and dedicated coordination by the FS Team strengthened the legitimacy and collective ownership of the FSS, while REM also revealed unintended effects, including emotional strain due to the Team's bridging role. Our findings highlight the importance of trust-based relationships for sustaining food system strategies, and demonstrate the value of REM for capturing ongoing processes, outcomes and impacts.

Symposium 1.1

Submitting Author: Emma Frew

Email: e.frew@bham.ac.uk

Department and Institution: Health Economics Unit, University of Birmingham

TUKFS Investment: Mandala

Chair: Hannah Brinsden, The Food Foundation

Discussant: Myles Bremner, Bremner & Co

Title

Expanding free school meal provision in England: economic evidence, auto-enrolment, and implementation for scalable, equitable policy reform

Overall symposium outline

Background: Access to nutritious school meals is increasingly recognised as a key lever for improving children's health, reducing food insecurity, and supporting educational attainment. In England, rising levels of household food insecurity and widening dietary inequalities have intensified calls to expand Free School Meal (FSM) provision. However, the evidence needed to inform such policy reform spans multiple domains: economic evaluation to guide investment decisions, administrative and operational mechanisms to increase equitable uptake, and implementation research to understand real-world feasibility. This symposium brings together new evidence that can support national decision-making on the future of school meal policy in England. The three papers have been selected to provide a coherent and policy-relevant narrative on the expansion of Free School Meals in England:

Paper 1, a cost-benefit analysis (CBA), quantifies the long-term economic returns of expanding school meal provision under different policy scenarios.

Paper 2 examines auto-enrolment mechanisms to increase uptake among eligible children. The auto-enrolment evidence illustrates how policy designs can maximise reach and reduce administrative barriers.

Paper 3, a qualitative implementation study, explores the practical challenges and enablers of scaling school meal expansion across England's complex school food system.

Together, the three papers form a coherent evidence base that progresses logically from assessing which policies are most effective and cost-beneficial, to examining how eligible children can be reliably identified and enrolled, to exploring how these policies can be implemented sustainably and at scale. The symposium therefore provides a comprehensive examination of the future of school meal expansion in England, offering both strategic economic insights and practical, system-level recommendations.

Symposium 1.1 paper 1

Authors: [Bisola Osifowora](#), Viktorija Kesaite, Amy Yau, Irina Pokhilenko, Rachel Loopstra, Steven Cummins, Martin White, Emma Frew

Department and Institution: Health Economics Unit, University of Birmingham

TUKFS Investment: Mandala

Title

Using cost-benefit analysis to estimate the economic value of a complex intervention: expanding provision of primary school meals in England

Abstract

Background: Complex health interventions often involve costs and benefits that span multiple sectors. School meals are one such intervention: they can improve access to nutritious food, reduce food insecurity, improve health and educational outcomes, and reduce long-term healthcare costs. This study uses a cost-benefit analysis (CBA) to estimate the costs and benefits of expanding school meal provision in primary schools across England and to illustrate how uncertainty can be assessed when comparing policy options.

Methods: Taking a societal perspective, we compared six new policy options – two wider expansion and four targeted policies – with the current policy (as of June 2025) over a 20-year period. Return on investment (ROI) was calculated, considering programme and implementation costs, household food expenditure, school meal uptake, health outcomes and educational

outcomes. We estimated net present value (NPV) and benefit–cost ratios (BCR) for each option and applied a probabilistic sensitivity analysis (PSA) to explore uncertainty in key parameters and its implications for decision-making.

Results: The CBA found that a national subsidised scheme delivered the highest ROI, with an NPV of £2.0 billion and BCR of 1.29. For this scheme, household cost savings and lifetime productivity gains accounted for 54% and 43% of total benefits respectively. The PSA showed that schemes which scaled up school meal provision generated both larger expected net benefits and greater certainty of achieving a positive ROI compared with more narrowly targeted policies.

Conclusion: This study demonstrates how CBA can be used to evaluate complex interventions such as the expansion of primary school meal provision in England. For decision-makers prioritising scale and impact, wider expansion options appear to provide the greatest overall return. The findings offer important economic evidence on how school food policies can support the wider determinants of population health.

Symposium 1.1 paper 2

All Authors: [Bryant M](#), Mahdi S, Padgett L, Oxley R, Bremner M, Goudie S, Doherty B

Department and Institution: Hull York Medical School and the Department of Health Sciences, University of York

TUKFS Investment: FixOurFood

Title

Auto-enrolment of free school meals

Abstract

Introduction: Means tested free schools meals (FSM) provides a social safety net to approximately 25% of English children. Not only do they provide a daily hot meal, they also bring in funding to schools; predominantly via Pupil Premium. Recent policy announcements to extend the entitlement criteria to include all children on Universal Credit mean that many more children will be able to claim FSM from September 2026. However, there is still a requirement for families to submit a claim for this benefit. Estimates suggest that 11% of families do not apply for many reasons. In partnership with Bremner & Co, and the Food Foundation, the FixOurFood team have delivered action oriented research to support local authorities to apply on behalf of families. This presentation will deliver the key findings of this work.

Methods: We worked with LAs to develop a toolkit of resources to support the set-up and delivery of auto-enrolment of FSM. Data were captured on its implementation and impact (n=49 interviews, 3 repeated surveys (n=85 LAs), documentary analysis (n=142 documents) and direct data sharing (n=15 LAs))

Results: Although data continue to be collected to capture on-going impact, analysis in August 2025 indicated that an additional 35 local authorities implemented FSM auto-enrolment at least once since the start of the project (with a further 20 in set-up). This led to an extra 22,597 children having access to FSM and additional pupil premium funding totalling £27,019,250. The process was challenging for local authorities (mainly due to governance and data sharing barriers), but highly acceptable to schools and parents (1.3% of parents opted out). An implementation cost analysis is ongoing.

Conclusion: This project has generated (and continues to generate) substantial impact, as well as supporting policy making conversations at local and national levels. It has been highlighted in a number of eminent reports and is being used to support decision making around the wider implementation strategy for means tested FSM.

Symposium 1.1 paper 3

All Authors: Catrin Jones, Bisola Osifowora, Viktorija Kesaite, Irina Pokhilenko, Steven Cummins, Rachel Loopstra, Alexia Sawyer, Amy Yau, Martin White, [Emma Frew](#)

Department and Institution: Health Economics Unit, University of Birmingham

TUKFS Investment: Mandala

Title

Policy options to increase the provision of free school meals (FSMs) in England: a qualitative exploration of policy implementation challenges through stakeholder

Abstract

Background: Rising household food insecurity in England, and its impact on children's health and wellbeing, has led to calls to expand access to free school meals (FSMs). However, policymakers have been hesitant to extend provision due to concerns about acceptability, affordability and implementation challenges. The most effective and feasible strategies for expanding FSMs are not yet fully understood. This study explores school meal policy from the perspective of multiple stakeholders to identify key

implementation challenges and develop actionable recommendations to support policies that could expand school meal provision.

Methods: We conducted a qualitative interview study in England, United Kingdom. Seventeen stakeholders were recruited to represent local, regional and national government, policy, academia and schools. Data were analysed using the Framework Method, underpinned by the Context and Implementation of Complex Interventions (CICI) framework. Themes were categorised into context-related and implementation-related factors, and detailed recommendations were developed at macro, meso and micro levels of the school food system.

Results: Stakeholders emphasised that policies to expand FSMs should prioritise stigma reduction and be integrated with existing school policies wherever possible. Key recommendations included aligning expansion with robust monitoring of school food standards, ensuring the maintenance of food quality, improving administrative processes and enhancing communication with families. Participants also called for a more joined-up approach that links interventions with common goals across the wider food system, to support coherence and sustainability of school food policies.

Conclusions: These findings highlight specific system-level changes that could improve the acceptability and feasibility of expansion and help ensure that school meal policies effectively address food insecurity and support children's health. This qualitative work complements the economic evidence by identifying the conditions needed for implementation at scale.

Symposium 1.2

Submitting Author: Clare Pettinger

Email: clare.pettinger@plymouth.ac.uk

Department and Institution: University of Plymouth, Faculty of Health (School of Health Professions)

TUKFS Investment: FoodSEqual

Name of Chair: Tracey Dunscombe

Name of Discussant: Rebecca Wells

Title

Enhancing TUKFS programme level impact via three collaborative 'Synergy projects' – a critical discussion of process and outcome

Overall symposium outline

The TUKFS programme offered several Synergy funding opportunities, which aimed to support cross-project activities to add value to the funded portfolio and encourage partnerships with related investments. One of the key drivers of these Synergy projects was to encourage engagement across food system stakeholders to inform policy and practice actions and/or develop programme-wide tools for use by researchers, policy makers and practitioners. This symposium will focus on the three Synergy projects funded in the final year of TUKFS. Each of these projects took a cross-project collaborative approach, using evidence from across the TUKFS programme to build intelligence, knowledge and learning to bolster research capacity and drive programme level impact. Three papers:

1. Interdisciplinary working in food systems research: lessons from the TUKFS programme. This project explored the TUKFS programme requirement to take an interdisciplinary 'food systems' approach, working across the natural and social sciences.
2. BRIDGE ACT project - a real-world mapping tool for applied learning and impact analysis. This project has developed digital and physical resources to aid researchers in navigating food system complexities and optimise impact pathways.
3. TUKFS 'co-production toolkit' – maximising its reach beyond academics, to project beneficiaries and policymakers. This two-part project co-created a 'co-production toolkit' featuring good practice case studies from across the TUKFS programme. The toolkit was sense-checked with project collaborators, including policy advocates. Finally, it drew on community focussed research to illustrate the more 'hidden' (challenging) aspects of this research approach.

Symposium 1.2 paper 1

Department and Institution: University of Sheffield (Institute for sustainable food); University of Cambridge (MRC Epidemiology Unit)

TUKFS Investment: H3 and Mandala

All Authors: [Peter Jackson](#), [Kelly Parsons](#), [Rebecca Wells](#), [Isabel Fletcher](#), [Davi Lemos](#)

Title

Interdisciplinary working in food systems research: lessons from the TUKFS programme.

Abstract

Background: This presentation explores the TUKFS requirement for projects to take an interdisciplinary 'food systems' approach, working across the natural and social sciences. While interdisciplinarity is widely advocated, the views of researchers engaged in such work are rarely reported. This presentation aims to capture programme participants' views, with recommendations for future interdisciplinary research.

Methods: The research was based on an online survey, completed by TUKFS researchers, and a workshop to follow up on the survey results and formulate recommendations.

Results: Distinguishing between multi-, inter- and trans-disciplinary research, the presentation reports the views of programme participants regarding their experience of working across disciplinary boundaries. Positive views included the production of richer analyses, novel outputs and more socially relevant research. Negative experiences of interdisciplinarity's 'dark side' included the hidden labour involved in interdisciplinary working, potential career penalties and unacknowledged power relations. While there was overwhelming agreement that some degree of interdisciplinarity is necessary for effective food systems research, numerous limitations were reported. These include well-rehearsed challenges around communication and shared language; the need for additional time and resources; and the under-valuing of project managers and professional service staff who shoulder much of the responsibility for brokering between researchers from different disciplinary backgrounds. Our findings also suggest that skills training

should focus on the attributes required for effective collaboration (often disparaged as ‘soft’ skills) as well as the academic skills required for successful interdisciplinary research.

Conclusions: The research demonstrates that interdisciplinary working requires early relationship building; the development of a common framework; strong leadership and project management; setting clear goals, agreed ground rules and transparent expectations. The research also highlights the need for training in interdisciplinary working for researchers at all career stages (not just PhD students and ECRs). Our recommendations are directed at research funders, HEIs and all involved in undertaking interdisciplinary research.

Symposium 1.2 paper 2

Department and Institution: University of Aberdeen (Rowett Institute of Nutrition and Health)

TUKFS Investment: FIOFoods

All Authors: [Marta Lonnie](#), Emma Hunter, Hanna Didcock, Manik Puranik, Victoria Norton, Bramble Gardiner, Jessica Bosseaux, Ferne Edwards, Brenda Mogeni, Hannah Greatwood, Alexandra Johnstone

Title

Bridging theory and practice for actionable change in transforming food systems (BRIDGE-ACT)

Abstract

Introduction. The Transforming the UK Food System (TUKFS) Early Career Researchers (ECRs) created BRIDGE-ACT informed by their lived experience of entering food system (FS) research from diverse disciplinary backgrounds. BRIDGE-ACT addresses the need for practical tools to support interdisciplinary and cross-sector collaboration, specifically for place-based work with local authorities.

Aim. To bridge the gap between theory and practice of FS's, by providing interactive, place-based mapping tools that support strategic impact planning, stakeholder engagement, and systems thinking.

Methods. The development of BRIDGE-ACT applied an iterative, participatory methodology. The initial design was informed by the widely recognised "flower diagram" of the FS [1], adapted into a place-based mapping format. The toolkit consists of two main resources: the Impact Navigator, an online platform that visualises impact pathways, and the Impact Planner, a practical, printable resource that promotes stakeholder engagement and strategic impact planning.

Users. The toolkit was primarily designed for two user groups: i) local authorities, to support the development of evidence-based local community planning frameworks, and ii) ECR community, to assist in preparing innovative research proposals, reducing duplication and enabling a more effective use of research capacity. The project will conduct workshops with each target audience, to test prototypes through challenge-based learning, incorporating feedback to improve relevance and clarity.

Conclusions. The toolkit directly contributes to the TUKFS programme-wide impact on skills and capacity building in FS research [2]. By synthesising research, enhancing stakeholder engagement, and providing practical tools for impact planning, BRIDGE-ACT has fostered more effective cross-sector collaboration and evidence-based local policy development. Ultimately, BRIDGE-ACT is promoting a culture of inclusive, transdisciplinary research and accelerating progress towards a sustainable, equitable UK FS.

References: 1. Parsons, Hawkes, & Wells, R. (2019). 2. ICF. (2025) TUKFS Programme Interim Impact Evaluation Report.

Symposium 1.2 paper 3

Department and Institution: University of Plymouth, Faculty of Health (School of Health Professions)

TUKFS Investment: FoodSEqual

All Authors: Clare Pettinger, Charlotte Hardman, Rebecca Wells, Ulrike Ehgartner, Lisa Morgans, Neil Boyle, Naomi Shaw, Lisa Howard, Hannah Mumby

Title

TUKFS 'co-production toolkit' – maximising its reach beyond academics, to project beneficiaries and policymakers

Abstract

Background: “Co producing research” is a key strategic aim of the TUKFS research programme. This two-part Synergy project created a 'co-production toolkit' featuring good practice case studies from across TUKFS projects. This presentation will share insights into the project, its processes and outcomes to support how creative co-production approaches can successfully disseminate key TUKFS programme findings and learnings tailored to the needs of diverse stakeholders.

Methods: participatory approaches including creative workshops, critical conversations, arts-based methods and policy workshop. N=39 food system stakeholders participated, and the project team collaborated with a creative illustrator for visually accessible outputs. The toolkit includes voices from diverse project beneficiaries, including policy advocates, project collaborators, partners and academics. A publication has enabled critique of this complex area of practice. Ongoing reflexivity on the 'hidden' (challenging) aspects of co-production in community-facing food systems research is emerging.

Results: Findings highlighted areas of 'messiness' and complexity, challenges associated with applying co-production approaches and practical solutions. Four key principles were identified: (1) Relationships: developing and maintaining reciprocity-based partnerships; (2) Knowledge: recognising the contribution of diverse forms of expertise; (3) Power: considering power dynamics and addressing imbalances; and (4) Inclusivity: ensuring research is accessible to all who wish to participate. Reflection and reflexivity are considered crucial across all these areas. This presentation will illustrate further emerging recommendations that relate to how the toolkit can be optimised for wider accessibility, including policy makers. The toolkit itself will be showcased alongside its new navigational video.

Conclusions: Findings contribute important insights towards a shared conceptual understanding of 'co-production' for food system transformation research. This presentation will make recommendations for researchers, practitioners, academic institutions and funders working in this area of research and practice.

Symposium 1.3

Submitting Author: Alice Kininmonth

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Department and Institution: School of Food Science and Nutrition, University of Leeds

TUKFS Investment: FIO-FOOD, Food insecurity in people living with obesity – improving sustainable and healthier food choices in the retail food environment & DIO-Food – Diet and health inequalities.

Chair: Michelle Morris

Title

From research to impact: Using real-world supermarket transaction data to provide insights for policy and practice in the FIO Food and DIO Food projects.

Abstract

Background: Supermarket transaction data can offer valuable insights into complex problems, from obesity and dietary inequalities to the climate impacts of diets. However, these data are not research ready and utilising them to generate credible, actionable evidence requires substantial upfront investment, including establishing trusted partnerships, protocols to protect scientific independence, secure data infrastructures, and rigorous data preparation informed by subject-matter expertise. Despite these complexities, when these elements align, the resulting insights can meaningfully inform policy and practice. This session showcases work using supermarket transaction data from the Transforming UK Food Systems FIO Food and DIO Food projects. Across five talks and a panel discussion, we will present: i) how industry-academic partnerships were established to enable access to commercially sensitive data while protecting academic independence; ii) retail-sector perspectives on the feasibility and acceptability of interventions to support healthier, sustainable food purchasing, including implementation and evaluation challenges and opportunities, iii) how supermarket transaction data has been used to evaluate a public health policy and examine the interplay

between environmental sustainability and health; and iv) cross-collaboration learnings on translating evidence into actionable insights.

Symposium 1.3 Paper 1

Department and Institution of presenting author: School of Food Science and Nutrition, University of Leeds

TUKFS Investment: FIO-FOOD, Food Insecurity in people living with obesity – improving sustainable and healthier food choices in the retail food environment

Authors: Jenneson VL, Stone, RA, Ennis E, Naisbitt R, Lomax N, Morris M

Title

Learnings from working with industry partners – the Academic-Industry Partnership “AIP” framework.

Abstract

In the DIO-Food project, Asda, Morrisons, Sainsburys and Tesco came together in a unique collaboration to share sales data with the University of Leeds for research into the impact of the High Fat Sugar and Salt (HFSS) product placement restrictions in England. To our knowledge, this is the first time competitor retailers have shared data for the same academic project for policy insights.

This collaboration was made possible by a longstanding reputation for academic-industry data sharing projects in domains of health, sustainability and retail planning. In 2021, the Leeds Institute for Data Analytics (LIDA) announced a strategic partnership with Sainsbury’s Plc, which was followed by further retailer partnerships.

Here we report qualitative findings from interviews with ten participants from both sides of the Sainsburys-LIDA strategic partnership, conducted to identify the key elements that have contributed to its success. Insights were thematically summarised into the Academic Industry data sharing Partnership framework (the AIP), a preliminary framework of partnership building with commercial data sharing, comprising of 1) a Research Infrastructure Foundation; 2) The Data Sharing process; 3) The Research Process; and 4) The Partnership Strategy.

We reflect on how the AIP framework enabled cross-retailer collaboration in the DIO-Food project, whilst maintaining academic independence, with the aim of supporting others to unlock the value of commercial data for societal gain.

Symposium 1.3 Paper 2

Department and Institution of presenting author: Institute of Population Health, University of Liverpool.

TUKFS Investment: FIO-FOOD, Food Insecurity in People Living With Obesity – Improving Sustainable and Healthier Food Choices in the Retail FOOD Environment

Authors: Hardman CA, Stone RA, Brown A, Douglas F, Greatwood H, Griffiths C, Hunter E, Johnstone A, Lonnie M, Morris M, Skeggs H

Title

The retailer perspective on implementing and evaluating interventions to support healthy sustainable food purchasing: challenges and opportunities.

Abstract

Background: There is an urgent need to increase purchasing of healthy sustainable foods in retail settings, and interventions based on lowering prices may be most acceptable to customers. However, the retailer perspective on implementing and evaluating the impacts of these interventions is under-researched. This study explored the perspectives, views, and experiences of major UK supermarkets on the acceptability and feasibility of implementing and evaluating affordability interventions for healthy sustainable food purchasing.

Methods: This pre-registered qualitative study conducted semi-structured interviews with seven senior supermarket nutritionists who represented 85% of the UK grocery market share. Data were analysed using reflective thematic analysis.

Results: All respondents reported that their business is strongly committed to supporting health and sustainability. However, there were multiple challenges associated with implementing affordability interventions (e.g. profitability concerns, unpredictability of intervention outcomes). Supermarkets took different approaches to evaluation, but all respondents expressed willingness to collaborate with academics and other retailers.

Conclusions: Affordability interventions to support healthy sustainable food purchasing require supermarkets to navigate multiple challenges. Further exploration of collaboration opportunities across the retail sector could produce valuable insights to supporting future policy and practice.

Symposium 1.3 Paper 3

Department and Institution of presenting author: School of Food Science and Nutrition, University of Leeds

TUKFS Investment: FIO-FOOD, Food Insecurity in people living with obesity – improving sustainable and healthier food choices in the retail food environment

Authors: Wilkins E, Green M, Gilthorpe M S, Johnstone A, Morris M

Title

FIO food - Using supermarket transaction data to estimate environmental sustainability footprints of food and drink purchases, and their interplay with health, demographics and food and drink cost.

Abstract

Research into the environmental sustainability of foods and diets, and how these covary with healthiness, cost and demographics is limited. Supermarket transaction data offers a valuable objective alternative to traditional dietary data for research.

We linked >160 million de-identified transactions from customers in Yorkshire and the Humber in 2022 from a major UK supermarket to environmental footprint (EF) data using a novel method and describe how the sustainability of food purchases varies across product categories, cost, High in Fat Salt and Sugar (HFSS) status, and neighbourhood demographics. EF (per kg and total from sales) were estimated for each product from published data on mean greenhouse gas emissions (GHGE), land use, and water use.

Analyses showed that beef, cheese, milk, ready-meals and chocolate had the highest sales-weighted EF. Products classified as non-HFSS and low-impact were >3x cheaper on average than HFSS, high-impact products, but there was considerable variability in the cost per kg of products within these groups. Products ranking favourably for environmental impact, HFSS, and cost included fruits, vegetables, bread, potatoes, pasta and mineral water. Households in more deprived areas purchased foods with a higher impact per kg, but households in the least deprived areas had higher sales-weighted footprints.

This work provides evidence to guide impactful and equitable interventions promoting healthier and more sustainable purchasing.

Symposium 1.3 Paper 4

Department and Institution: School of Food Science and Nutrition, University of Leeds

TUKFS Investment: DIO-FOOD, Diet and health inequalities (Sister project of FIO Food)

Authors: Kininmonth AR, Jenneson VL, Wilkins E, Chukwu I, Eselebor O, Pontin F, Naisbitt R, Johnstone A, Fildes A, Morris M

Title

DIO Food – Using supermarket transaction data to evaluate the impact of the high in fat, sugar and salt (HFSS) legislation on purchases of HFSS products and whether the legislation was equitable.

Abstract

In October 2022, legislation in England restricted retailer placement of high in fat, sugar, and salt (HFSS) products in prominent locations in-store and online. This study evaluates the impacts of the legislation, and whether impacts were equitable. Interrupted time series analyses, using daily store-level sales data from up-to-18-months pre- and 12-months post-legislation across 480 stores from three retailers in England were conducted. Results revealed 0.63 percentage-point (95% CI: -1.24, -0.51) reduction in in-store sales of in-scope HFSS products by weight and a 1.19 percentage-point (95% CI: -1.61, -0.77) reduction by unit volume, following the introduction of the legislation. Subgroup analysis indicated equal impact across different neighbourhood types. Findings demonstrate that legislation restricting promotion of less healthy foods drives reductions in sales of in-scope HFSS products. Further legislation is needed to promote healthier food environments contributing to achieving the magnitude of change necessary to reverse obesity trends and improve population health.

Symposium 1.3 Paper 5

Organisation: Institute of Grocery Distribution

Speaker: Hannah Skeggs

Non-academic perspective talk: From research to action – cross-collaboration learnings.

Abstract

In this talk, Hannah Skeggs (Senior Health & Sustainable Diets Manager at IGD) will reflect on cross-collaboration learnings from the Transforming UK Food Systems DIO-FOOD and FIO-FOOD projects and her wider cross-sector partnerships. In her role at IGD, Hannah works at the intersection of research, policy and industry, convening food retailers, manufacturers, academics and

polymakers to translate scientific evidence into practical and scalable action to support healthier and more sustainable diets. A central focus of this talk will be the innovative use of supermarket transaction data to explore the impacts of health legislation on food and drink purchasing patterns. Hannah will share insights from her contribution to the first independent evaluation of the impacts of HFSS legislation on purchasing of high fat, salt and sugar products, led by the University of Leeds in collaboration with IGD, Asda, Morrisons, Sainsbury's and Tesco. The presentation will explore what it takes to move from complex research evidence to actionable insights for policy and practice, and how study findings can be amplified to reach new audiences and drive future impact.

Symposium 1.4

Submitting Author: Pippa Chapman

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Department and Institution: School of Geography, University of Leeds

TUKFS Investment: FixourFood

Chair: Pippa Chapman

Discussant: Lynn Dicks

Title

Environmental and socio-economic outcomes of transitioning to regenerative agriculture

Overall symposium outline

Background – Regenerative agriculture seeks to produce food while improving soil health, supporting biodiversity, and enhancing climate resilience. However, evidence on its environmental and socio-economic outcomes remains limited, especially for whole-farm scale transitions. The H3 and FixOurFood, two TUKFS research projects, have worked in partnership with farmer and at different scales to fill this research gap.

Papers – In this symposium, we will present our findings from the H3 and FixourFood projects. The H3 project assessed the transition from conventional to regenerative farming through a landscape-scale experiment, co designed with commercial farmers across two UK regions. The FixourFood project co-designed and established a replicated large-plot trial to demonstrate and measure the effects of stacking regenerative agriculture principles on environmental and socio-economic outcomes.

In the first paper, we outline the impact of stacking regenerative principles on soil health, hydrology, soil biodiversity, crop health and yield from five regenerative farming systems in comparison to a conventional farming system during a drought year and highlight some of the challenges as well as the benefits of transitioning to regenerative agriculture.

In the second paper, we present a scoring system developed by the H3 project to evaluate the outcomes of regenerative agriculture on soil, biodiversity, yields, and crop health.

In the third paper, we present findings from interviews with farmers outlining barriers and opportunities they perceive about transitioning to regenerative agriculture and we present some preliminary economic data and the role of agri-environment schemes.

Through these three papers we cover both the environmental and socio-economic outcomes of transitioning to regenerative agriculture and highlight some of the benefits, opportunities and trade-offs.

Symposium 1.4 paper 1

Department and Institution: Schools of Biology & Geography, University of Leeds

TUKFS Investment: FixourFood

Authors: [Kellie Smith](#), Ruth Wade, Martin Gilpin, Holly Armitage, Lisa Collins, Bob Doherty, Pippa Chapman

Title

Measuring effects of stacking regenerative agriculture principles on environmental and socio-economic outcomes: Results from a drought year.

Abstract

Conventional agriculture uses intensive, short-term practices that aim to maximize crop yield but lead to soil degradation, nutrient loss, and a decline in beneficial soil organisms. Regenerative agriculture shifts the focus toward long-term restoration by reducing soil erosion and compaction, limiting harmful chemical use, and building soil quality while maintaining crop yield. As part of the FixourFood project, we have established a replicated large-plot trial that stacks regenerative principles (minimising soil disturbance, keeping the soil covered, increasing crop diversity, integrating livestock, maintaining a year-round living root). The trial now in its fourth year, uses cutting-edge methods to analyse soil physical, chemical, and biological properties, measures continuous greenhouse gas emissions, and assesses plant quality, pest and disease presence and crop yields across five regenerative agriculture farming systems and a conventional system within the same farm context. Here we present the challenges of intercropping beans and oats during the drought of 2025. We found that water scarcity created competition between beans and oats and reduced bean yields in the regenerative agriculture farming systems compared to the conventional bean monocrop system. Many aspects of plant development were stunted in the regenerative agriculture systems including reduced leaf and pod densities compared to conventional. So far, the results from the trial highlight the importance of crop and climate context. Three years is

relatively early in the transition to regenerative agriculture, but there is a strong demand for long-term trial data to monitor agricultural improvements and this trial is providing useful data for researchers, farmers and policy makers.

Symposium 1.4 paper 2

Department and Institution: Department of Zoology, University of Cambridge

TUKFS Investment: H3

Authors: Katherine Berthon, Coline Jaworski, Jonathan Beacham, Peter Jackson, Jonathan Leake, Niamh McHugh, Lucy Capstick, Tim Daniell, Yu Zhao, Penelope Watt, and Lynn Dicks

Title

The H3 Project: results of a four-year quasi-experiment measuring outcomes of regenerative agriculture transitions in England

Abstract

Regenerative agriculture seeks to produce food while improving soil health, supporting biodiversity, reducing inputs, and enhancing climate resilience. However, evidence on its environmental and socio-economic impacts remains limited, especially for whole-farm scale transitions. The H3 project assessed the transition from conventional to regenerative farming through a landscape-scale experiment, co-designed with commercial farmers across two UK regions. As practices vary by farm, we developed a scoring system to evaluate impacts on soil health (water-stable macroaggregates, earthworms), biodiversity (birds, insects), yields, and crop health. Our findings show that higher regenerative scores correspond with improved soil health, decreased fertilizer and fuel use, and greater bird and spider diversity. However, benefits are not universal: pollinators, beetle abundances, crop health and herbicide use do not change with increasing regenerative scores, and yields were sometimes lower depending on crop type. Outcomes also varied across landscapes and soil types, emphasizing the need for more context specific information.

Symposium 1.4 paper 3

Department and Institution: Department of Geography, University of Sheffield & Schools of Biology & Geography, University of Leeds

TUKFS Investment: H3 and FixourFood

Authors: Peter Jackson, Jonathan Beacham, Katherine Berthon, Anne Blenkinsopp, Lynn Dicks, Kristian Rogers, Pippa Chapman, Ruth Wade

Title

Farmer perspectives on the transition to regenerative agriculture: barriers, opportunities and economic dimensions

Abstract

Regenerative agriculture is a loosely defined term which covers a range of practices that seek to improve the environmental sustainability of the contemporary farmed landscape with an emphasis on restoring soil health. This paper (i) seeks to understand the evolving interest in regenerative agriculture among two groups of farmers in the East and South-West of England who were interviewed in 2022 and 2025 and (ii) presents some preliminary economic data and discusses the role of agri-environment schemes. Our analysis focuses on the different temporalities that are associated with the introduction of regenerative agriculture, as expressed by our interviewees which fall both within and beyond their control. These included: the long timeframes that are required to judge the impact of introducing regenerative practices (on yield, profitability, soil health and biodiversity); the different speeds at which innovations can be introduced, the rates at which these take effect (and the challenges of changing tack once initial investments have been made); generational differences in attitudes towards regenerative agriculture (and the likely impact of proposed changes to inheritance tax on farm land and assets); the impact of seasonal variations and the unpredictable impact of changes in climate and weather on these new practices; the short termism and volatility of government policy (compared to the farmers' desire and need for stability and long-term strategy); the temporal horizons involved in managing risk; and variations in how farmers see the future. This temporality is also reflected in practice implementation data collected during the project timeframe. While the paper is primarily empirical – reporting farmers' views in their own words – we draw on relevant theoretical ideas from E.P. Thompson and Henri Lefebvre to help understand the significance of different views of time and temporality in our interview material.

Symposium 1.5

Submitting Author: Owen Nicholas

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Department and Institution: Department of Statistical Science, University College London

TUKFS Investment: Mandala

Chair: Carol Wagstaff

Discussant: Jag Srai

Title

Drivers, impact, variation, and redistribution of food donations, surplus and waste: Insights to balance conflicting aims in the UK food system

Overall symposium outline

Wasted food occurs along the whole supply chain - from consumers to retailers and growers. It is in part driven by inefficiencies in aligning uncertain production, uncertain demand and uncertain consumption, particularly for perishable products, and leads to financial loss and environmental impact. On the other hand, donated and surplus food can feed those unable to afford or access it in the first place, albeit with less reliability and less dignity. This symposium brings together qualitative and quantitative research addressing food waste, donation and surplus through surveys, modelling, and analysis of the UK food system, identifying and quantifying levers to shift inefficiencies and inequities.

The papers address critical aspects of waste, donation and redistribution with clear policy relevance. Yau et al. et al. quantify household-level waste and demographic patterns, informing targeted interventions such as age-specific campaigns based on implications for financial and environmental cost. Nicholas highlights how retailer stocking decisions under demand uncertainty drive surplus, suggesting policies on retailer density and incentives for improved demand forecasting to balance availability and waste reduction. Chadwick et al. et al. articulate variability in redistribution supply chains, pointing to the need for coordinated planning, infrastructure investment, and hybrid push-pull models to stabilise food aid provision. Together, they cover the supply chain applying a range of methods to identify and estimate the effect of levers for change.

Symposium 1.5 paper 1

Department and Institution: Population Health Innovation Lab, The London School of Tropical Hygiene and Medicine

TUKFS Investment: Mandala

Authors: [Amy Yau](#), Sophie Hedges, Thomas Ball, Andrew Balmford, Lynn V. Dicks, Paul Adeosun, Lin Fu, Viktorija Kesaite, Kelly Parsons, Alexia Sawyer, Martin White, Steven Cummins, Owen Nicholas

Title

Household spend on wasted food and environmental impact of food waste across household types: a cross-sectional analysis of data from an English consumer panel

Abstract

Background: Food waste accounts for 6-7% of greenhouse gas emissions annually, provides no nutritional benefit and costs households to purchase. Despite reducing household food waste being a priority for emissions reduction, relatively little is known about its impact in the UK. This study aimed to quantify the impact of household food waste on households and the environment. We also explore whether wastage varied by household characteristics.

Methods: We surveyed consumer panel participants residing in England (July 2024; n=840), who estimated their wastage of six food groups (milk, cheese, red meat, white meat and fish, bread, and vegetables) and reported weekly household food and drink purchases. Combining survey responses and purchase records, we estimated annual food waste for each household and the associated cost to the household and environmental impacts (carbon emissions, biodiversity loss and water use). Adjusted logistic regression models examined associations between household characteristics and outcome measures.

Results: Households spent a median of £44.09 annually on wasted food across the six food groups. Median annual household vegetable wastage was 5.8 kg (LQ 1.7, UQ 22.5) and had the highest water use (130.9 L [LQ 19.2, UQ 920.6]) of the six studied food groups. Milk had the highest carbon emissions (13.7 kg of CO₂ [LQ 4.8, UQ 41.7]). White meat and fish had the greatest impact on biodiversity (9.4x10⁻¹¹ expected extinctions [LQ 1.7x10⁻¹¹, UQ 5.6x10⁻¹⁰]). Multi-adult households were less likely to waste red meat than single-adult households (OR 0.16, 95% CI 0.03-0.84 for 3 adults vs 1 adult). Shoppers ≥70 years (vs <40 years) had lower odds of bread waste (OR 0.56, 95% CI 0.32-0.97). Ethnic minority (vs white British) households were less likely to waste bread (OR

0.65, 95% CI 0.44-0.95). Households with ≥ 2 children (vs no children) were more likely to waste milk (OR 1.94, 95% 1.15-3.26), white meat and fish (OR 1.83, 95% CI 1.05-3.18) and vegetables (OR 2.05, 95% CI 1.25-3.38).

Conclusions: The impacts of household food waste differed by household composition, age and ethnicity. Support from manufacturers and retailers (e.g. selling items loose, ensuring that pricing does not encourage over-purchasing and removing 'use-by' dates) may be needed to reduce household food waste.

Symposium 1.5 paper 2

Department and Institution: Department of Statistical Science, University College London

TUKFS Investment: Mandala

Authors: Owen Nicholas on behalf of the Mandala Consortium

Title

The reliability of unsold fresh food as a source for redistribution: A case study by simulation comparing retail outlets by size and inventory level using data from British supermarkets

Abstract

Background: To assess the day-to-day reliability of food provision via redistribution, we would ideally know both the amount, and day-to-day variation, of surplus food from contributing retail outlets. While amount may be reported, variation is rarely discussed.

Methods: A key driver of surplus is uncertainty about actual demand from customers at an outlet over the food's shelf-life. Another driver is the daily level of availability, "inventory", the outlet starts with. Using recommendations on the chance an outlet runs out of inventory, and surplus food figures, we calibrated a gamma distribution for daily demand at an outlet serving 1,150 households (a typical size for a supermarket) for items with 1-day shelf-life, using analytical methods, and Markov chain Monte Carlo methods for items with 2 and 3-day shelf-lives. The calibration matches average surplus and inventory, giving daily variation in the amount of surplus. We adapted the distribution for sensitivity analyses, and scenarios comparing outlet size and inventory level.

Results: We report estimates and confidence intervals for a range of inventory and outlet size scenarios, some given in the Table below. Variability in surplus has standard deviation between 1.3 and 2.2 times the mean in the scenarios. It would take more than 170 contributing outlets to reduce the standard deviation of their total contribution to within 10% of the mean. Also, surplus is reduced to less than half when inventory is 90% compared with 95%.

Conclusions: For short shelf-life food we estimated demand variability at an outlet and consequent surplus variability, and how surplus variability depends on inventory level and outlet size. Estimates need adjusting for spoilage and other factors to inform redistribution planning, and we ignored correlated demand for foods, but this work makes predictions which are testable.

Unavailable to us, retail chains have extensive data on demand variability from sales and loyalty programs on which to base their decisions, balancing the costs of surplus (leading to waste and financial loss); and lower inventory (causing missed sales and dissatisfied customers) which can lead customers to less healthy alternative choices. This work fills a gap by estimating demand variability from limited, but available, data.

Table: Surplus mean and coefficient of variation (CoV = standard deviation divided by mean, a smaller value indicates a more reliable source) over 1 day for fresh food with (i) 1 day shelf-life, and (ii) 5% mean surplus when calibrated to an outlet of size 1,150 and inventory level 95% (meaning 5% of demand is not met on average). Confidence interval in brackets. Similar estimates hold for food of 2 and 3-day shelf lives.

Inventory	Surplus	Number of households served by retailer	
		1,150	1,265 = 1.1X 1,150
95%	Mean (%)	5.00,	4.57 (4.56 to 4.58),
	CoV	1.39 (1.32 to 1.46)	1.43 (1.35 to 1.50)
90%	Mean (%)	2.27 (2.03 to 2.47),	2.00 (1.79 to 2.18),
	CoV	2.12 (2.12 to 2.14)	2.21 (2.21 to 2.22)

Symposium 1.5 paper 3

Department and Institution: The School of Management, Cranfield University

TUKFS Investment: FoodSEqual

Authors: Martin Chadwick, Philip Hadley, Emmanuel Sawyerr, Bob Doherty, Carol Wagstaff, Michael Bourlakis

Title

Managing fluctuations in UK fresh produce redistribution

Abstract

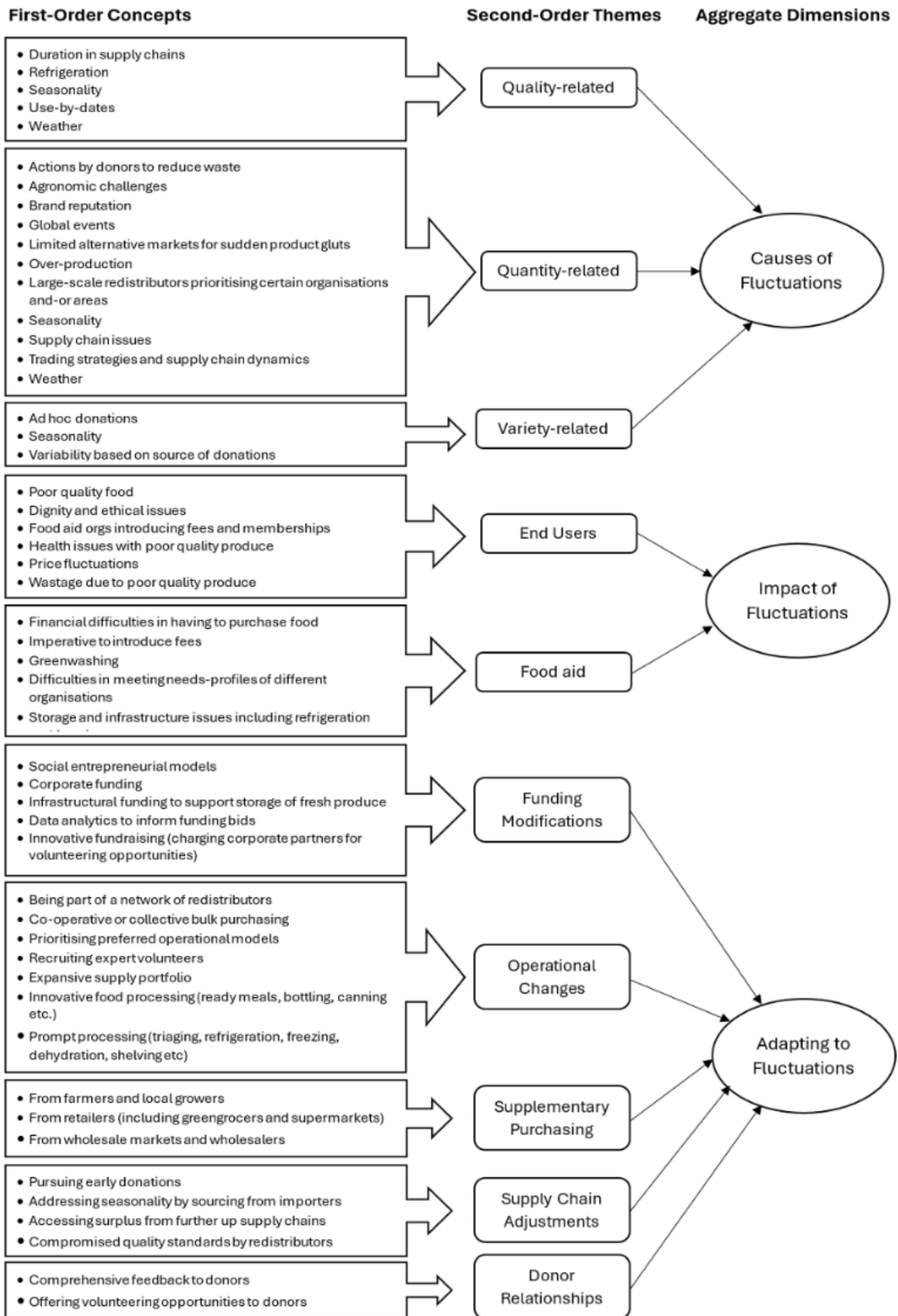
Background to the study: The supply of fresh produce into food redistribution sector is variable. This creates many challenges for citizens reliant on food aid distribution as a core part of how they obtain their food. The purpose of this work is to understand why the flow of fresh produce into the food aid redistribution is so variable and identify areas that could enable better forward planning to secure the redistribution of supply.

Methods: A qualitative research design addressed these issues by undertaking fourteen semi-structured interviews with food aid distributors, retailers, wholesalers and growers. Three researchers also interviewed representatives from organisations involved in policy and practice-support related to this sector. The study followed an inductive coding approach, it systematised a three-level coding methodology and a thematic analysis regarding fluctuations in the supply of fresh produce (Figure 1).

Results: Interviewees noted that unpredictability of season, extreme events, floods and droughts create fluctuations and highlighted changes to the organisational structure of the food aid supply chain. Fluctuations create a strain on variety and larger distributors adapt to fluctuations. Volume of supply was not considered the primary concern, but rather the variety of what is available, as lacking key food groups leads to increased financial pressures to maintain a nutritionally balanced diet. Organisations use prompt processing (triaging, refrigeration, freezing, dehydration, shelving etc), innovative processing, co-operative or collective bulk purchasing to address supply variability. Redistributors cope with supply variability by diversifying supply base to include importers. Retailers and producers adapt to fluctuations by developing relations with food aid organisations.

Conclusions: In the “push” supply chain system, products are produced in anticipation of customer demand and pushed through the supply chain. For “pull” systems, consumer demand is the driver for production to meet that known demand. We reveal a mix of two systems, a hybrid “push-pull” supply chain system whereby donors supply types of food regardless of demand, while demand tries to “pull” needed supply. Meeting the specific needs of consumers is not a priority and food redistribution organisations investing additional resources is untenable.

Figure 1: Representative Data Structure



Individual papers 2.1

Submitting Author: Leona Lindberg

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Department and Institution: School of Biological Sciences, Queen's University Belfast

TUKFS Investment: Sus-Health – Sustainable and Healthy Diets for All

All Authors: Lindberg L, Brereton P, Hutchinson G, Livingstone D, Thomas EL, Cheng S, Grigoriadis V, Nugent AP, Woodside JV, Smyth B, Vlajic J, Fu R, Collins O, Areal F, Frewer LJ

Title

The development and testing of the Sus-Health Index: A combined score which assesses and presents the nutritional content and environmental impact of a meal

Abstract

Background: Changes in dietary patterns are essential to reduce diet-related environmental impacts whilst contributing to good health. The aim of the Sus-Health project was to 1) co-create an index that describes both the nutritive value and environmental impact of meals in one combined index and 2) to test the impact of that index on influencing consumer food choices.

Methods: The EnviroScore and Nutrient Profiling Model (NPM) are used to calculate the environmental impact and nutritive value of a meal. The scores are then combined using the composite indicator methodology and a 1:1 weighting. The index can be presented quantitatively or qualitatively on a scale of A (best score) - E (worst score). The index was applied and tested using a framed field experiment methodology in a commercial restaurant in Belfast city centre. Purposive sampling was employed to recruit students above 18 years old and with no food allergies. Three treatments were used: 1) Menu 1- baseline menu with meal descriptions 2) Menu 2- menu with meal descriptions and corresponding Sus-Health scores 3) Menu 3- menu with meal descriptions, corresponding Sus-Health scores and price adjustments (20% off) for meals with A-B scores. Participants made their meal selection for each menu and the menu served was selected at random. Data were analysed using Cochran's Q test and a post-hoc analysis was performed using pairwise McNemar's tests with a Bonferroni correction applied. Statistical significance was set at the 95% confidence level ($P < 0.05$).

Results: The Sus-Health index was applied to 7 meals. One meal scored an A, two meals scored a B, two meals scored a C and one meal scored a D. A total of 111 students completed the study. The proportion of A-B meals selected across the three menu cards was significantly different ($P < 0.001$) with an increased proportion of participants selecting A-B meals in menu 2 (64%) and menu 3 (77%) compared to menu 1 (50%).

Conclusions: The Sus-Health index was successful at influencing consumer meal choices within this restaurant setting, however, a combination of the Sus-Health index and price adjustments to reflect better Sus-Health scores, was more successful at influencing consumer meal choices within this income-constraint group. Further research on the impact of the Sus-Health index on consumer meal choices across different contexts and among different demographic groups is ongoing to better understand the effectiveness of this combined index at influencing consumer food choices towards healthier and more sustainable options.

Individual papers 2.1

Submitting Author: Amy Yau

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Department and Institution: Department of Public Health, Environments & Society, London School of Hygiene & Tropical Medicine

TUKFS Investment: Mandala

All Authors: Yau A, Hedges S, Parsons K, Smith R, White M, Cummins S

Title

Overlap between healthiness, environmental impact and cost: a cross-sectional analysis of food and drink purchases made by an English consumer panel

Abstract

Background: Changing diets to contain healthier and more environmentally sustainable foods and drinks has human and planetary health co-benefits. However, the price of such items is a potential barrier to achieving this. Identifying and encouraging the purchase of healthier and more sustainable items that are relatively low-cost is therefore an important goal. This study identifies the extent to which households purchase healthier, more sustainable and relatively low-cost items, and how this varies by household characteristics.

Methods: This study used consumer panel data on n=4,806,136 food and drink purchases (n=86,087 unique items) made by 2,122 households (June 2023 to August 2025). We categorised individual purchases by healthiness (whether the purchase was high in fat, salt and sugar [HFSS]; UK Nutrient Profiling Model), environmental impact (carbon emissions [kg of CO₂], biodiversity loss [expected extinctions] and water use [litres]) and cost (£/calorie). Purchases were deemed healthy, sustainable and low-cost if non-HFSS and below the median for environmental impacts and cost per calorie. Adjusted logistic regression models examined the association between the proportion of spend used to purchase such items and household characteristics (sex, age, social class, number of adults, number of children, ethnicity).

Results: Healthy, sustainable and low-cost items represented 2.6% (n=125,550) of total purchases and 2.0% (n=1,752) of unique items purchased, whilst healthy, sustainable and high-cost items accounted for 8.4% (n=405,550) of total purchases and 7.5% (n=6,493) of unique items purchased. Higher proportional spend on healthy, sustainable and low-cost items was observed for younger shoppers (OR 2.16, 95% CI 1.49-3.13 for <40 years vs ≥70 years), households in the middle social class group (OR 1.35, 95% CI 1.02-1.79 vs the highest social class group), households with ≥2 children (OR 1.39, 95% CI 1.04-1.87 vs no children), and white British households (OR 1.32, 95% CI 1.05-1.67 vs ethnic minority households). No differences were observed by sex or number of adults.

Conclusions: Households purchased very few items that were considered healthy, sustainable and low-cost. To support households in the shift to purchasing these items, we need policies that ensure people have access to a range of affordable options.

Individual papers 2.1

Submitting Author: Lynn Frewer

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Department and Institution: School of Natural and Environmental Sciences, Newcastle University

TUKFS Investment: Sus-Health – Sustainable and Healthy Diets for All

All Authors: [Frewer LJ](#), Fu R, Collins O, Higgins K, Karbo RT, Clark B, Sari NH, Raley M, Jin A, Areal F, Thomas EL, Vlajic J, Smyth B, Livingstone D, Lindberg L, Hutchinson G, Thompson A, Woodside J, Nugent AP, Brereton P

Title

Consumer attitudes towards a combined nutrition and sustainability label developed from initial modelling and stakeholder coproduction of label design

Abstract

Background: To transform our food system, consumer demand and preferences must support increased production and availability of sustainable and nutritious foods. This research aimed to understand consumer attitudes towards a combined nutrition and sustainability label developed from initial modelling and stakeholder coproduction of label design (Grigordoris et al, 2025).

Methods: Exploratory research (focus groups: n=5) and interviews; n=20) (Collins et al, 2025) informed the design of a UK scale survey (n=1,970). This assessed attitudes towards health and the environment, food choices, and included a discrete choice task.

Results: The combined index was appreciated by participants but transparency regarding how scores were calculated was needed if labels are to be trusted and understood. UK consumers significantly prioritised health over environmental information in relation to food choices. Combined health and environmental labelling amplified the impact of both, although this effect varies across food categories (Fu et al, submitted). Latent class analysis identified four consumer 1). Environmental and health scores considered simultaneously (and were tax sensitive) 2). Health prioritised over environmental scores (subsidy sensitive) 3). Price. 4). Food quality.

Conclusions: Consumers value the ability to assess nutrition and the environmental impact of foods and meals, while exhibiting price sensitivity. Interventions that directly impact the final price are likely to influence purchasing decisions. An asymmetry was observed whereby taxes exert a significantly negative effect on most consumer choices, while subsidies appear to have less impact. As 59.4% of the participants' food choices were positively affected by both scores, and 13.3% (health-driven consumers) were positively influenced by the health score, combined labelling represents useful strategy to facilitate healthy and sustainable food consumption. The UK Food Data Transparency Partnership on food data could consider integrating combined health and environmental sustainability labels into existing UK packaging regulations. The production of sustainable and nutritious foods and adoption of new labels may lead to increased costs, and ensuring affordability is important to the negative impact of higher prices on consumer choice.

Individual papers 2.1

Submitting Author: Michelle Thomas

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Department and Institution: Division of Food and Nutritional Sciences

TUKFS Investment: FoodSEqual

All Authors: Thomas M, Fisher D, Methven L, Wagstaff C

Title

Grocery purchasing and dietary patterning amongst households in the UK across social-economic- classifications: Secondary data analysis using WorldPanel by Numerator and National Diet and Nutrition Survey (NDNS) data sets.

Abstract

Background: A socio-economic gradient in diet exists, a factor in health inequalities within society. Grocery purchasing and dietary data provide insight into disparities between socio-economic classifications (S.E.C). However, underreporting plus low representation of people from a lower S.E.C in national datasets can mask realities at a neighbourhood level. We investigated trends in food purchasing and consumption across the S.E.C in the UK to identify disparities in spend and consumption of foods for which there are implications for health. We present the result of this analysis which informed subsequent research in neighbourhoods of high deprivation exploring food lives and aspirations for diet.

Methods: Secondary data analysis of household-level shopping basket data from WorldPanel by Numerator (WP) (Great Britain, Take Home Panel, 4 w/e 01January 2018-27 December 2020) and dietary data for adults ≥ 19 years ($n = 2756$) (NDNS rolling programme, years 2016-2019) was undertaken. Key foods/food groups were selected based on differences in total spend, total grams and proportion of the population consuming each food. WP data are reported as the mean weighted spend per 4-weeks. Estimated daily intakes (g) are presented as medians with 25th and 75th percentiles (Table 1). Descriptive statistics are reported for percent difference in spend and the proportion of the population eating key foods. Differences in estimated daily intakes (g) were analysed using Kruskal Wallis with Bonferroni Adj post hoc test.

Results: Table 1 presents the results for key food spend and total grams consumed: Higher professionals (HP) spent the most on fruit, and vegetables and lower working-class (LWC) the least, (a 36.8% and 39.0% difference, respectively). The proportion consuming fruit decreased as S.E.C decreased (HP, 89.6% vs LWC, 72.0%). Nearly all ate vegetables ranging from 99.8% (HP) to 97.9% (LWC) although differences existed in the total grams consumed ($p \leq 0.001$). Lower professionals spent the least and LWC the most on white bread (13.2% difference). The proportion consuming white bread increased as S.E.C decreased (HP, 72.2% vs LWC, 78.4%).

Conclusions: Combining purchasing with dietary data provides insights into national level patterns, aiding in identifying population groups at risk of poor diet. National data can provide a basis for local level research, for engaging residents and supporting the co-development of interventions meeting the dietary needs of residents.

Table 1, Weighted average spends on key food groups per 4-week period from January 2018 - December 2020 and average per day median dietary intakes amongst adults 19 years and over between 2016 and 2019

Foods/Food Group	Higher S.E.C															Lower S.E.C										P value (g)
	Higher Professional (AB)					Lower Professional (C1)					Intermediate (C2)					Higher working Class (D)					Lower working class (E)					
	£	(SD)	g	25	75	(£)	(SD)	(g)	25	75	(£)	(SD)	(g)	25	75	(£)	(SD)	(g)	25	75	(£)	(SD)	(g)	25	75	
White Bread	4.27	(0.18)	24.0 ^a	0.0	61.1	4.19	(0.14)	27.5 ^{ab}	0.0	58.3	4.74	(0.17)	31.9 ^c	0	65	4.46	(0.17)	43.8 ^b	0.0	83.5	4.78	(0.12)	33.0 ^{bc}	9.7	77.0	<.001
Fruit	21.16	(2.29)	116.6 ^b	42.3	178.9	17.48	(1.85)	90.0 ^{bc}	30.0	172.5	17.02	(1.67)	84.9 ^c	22.5	165.9	15.37	(1.37)	50.0 ^a	0.0	128.0	14.59	(1.49)	62.5 ^b	0.0	122.2	<.001
Vegetables	27.44	(2.36)	187.0 ^c	124.8	278.3	23.24	(1.63)	192.8 ^c	109.3	291.8	22.18	(1.50)	161.2 ^b	97.1	246.3	19.67	(1.09)	126.6 ^b	72.6	202.9	18.49	(0.81)	126.9 ^b	67.5	207.0	<.001

Weighted values

National Diet and Nutrition Survey Higher professionals; $n = 579$, Lower professionals $n = 740$, Intermediate $n = 559$, Higher working-class $n = 512$, Lower working-class $n = 366$

Total grams (g) includes consumers and non-consumers

Different letters denote significant difference between the socio-economic classifications

Individual papers 2.2

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TUKFS Investment: Social Enterprise as a Catalyst for Sustainable and Healthy Local Food Systems

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Title

Open innovation for transforming food systems: Social enterprise as a catalyst for bottom-up collaborative social innovation

Abstract

Background: This paper explores alternative visions of food systems innovation as collaborative processes for societal benefit. It draws on the experience of social enterprises (SEs) as pathways to “open social innovation” in collaborative, inclusive, sustainable and healthy local food systems. We challenge the idea of innovation as monodisciplinary, laboratory or technology-based change linked to business control of intellectual property for maximising profit. Research question: How do social enterprises catalyse and scale open social innovation for food system transformation?

Methods: This paper addresses these issues by taking a qualitative approach, drawing on the experiences of 6 social enterprises (29 in depth interviews in total). Qualitative analysis used an abductive approach with coding systems drawing from the literature review and informed by the emerging findings.

Results: Enterprises demonstrated ‘bottom up’ ways of engaging people in innovative activity:

- Addressing food poverty and basic needs

- Behaviour change about healthy diets and nutrition

- Therapeutic services and social prescribing using gardening/growing, cookery classes etc

- Community cafes and catering - bringing people together socially as well as generating income

- Sustainable, local and organic growing

The open social innovation approaches were found to be based on different approaches to encouraging participation and inclusive decision-making. (Participatory forums/events, user co-production groups, Staff Councils and informal engagement). They bring together different stakeholders in interdisciplinary and transdisciplinary approaches.

Conclusion: Open social innovation for food system transformation requires adapting methods of engagement, bringing in new diverse collaborators and community involvement to have everyday understandings of sustainability and dietary health. The bottom-up approaches avoid being overly didactic and proselytising and in contrast to overly ‘top-down’ campaigns which can be perceived as patronising and stigmatising. This study is limited by its selection of only 6 in depth cases. Further research could extend this study to look at food social innovations in a wider range of social enterprises and the longitudinal changes. Implications are drawn for building range of capabilities that enterprises require for open social innovation.

Individual papers 2.2

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TUKFS Investment: PhD funded by the Vice Chancellor Scholarship at the University of Greenwich

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Title

Unequal resilience in UK-connected food systems: power, shock propagation, and the politics of food system adaptation

Abstract

UK food systems are increasingly shaped by climate extremes, geopolitical instability, and energy and price volatility. While these disruptions are often framed as temporary “shocks” requiring technical fixes, they reveal deeper structural vulnerabilities embedded within highly concentrated, globally connected, and import-dependent supply chains. Rather than treating disruption as an anomaly, this research approaches it as a diagnostic lens to explore how power and risk are organised within contemporary food systems. It asks: when disruption occurs, who absorbs the cost, and what does that mean for equitable food system transformation? Drawing on 29 semi-structured interviews with agri-food actors across production stages, processing, trade, logistics, and retail, many directly connected to UK supply chains, this study examines how shocks propagate across interconnected nodes. Using a relational framework, it traces how events such as extreme weather, fertiliser shortages, and trade restrictions cascade through both physical and market pathways, reallocating costs, reshaping contractual relations, and reconfiguring decision-making power across space. The findings show that resilience is unevenly distributed. Downstream actors often draw on buffering mechanisms, contractual flexibility, and institutional leverage, while upstream producers and input-dependent sectors face prolonged exposure to volatility and rising costs. These asymmetries highlight how adaptive responses can stabilise food availability while simultaneously intensifying financial, environmental, and labour pressures elsewhere in the system, raising questions about what counts as “successful” adaptation. For UK food system transformation, this issue raises critical questions. Efforts to build resilience cannot focus solely on efficiency, substitution, or behavioural change. Instead, transformation must address structural power relations, risk allocation, and the political economy of adaptation. By highlighting inequalities and the pathways through which shocks propagate, this research contributes to debates on UK food system resilience and just transitions, moving beyond reactive crisis management toward more relational, place-sensitive, and equity-oriented approaches to food system transformation.

Individual papers 2.2

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Title

How transformative governance for food system transformation can be co-created with local actors

Abstract

Transforming complex systems requires governance approaches capable of enabling systemic reconfiguration rather than incremental improvement. Yet empirical understanding of how such governance can be designed and enacted in practice remains limited. This paper presents action-research conducted in North Yorkshire's food system through a collaboration between the FixOurFood programme and North Yorkshire Council, examining how transformative governance can be co-created with local actors. Working with stakeholders from local government, community organisations, food producers, education, and public health, the study explored existing governance experiences, identified shifts needed for systemic change, and collaboratively designed a governance model tailored to the region. The resulting model centres on transformative values—ambition, reflexivity, inclusion and shared endeavour—supported by decision-making processes that integrate diverse knowledge, distribute authority, enhance systemic awareness and enable collaborative experimentation. These are reinforced through enabling conditions such as self-organising clusters, reciprocal relationships and ongoing reflexive evaluation. The model was operationalised during a multi-stakeholder action-planning event that applied co-designed transformative criteria to prioritise 'Key to Change' actions and establish mechanisms for distributed agency, cross-domain coordination and continuous adaptation. The study contributes an empirically grounded approach for designing and implementing transformative governance within place-based partnerships, offering practical insights for regions seeking to translate systemic ambitions into collective action.

Individual papers 2.2

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TUKFS Investment: Realigning UK Food Production and Trade for Transition to Healthy and Sustainable Diets

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Title

Regulatory tools for a healthy and sustainable diet: the case of command-and-control regulation, tariffs, and economic instruments.

Abstract

Background: The transition to healthy and sustainable diets (HSD) in the UK requires substantial transformation across the food system, encompassing production, trade, environmental sustainability, and public health. Despite growing policy recognition of these challenges, the UK regulatory framework continues to rely predominantly on voluntary and informational measures (e.g., food labelling) which have delivered limited systemic change and signify a gap in knowledge re more interventionist regulatory tools for reform across agrifood supply chains.

This presentation addresses that gap by examining the role of command-and-control regulation, tariffs, and economic instruments in realigning UK food production and trade to support HSDs and assess the impact of a shift towards mandatory regulatory approaches.

Methods: This presentation is based on the TUKFS WP3 report, Regulatory Tools for a HSD, developed as part of the project (TUKFS Realigning UK Food Production and Trade for Transition to HSDs). It adopts a doctrinal and policy-based legal analysis to examine the range of regulatory instruments available within UK law and policy.

Results: The analysis demonstrates that mandatory command-and-control regulation has significant potential to drive structural change across agrifood supply chains, particularly when compared with voluntary approaches. Economic instruments are shown to be effective mechanisms for internalising environmental and health externalities and reshaping incentives for producers, processors, and retailers. The findings further highlight the role of tariffs and other trade-related instruments in aligning imported food products with domestic sustainability and health objectives, reducing regulatory leakage, and supporting a level playing field for UK producers. Together, these tools offer a more coherent and impactful regulatory strategy.

Conclusions: A decisive shift towards mandatory command-based and economic regulatory measures is essential to achieve systemic change in the UK food system. Integrating domestic regulation with trade policy is critical to ensuring that the transition to HSDs is both effective and equitable. It demonstrates the limitations of voluntary regulatory approaches and articulates the need for a more robust legal and policy framework for food system transformation., as well as highlighting key limitations (e.g., UK-specific analysis; further empirical evaluation of long-term impacts).

Individual papers 2.3

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TUKFS Investment: Mandala

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Title

Evaluation of Birmingham City Council's grant programmes for food aid organisations during the cost-of-living crisis, 2022-2024.

Abstract

Background: Use of food aid has risen in the UK over the cost-of-living crisis. Food aid organisations were concerned they would not have sufficient food supplies to meet rising demand. Government funding for the cost-of-living crisis was used by local councils to support food aid organisations. This study evaluated the impacts of funding provided by Birmingham City Council (BCC), which gave £5000 to individual food aid projects for the purchase of food and other essentials in Winter 2022-23 and 2023-24.

Methods: This mixed methods study involved interviews with 23 organisations in receipt of BCC funding and a pre-post survey of 79 organisations over 2023 to 2024. Framework analysis was used to capture reported outputs and short- and long-term outcomes, as well as unintended outcomes. A pre-post analysis examined whether the proportion of organisations reporting difficulty meeting demands for their services changed with funding.

Results: Preliminary analyses from qualitative interviews suggested a variety of priorities for organisations, including boosting the nutritional content of food provision; ensuring a good supply of long-life staples; and catering to meet cultural food needs. Short-term outcomes were food project clients receiving better quality, quantity and variety of foods, but few long-term outcomes were reported. Unintended consequences included raising clients' expectations of what would be provided in the longer term.

Quantitative findings indicated lower odds of organisations having insufficient food supplies (OR: 0.43 (95%CI: 0.21 to 0.91) and of organisations turning people away without food (OR: 0.43 (95%CI: 0.21 to 0.89) during the funded period compared to baseline.

Conclusions: Funding had an immediate impact on the food supplies food aid organisations were able to provide, but limited impacts beyond the funding period. Local councils need to be better supported to effectively invest in interventions that will reduce food insecurity in the longer-term.

Individual papers 2.3

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TUKFS Investment: FoodSEqual

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Title

Neighbourhood food stories: a qualitative secondary analysis across 5 years of FoodSEqual data identifying food practices in a community facing financial constraints, contextual influences and participant proposals for change

Abstract

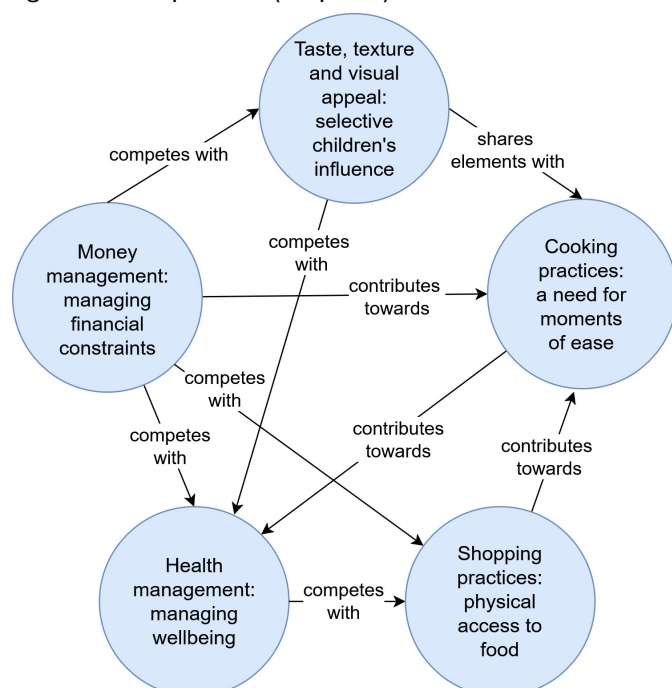
Background: Diet inequalities are one of many social determinants of health disproportionately affecting low-income communities. FoodSEqual worked across four such communities from 2021-2025, aiming to co-produce changes to reduce food system inequality. Most outputs had specific purposes (e.g. food products) and used specific parts of the data. We look across the rich lived/living experiences captured in one FoodSEqual location (Whitley, Reading) to investigate everyday food practices and contextual influences. Following participatory values, we also explore participant's proposals for change.

Methods: Our qualitative content analysis used NVivo and an a priori approach to identify 'nexus practices' which sit at the intersection of many others. Our secondary analysis included outputs from multiple FoodSEqual studies: 3 sets of interviews (n=171), 3 questionnaires (n=130), 10+ workshops (n=86), and feedback on findings (n=32). All participants lived in or were connected to Whitley. As all co-authors were involved in the primary study, there was little need to re-contextualise the data. However, FoodSEqual's strong focus on food products is a potential source of bias.

Results: The most connected nexus practice was 'managing financial constraints' (figure 1, below), affirming cost as a big influence in food practices. We observe broader impacts, such as choosing long-life foods to avoid waste and navigate financial instability. Participants proposed upstream and 'sideways' interventions like improving conditions for workers and routes to work alongside targeted cash or voucher assistance. The next most connected practice was 'a need for moments of ease'. This alternative to 'convenience' aims to catalyse novel interventions. The third most connected was 'selective children influencing household foods', and 'managing wellbeing' had the most competing connections. We found broader wellbeing needs sometimes prioritised over nutrition. Both matter. Experiences and impacts of income-related stigma were evident, impacting wellbeing, trust and participation. Community feedback emphasised physical access challenges, influenced by life circumstances and health.

Conclusions: Interventions must attend to bias and go beyond food to influence food practices including reducing financial constraints, identifying how to meet needs for wellbeing and ease, and addressing children's selective eating with family, community, and regulatory action.

Figure 1: Nexus practices (simplified)



Individual papers 2.3

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Title

Mapping the evidence on impacts of the redistribution of surplus food through the community food aid sector: a systematic scoping review

Abstract

Background: Surplus food redistribution is expanding globally, particularly in high-income countries, due to its perceived role in addressing food insecurity and reducing the environmental impacts of food waste. Although ongoing debates question the extent to which surplus food redistribution can alleviate food insecurity and raise concerns about stigma associated with these practices, redistribution efforts continue to grow. Reliance on surplus food and competition for it within the community food sector are also increasing. We conducted a systematic scoping review to identify and summarise the measured outcomes arising from the practice of distributing surplus food to the community food aid sector, the research methodologies and the main findings reported in included studies.

Methods: We followed the PRISMA framework extension for scoping reviews (PRISMA-ScR). We used Covidence software to facilitate the screening process and determine study inclusion using predefined criteria. To summarise the nature of evidence, we used descriptive statistics and a thematic framework to code the nature of outcomes. A total of 795 records were screened, with 116 records included for analysis.

Results: Included studies spanned a range of disciplines, including agribusiness, environmental science, economics, sociology, computer science, and human geography. The majority of studies were conducted in either the United States (31.0%), the United Kingdom (10.3%), or Australia (8.64%). Publications increased over time, with a notable rise from 2017 (10.3%) to 2023 (14.7%). Most studies included outcomes relating to impacts of surplus food redistribution on the community food sector (75.86%), followed by impacts on individuals accessing the community food sector (42.24%), the environment (16.38%), and businesses (12.93%). Reported outcomes included food availability and quality, social responsibility, environmental benefits, cost-savings, cost-effectiveness, and the efficiency of food waste redistribution.

Conclusion: This systematic scoping review demonstrates that the impacts of redistributing food to the community food aid sector has been examined from a range of angles. Drawing conclusions on the benefits or drawbacks of this practice should consider the range of stakeholders impacted as well as wider impacts on society and the environment.

Individual papers 2.3

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Title

Urinary and hair biomarkers as objective measures of dietary intake in disadvantaged UK communities

Abstract

Background: Health inequalities related to poor diet are more prevalent in disadvantaged communities. Traditional dietary assessment tools (FFQ, 24-hour recall) are limited by recall bias and underreporting. Biomarkers provide objective and quantifiable measures of nutrient intake. This study aimed to evaluate urinary and hair biomarkers as indicators of dietary intake, compare biomarker values with self-reported dietary information, and examine site-based dietary differences across four disadvantaged communities in the UK.

Methods: Urine samples were analysed for hippuric acid, hydroxy hippuric acids, sucrose (LC-MS), and sodium-to-potassium (Na/K) ratio (ICP-MS) as indicators of fruit and vegetable intake, sugar intake, and salt intake, respectively. Hair samples were analysed for stable isotope ratios ($\delta^{13}\text{C}$, $\delta^{15}\text{N}$, $\delta^{34}\text{S}$), using IR-MS to assess dietary protein sources. Biomarker values were compared across cohorts and interpreted alongside known sociodemographic and cultural dietary factors.

Results: Levels of 3-hydroxy hippuric acid showed no meaningful differences between sites, suggesting comparable fruit and vegetable intake across cohorts. Urinary sucrose concentrations were notably higher in Reading, indicating greater exposure to sugar-rich foods and beverages. The Tower Hamlets cohort had a higher Na/K ratio, consistent with diets containing more salted foods. Hair biomarker data will be presented at the conference.

Conclusion: Biomarkers offer objective and quantifiable insights into dietary intake, helping reveal nutritional patterns that may not be detectable through traditional assessment approaches. Clear site-specific differences reflected the influence of cultural practices and local food environments on dietary behaviour. However, the cross-sectional design, modest sample sizes, and reliance on single-spot urine and hair samples limit the ability to capture long-term intake. Despite these constraints, biomarker evidence provides a valuable foundation for designing targeted, equitable interventions to support healthier and more sustainable diets in disadvantaged communities.

Individual papers 2.4

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Title

Red clover as a novel source of protein for human consumption: processing methods and potential pitfalls

Abstract

Keywords: food production, red clover, alternative proteins, high moisture extrusion

Global demand for protein is increasing due to population growth and a shift toward plant-based diets driven by health, sustainability, and ethical concerns. The plant-based protein market is projected to reach \$162 billion by 2030, yet it is currently dominated by soy, whose import dependence raises environmental and food-security concerns for regions such as the UK. Green leaf biomass represents an underutilised but nutritionally rich alternative protein source. Red clover (RC), traditionally used as livestock forage, contains 15–30 % leaf protein (dry matter) with high levels of Rubisco and a complete essential amino acid profile. As a perennial crop suited to UK climates, RC could strengthen domestic protein production; however, high polyphenol oxidase (PPO) levels may negatively affect flavour, appearance, and digestibility.

This study compared three protein fractionation methods i.e., acid precipitation, heat treatment, and a combined approach, to determine optimal Rubisco yield and quality from RC. Protein quantity and functionality were evaluated using SDS-PAGE, DUMAS, in-vitro digestibility, amino acid profiling, and functional property tests. High-moisture extrusion and rheology were conducted on blends of RC crude protein with pea protein isolate (1:10) to assess effects on gelation and texture. Acid precipitation produced the highest crude protein yield, while heat treatment yielded the lowest, highlighting a trade-off between purity and recovery. Digestibility and amino acid profiles of green and chlorophyll-removed fractions were similar, indicating limited benefit of extensive fractionation. Functional testing showed differences in solubility, water/oil holding capacity, emulsification, and gel strength, which influenced extrusion texture. These findings suggest RC has potential as a sustainable, locally sourced protein, although further optimisation is required for food applications.

Individual papers 2.4

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Title

Variations in iron, zinc and selenium content of UK bread-making wheat flours: implications for nutrition security

Abstract

Background: Fe, Zn, and Se are essential trace elements supporting immune, cognitive, and metabolic functions. While overt deficiencies are rare in the UK, suboptimal intakes are common, especially in less diverse diets. As a dietary staple, wheat contributes substantially to micronutrient intake; however, its nutrient content varies depending on soil, genotype, climate, and processing. Understanding this variability is key to identifying nutrient gaps and informing interventions that strengthen nutrition security across food systems.

Methods: Concentrations (Fe, Zn, Se) in UK bread-making wheat flours were quantified using ICP-MS/OES. Samples were sourced from traditional mills (n = 44), independent mills (n = 41), supermarkets (n = 24), industrial mills (n = 41), and a field liming trial, accounting for extraction rate, wheat species/variety, and farming practices. Differences among flour types and sources were tested using ANOVA with post hoc comparisons. Contributions to adult female (19–49 years; n=3328) Reference Nutrient Intakes (RNI) were estimated using reference values and average flour and bread intake from the National Diet and Nutrition Survey (2008–2019).

Results: Wholemeal flours contained significantly higher Fe, Zn, and Se concentrations than white (p <0.001), contributing up to 18–30% (Fe), 20–45% (Se), and 15–35% (Zn) of the RNI per 100 g. Zn (p = 0.004) and Se (p <0.001), but not Fe (p = 0.956) varied across wholemeal sources. Fe concentrations were comparable between independent and supermarket flours (3.8 vs. 3.7 mg/100 g); Zn was highest in independent mills (3.2 mg/100 g) and Se in supermarket flours (0.011 mg/100 g). Agronomically enhanced flours provided 16–47% higher Zn than the retail sources. Based on average intake (~41 g/day), white bread contributed the highest absolute amounts of Fe, Zn, and Se. Supermarket flour contributed the highest Fe (5.3% RNI), independent mills the highest Zn (6.3% RNI), and industrial mills the highest Se (3.2% RNI). Reference composition values underestimated Fe by 30% and overestimated Zn and Se by 48% and 36%, respectively.

Conclusions: Micronutrient concentration varies markedly across flour sources, underscoring the need to update food composition data to reflect current agricultural practices. Interventions across wheat value chains must balance Fe, Zn, and Se delivery and be strategically aligned to support nutrition security amid changing climates and dietary patterns.

Individual papers 2.4

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TUKFS Investment: Healthy Soil, Healthy Food, Healthy People (H3)

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Title

Validating year-round leafy green production in the UK using low-input passive polytunnel hydroponics: a biological and economic assessment

Abstract

Background The UK food system faces challenges of reliance on climate-vulnerable imports and high energy costs of domestic high-tech Controlled Environment Agriculture (CEA). While providing food security, high-tech glasshouses are often cost-prohibitive. A critical gap exists regarding intermediate technologies: low-input systems balancing yield with sustainability. This study validates the biological potential and economic feasibility of low-tech, self-constructed Nutrient Film Technique (NFT) hydroponics in passive polytunnels for UK peri-urban production.

Methods Trials ran from Oct 2023 to Dec 2024 in South Yorkshire using three polytunnels retrofitted with bespoke NFT systems. Stratified *Lactuca sativa* cultivars (Cool, Warm, Universal) were cultivated sequentially. Growth kinetics were analysed using Generalized Linear Models to quantify effects of Growing Degree Days (GDD) and seasonality. Economic viability was modelled by simulating planting cycles optimised for either maximum yield or maximum profit. Financial assessment incorporated annual operational costs, fixed labour (one employee at £30k/year), and revenue based on direct-to-consumer (DTC) prices.

Results Biologically, systems supported year-round production; polytunnels increased daily mean temperatures by up to 4°C relative to ambient. Biomass accumulation followed a seasonal rise-and-fall trajectory driven by thermal time. Top-performing varieties such as 'Euler' achieved theoretical annual yields of 34.3 kg m⁻²—a 6-8 fold increase over field yields. Economically, modelling indicates specific varieties remain viable under a DTC model even with significant fixed labour costs. Maximum profit scheduling revealed that while winter production is biologically possible, low-light periods were uneconomical. This defines a viable growing season from Feb-Dec.

Conclusions Low-tech, passive NFT hydroponics offers a viable pathway for sustainable intensification. While winter light levels limit year-round production, this study demonstrates that co-locating systems with peri-urban enterprises (e.g. Our Cow Molly, Wentworth Castle Gardens) unlocks synergistic benefits. Leveraging short supply chains allows low-capital systems to achieve economic viability while providing local employment and public engagement. This model offers a scalable solution for peri-urban diversification, enhancing domestic food security without the intense energy footprint of conventional CEA.

Individual papers 2.4

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Title

Investigating how power dynamics shape UK meat and livestock reduction: a multi-stakeholder study

Abstract

Despite extensive scientific evidence that reducing emissions, land use, and antibiotic use from the meat and livestock system is essential, change within the sector remains insufficient. This raises questions about why this is the case, and who or what would be able to drive the necessary change. In a system comprising competing priorities, stakeholder agencies, and structures, this research investigates UK meat and livestock reduction through the lens of power, examining who or what holds it, how it operates, and how the perspectives that get included shape the system's outcomes. This forms three distinct research questions: who are the key stakeholders in the UK meat and livestock system and how should its boundaries be defined; how can the system be conceptualised through the lens of power; and through which mechanisms do power dynamics shape meat and livestock reduction.

While some food systems literature acknowledges multiple stakeholder types, there is limited direct engagement with diverse actors simultaneously to understand and compare barriers to change from their perspectives. Furthermore, the perspectives of particular stakeholder types appear to be limited. For example, slaughterhouse workers', livestock veterinarians', and NGOs' perspectives are rarely examined alongside more commonly studied stakeholders. This research addresses these gaps by engaging with a wider range of meat and livestock system actors, and doing so in the same study.

The research involved two rounds of data collection: interviews and focus groups with 24 food system researchers, followed by interviews with 35 practice-based stakeholders, including livestock farmers, supermarket executives, slaughterhouse workers, food manufacturers, policy advisors, lawyers, and NGOs. Each round was followed by thematic analysis.

Findings indicate that incorporating livestock animals and natural systems into power analysis explicitly adds explanatory value beyond human-centred approaches. The system is conceptualised using a framework highlighting its layered and interdependent features. The research also identifies distinct, parallel versions of the meat and livestock system that co-exist. Findings suggest that power dynamics make these systems appear unified while structurally pushing them apart, contributing to limited transparency, disjointed enforcement, and persistent inaction.

Individual papers 2.5

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Title

Co-creating pulse-based snacks: a UK innovation journey

Abstract

Background: Fava bean is a crop that is ideal for cultivation in the UK, it is rich in micro and macronutrients and a natural nitrogen fixer. Due to its properties, there is a potential of developing snacks with the inclusion of fava bean flour. This could also tackle the challenge of food security, which is more prominent among less affluent, culturally diverse communities across Southern England.

Methods: In our case, participatory action research with the Whitley community in Reading, indicated aspirations for snacks that were a healthier and more satiating alternative to potato crisps, with the same shelf-stable, taste and convenience attributes. As such, we focused on the bench scale development of pulse-based snacks, as a potential substitute, after assessing various processing technologies, such as baking, air frying, and extrusion, in order to create a range of textures. Snacks were analysed for texture, colour, moisture and water activity.

Results: After optimisation, we developed an extruded prototype containing fava bean, yellow pea, green pea and rice flour, which could hold protein, fibre and gluten free claims and responds to the product brief attributes.

Conclusions: This research demonstrated the feasibility of using fava bean flour in the development of savoury snacks, which aligns with community's aspirations towards food security, as well as filling a gap in the UK market. It also showcased our work focusing on food systems, utilising UK grown crops, while being interdisciplinary in nature with multiple food system stakeholders. Future work will try to optimise the pulses inclusion and processing method in savoury snacks based on physicochemical changes and sensory properties, as well as community's preferences. Further funding will also be pursued towards the snack's commercialisation.

Individual papers 2.5

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TUKFS Investment: Mandala

All

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Title

Co-designing institutional catering interventions for food system change: developing a menu reformulation approach in a UK children's hospital

Abstract

Background: Attempts to identify and deliver actions which catalyse food system change are widespread in public sector institutions serving food, like schools and hospitals. Potential interventions to improve health and environmental sustainability outcomes include reducing meat and increasing plant content on menus, but limited evidence exists on how to initiate, design and implement such menu changes, particularly in a hospital inpatient setting. This study describes and appraises a process of intervention identification and co-design in the novel setting of a city children's hospital.

Methods: A bespoke process was developed to elicit and combine scientific evidence with expert and stakeholder knowledge and experience, and co-design the menu reformulation intervention. Methods used were systems mapping, solution scanning, literature review, expert elicitation workshops and semi-structured interviews.

Findings: Potential interventions and delivery partners were identified by developing an institutional catering sector system map, together with stakeholder engagement via embedded networks. Solution scanning and criteria application provided a shortlist of eligible interventions, from which menu reformulation was selected by children's hospital stakeholders, including the catering provider and hospital management. Inputs into intervention co-design included a review of menu interventions and a workshop on plant-rich school food. Qualitative interviews with key delivery stakeholders and regular knowledge exchange meetings provided context-specific data on the setting, captured in an intervention-specific causal loop diagram (CLD). The CLD provides a visual map of intervention inputs, constraints and potential moderating influences, and expected outcomes.

Conclusion: The study provides insights into barriers and enablers of transforming institutional catering in a paediatric setting, and a replicable process for intervention identification and co-design with wide applicability. Strengths of the approach include fostering of strong collaborative relationships between researchers and delivery partners, and deep understanding of a novel intervention and setting. There are potential limitations around applicability to other institution types. The intervention is presently being evaluated over an 18-month period.

Individual papers 2.5

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TUKFS Investment: FoodSEqual

All Authors: Hunt L, Pettinger C, Howard L, Gardiner B, Beggs J, Dunn L, and Hart J.

Title

Doing participatory data analysis: learnings from FoodSEqual Plymouth, a community-based participatory research project.

Abstract

Participatory research methods are advocated to redistribute power within the research process and foster engagement and local support for action. Community based participatory research often attempts to involve the community in the whole research process, yet this is frequently restricted to only some areas, such as data collection, with engagement in data analysis less common. Research identifying optimal participatory data analysis (PDA) methods enabling engagement has been called for.

This case study explores how PDA methods were developed in the FoodSEqual Plymouth team of Community Food Researchers (CFRs) (n=6), Community Practitioners (n=1), and academics (n=3). It explains how practice developed over three years via four PDA sessions, barriers and facilitators to this development, and the acceptability of PDA methods to the team. The following activities were treated as research methods in their own right; initial and ongoing training (two initial CFR training sessions and a subsequent team training session); critical reflection (during team meetings and individually by the Community Co-ordinator and Research Fellow); a team Group Level Assessment session (n=9 participants). A practice development timeline is presented alongside themes arising from basic thematic analysis undertaken during Group Level Assessment.

Iterative use of critical reflection with initial and ongoing training helped address practical and epistemological issues and facilitate practice development; managing time within PDA sessions was crucial, in particular, ensuring adequate time for 'making sense of' the data as this was when differing perspectives emerged; adequate facilitation was needed to ensure all voices were heard and power shared; in concert with creative methods (i.e., drawing), PDA methods could enable involvement of participants with varying literacy levels and facilitate community dissemination.

PDA methods can be acceptable, enable varying positions to be heard, help shift power from academics to community partners, and make community dissemination of findings easier. Linking practice to theory, this account of practice development in action may be useful to others doing similar work. The need for adequate time and resource is acknowledged, yet we suggest PDA methods can be effective, and hence relevant to research, policy and practice.

Individual papers 2.5

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UK Food Systems Centre for Doctoral Training (UKFS-CDT)

TUKFS Investment: TUKFS Centre for Doctoral Training (CDT)

All Authors: [Gizem Acar](#), Rachael Frost, Sukvinder Kaur Bhamra, Michael Heinrich

Title

Nutrition at the Frontline: A Systems Approach to Enhancing Public Health through Pharmacy Practice

Abstract

Unhealthy diets and nutrition-related non-communicable diseases remain a major public health challenge in the UK, underscoring the need for accessible, preventative nutrition support within primary care. Community pharmacies are highly accessible healthcare settings with an expanding clinical remit; however, structured nutrition care is not routinely embedded in practice. This doctoral research adopted a mixed-methods, systems-based approach to examine current nutrition provision in community pharmacies and to develop a feasible, practice-oriented Nutrition Toolkit for Pharmacy Practice.

The thesis comprises six interrelated studies. A scoping review mapped community pharmacy-delivered nutrition and diet-related health promotion interventions, identifying evidence gaps and implementation barriers. A national mixed-methods survey of pharmacy professionals (n=220) examined nutrition knowledge, attitudes and practices across obesity, diabetes, cardiovascular disease, malnutrition, micronutrient deficiencies and sustainable diets. Higher perceived nutrition knowledge was significantly associated with the provision of nutrition advice, while qualitative findings identified barriers, including limited training, time constraints, and a lack of clear practice guidance and referral pathways.

Interviews with pharmacists, dietitians, and nutritionists (n = 19) explored professional roles, interdisciplinary working, and requirements for feasible nutrition support in pharmacy settings. Focus groups with pharmacy users (n = 27) examined lived experiences and expectations of pharmacy-based nutrition advice, emphasising accessibility, trust, cultural sensitivity and practical guidance. Findings informed co-design workshops with pharmacy and nutrition professionals (n=16), where toolkit content was collaboratively developed and prioritised using feasibility and importance ranking.

The principal outcome is an evidence-based Nutrition Toolkit for Pharmacy Practice, supporting brief, patient-centred nutrition care by providing stepwise guidance for nutrition assessment, communication and signposting, alongside curated educational resources aligned with national public health guidance. By translating research into a practical resource, this thesis provides an applied contribution to public health nutrition and primary care, demonstrating how community pharmacies can strengthen their role in prevention, interdisciplinary working and population health improvement.

Plenary talks from TUKFS 2

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TUKFS Investment: TUKFS Centre for Doctoral Training (CDT)

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Title

How does power shape UK free school meals policy? A critical discourse analysis of parliamentary debates 2015-2025

Abstract

Background: Despite growing political and public attention to food-related issues, UK food policies continue to fall short of health, sustainability and equity goals. One reason is that policymaking involves a power struggle between competing interests, goals and ideas. Examining how power operates within specific policy and political contexts can help explain why certain policy directions prevail over time. However, these dynamics are poorly understood in the UK food policy context.

Methods: This study examined how power shapes UK food policy using free school meals (FSM) as a case study. A systematic Hansard search identified 44 debates and speeches on FSM policy from 2015-2025, totalling ~220,000 words. Transcripts were coded iteratively and inductively in NVIVO. An integrated analytical approach combining Fairclough's power-focused critical discourse analysis with an established argumentation framework was used to assess how power is exercised in and behind parliamentary discourse on FSM.

Results: Power in discourse: Three key framings were identified through which actors constructed and contested FSM policy: (1) Competing accounts of poverty and responsibility defined appropriate policy solutions, (2) shared economic concerns shaped what FSM policy actions were considered desirable and feasible, (3) (de)legitimation discourses were used to establish moral and political credibility and undermine opponents.

Power behind discourse: Enduring ideas about social class, responsibility and welfare position FSM policy as part of a wider political struggle, while assumptions about work, productivity and the primacy of economic goals reflect ideological and institutional constraints on policy decisions. Parliamentary procedures - weighted in favour of government - create a structural imbalance between parties that make debates appear performative. However, internal party conflict and external pressures (public, advocacy, media) were revealed through the debates as power dynamics that can influence policy decisions.

Conclusions: This study shows how parliamentary discourse, political structures, and ideologies interact to shape the making of food policy. Findings reflect parliamentary debate and may not capture informal dynamics, but they provide insight into why food policy change is difficult and identifies leverage points for reframing and influencing future policy.

Plenary talks from TUKFS 2

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TUKFS Investment: Mandala

All Authors: [Sophie Hedges](#), Amy Yau, Kelly Parsons, Alexia Sawyer, Martin White, Steven Cummins

Title

Mapping the physical and digital food environment in Birmingham: A cross-sectional analysis of online food delivery platforms and point-of-interest data

Abstract

Background: Online food delivery platforms (OFDPs) have become a major channel for accessing unhealthy ready to eat food, yet they are largely absent from conventional food environment monitoring, which typically relies on high-street outlet records. This may lead to underestimation of food access, particularly in urban communities where reliance on OFDPs is high. This study aimed to characterise the physical and online food environments in Birmingham, assess the extent to which OFDPs introduce additional food access points beyond physical datasets, and examine whether online exposure varies by neighbourhood deprivation.

Methods: We conducted a cross-sectional study using physical outlet data from Ordnance Survey Point-of-Interest registers (December 2024) and online outlet listings from the three leading food delivery platforms (January 2025). Online listings were matched to physical outlets using name standardisation, spatial proximity, and clustering. Two measures of online availability were derived: the Online Exposure Ratio (OER), defined as the number of online listings relative to physical outlets, and online exclusivity, defined as the proportion of online outlets with no identifiable physical counterpart. At Lower Super Output Area (LSOA) level, these metrics were linked to 2019 Index of Multiple Deprivation scores.

Results: We identified 2,829 physical outlets and 6,822 OFD listings. The OER was 9.88, indicating that there are nearly 10 times as many online listings as physical outlets. Most online outlets (83.7%) operated exclusively online without an identifiable physical storefront. After accounting for the size of the physical food environment, online food delivery outlet availability was highest in more deprived neighbourhoods; areas in the least deprived decile had approximately 50% fewer online listings compared with the most deprived areas.

Conclusions: Online platforms make a substantial and previously unmeasured contribution to Birmingham's food landscape, revealing many outlets not captured in physical datasets. Online food exposure shows a strong socio-economic gradient, with the greatest levels observed in deprived neighbourhoods. These findings support the routine integration of online outlet data into food environment surveillance and suggest an important new target for public health interventions. Key limitations include potential misclassification of home-based kitchens and the cross-sectional design.

Symposium 4.1

Submitting Author: Dr Sundus Mahdi

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TUKFS Investment: FixOurFood

Chair: Maria Bryant

Discussant: Charlotte Hardman

Title

Methods to improve the sustainability and nutrition of school dinners for both planetary and population health

Overall symposium outline

Background: Sustainable diets, rich in vegetables, fibre and whole foods, help prevent diet-related non-communicable diseases and reduce greenhouse gas emissions by promoting low-impact production and consumption. Given that children consume 30% of their diets at school, school settings play a pivotal role in achieving climate commitments and sustainable development goals, including promoting sustainable consumption and reducing food waste. This symposium presents interventional research by FixOurFood and BeanMeals, demonstrating practical methods to transform school meals to promote both planetary and population health.

Papers:

FixOurFood's Menu-Swaps Project will detail its journey from real-world observation of 3,526 school lunches across 18 schools to scalable menu reformulation. This paper will outline the multi-stakeholder co-design process used to transform 12 high-carbon footprint meals to ones that are more carbon neutral and nutrient-dense. The team will present mean differences between old and new menu items in nutrients, climate impact, and costs. Findings from child tasting workshops, child focus groups, and head chef interviews will be shared, offering critical acceptability and implementation insights, alongside key learnings.

The session is complemented by the BeanMeals Project, which provides a "fork-to-farm" perspective by starting with the meal and working backwards through supply to production. This paper will detail how novel UK-grown beans were integrated into primary school meals for food system transformation. BeanMeals will share results on optimising a whole-school food approach to successfully support the implementation, acceptability, and consumption of bean-based meals.

Symposium 4.1 paper 1

Department and Institution: Department of Health Sciences, University of York

TUKFS Investment: FixOurFood

Authors: [Zeynep Caferoglu Akin](#), Nicola Nixon, Rob Oxley, Sundus Mahdi, Sarah Bridle, Alana Kluczkovski, Jeff Brunstrom, Paul Davison, Nichola Harris, Alex Jemison, Polly Higginson, Bob Doherty, Maria Bryant

Title

Co-designed menu swaps to improve nutrition and environmental sustainability of primary school meals in socioeconomically deprived settings: early findings from the FixOurFood intervention

Abstract

Background: School meals offer a major opportunity to improve children's diet quality while reducing environmental impacts, particularly in socioeconomically deprived settings where school food is central to nutritional equity. Baseline observations of 3,526 lunch plates across 18 primary schools in Yorkshire showed frequent selection of meals high in saturated fat and carbon emissions, indicating the need for healthier and more sustainable recipe reformulation. This study reports the development and preliminary evaluation of a co-designed menu-swap intervention in Bradford, UK.

Methods: Foods were classified by popularity and CO₂e contribution using plate photography from baseline observation days. A multi-stakeholder co-design workshop involving local authorities, caterers and researchers informed the reformulation of 12 recipes (six vegetarian swaps and six blended meals). The nutritional composition and carbon footprint were calculated using Nutritics (Research Edition v6.12), and ingredient costs were estimated based on supplier price lists. Children's acceptability was assessed during a tasting workshop with 40 children (aged 4–11).

Results: Vegetarian swaps, predominantly whole-food plant-based and low in dairy, achieved the largest gains, including substantial reductions in saturated fat (–53% to –89%), marked increases in dietary fibre (up to +334%), and significant reductions in carbon footprint (–16% to –84%). Blended meals produced moderate but meaningful improvements (fibre +1% to +144%; saturated

fat -1% to -61%; CO₂e -9% to -34%). Cost impacts varied: whilst some vegetarian meals increased in cost (+10% to +63%) due to ingredient substitutions, others demonstrated notable savings (-40% to -55%). Acceptability testing indicated broadly positive responses, with mean liking scores ranging from 2.29 to 4.88 across the new dishes.

Conclusions: Co-designed recipe reformulation—particularly vegetarian substitutions—can meaningfully reduce the environmental footprint and saturated fat content of school meals while substantially increasing dietary fibre. These improvements can be achieved without a universal increase in cost. The results provide a strong foundation for the implementation phase currently underway, which will evaluate children's acceptability, plate waste, and real-world feasibility across five schools. Findings will inform future school meal policies seeking to align public health, affordability and climate goals.

Symposium 4.1 paper 2

Department and Institution: Department of Health Sciences, University of York

TUKFS Investment: FixOurFood

Authors: Sundus Mahdi, Zeynep Caferoglu Akin, Nicola Nixon, Louise Padgett, Bob Doherty, Maria Bryant

Title

Acceptability of new school menus for population and planetary health: a proof-of-concept study

Abstract

Introduction: Childhood obesity remains a significant public health challenge in the UK, with prevalence rising sharply from school entry to Year 6. Children's diets frequently fail to meet national nutrition guidelines (e.g., high in free sugars and saturated fat; insufficient fibre and vegetables), exacerbated by the surrounding obesogenic environment. Children consume approximately 30% of their food at school, therefore providing an ideal setting to implement change. This study co-designed new school food menus aimed at supporting population and planetary health by replacing high environmental impact menu items with sustainable alternatives, while maintaining nutritional quality, meeting nutritional standards, and limiting cost. This paper evaluates the acceptability of these new menus among school children and head chefs.

Methods: A co-production proof-of-concept intervention was conducted in partnership with Bradford City Council, schools, caterers, and children. The FixOurFood team identified school foods with the highest environmental impact and worked with stakeholders to co-design menu swaps, including introducing six new meals and adapting six existing "blended dishes" for improved health and sustainability. The new menus were implemented in five primary schools in Bradford (n=630 meals in total per day). Child focus groups and head chef interviews took place after the lunch service. To determine the acceptability of the new menus, a thematic analysis, informed by grounded theory, is being conducted to extract core codes and conceptual themes.

Results: The five child focus groups (n= 4-9) explored children's perceptions, acceptability, and areas of concern involving the new meals, alongside comparisons between old and new menus. Interviews with five head chefs focused on the feasibility of preparing and serving the new menus, student acceptance, intervention fidelity, and implementation barriers, alongside perceptions on the impact of the new menus on food waste. All acceptability data has been collected, and analysis is currently ongoing.

Conclusion: This evaluation explored the experiences of children and head chefs following the implementation of a novel menu designed to benefit both population and planetary health. The outcomes will directly inform improvements to the implementation process and menu choices for a larger-scale intervention, ultimately aiming to increase pupil acceptance and uptake of sustainable and healthy school meals.

Symposium 4.1 paper 3

Department and Institution: Department of Psychology, University of Liverpool

TUKFS Investment: BeanMeals

Authors: Charlotte Hardman, Natasha Bayes, Lisa Didier, John Ingram

Title

Children's acceptance and liking of novel UK-grown beans in primary schools: a quasi-experimental evaluation of the BeanMeals intervention

Abstract

Background: Schools are an important setting for enabling access to nutritious, environmentally sustainable foods. However, we currently lack evidence on optimal strategies to encourage uptake of novel school meals. The current study examined children's acceptance and liking of lunchtime meals comprising novel UK-grown beans in six Leicestershire primary schools.

Methods: Over 5 months, school cooks were provided with UK-grown beans and trained to prepare and offer them in new meals. Lunchtime staff were trained to nurture children's positive experiences. Children in Year 5 (9-10-year-olds) also participated in bean-based educational activities. Lunchtime observations were conducted at the start, midpoint, and end of the project. Individual-level data were collected for a subsample of children (N=91) in Years 4 and 5. Meal consumption was measured using pre-post meal photographs, and liking using child-friendly ratings (5-point scale "super yuck"–"super yum"). Mean percentage consumption and liking of the bean-meals was compared to the standard non-bean-meals. Year 5 children were also compared to Year 4 children on these outcomes to identify any additive effects of the educational activities.

Results: School cooks offered a range of bean-meals, most frequently bean-pizza and baked beans. Average consumption per bean-meal did not differ significantly from the non-bean-meal at timepoint 1 (respective mean % consumption (standard deviation) = 71 (26) vs. 68 (22), 95% confidence interval [-6.2, 13.7]) or at timepoint 3 (75 (24) vs. 69 (26), 95% CI [-4.5, 16.3]). Liking did not differ significantly at timepoint 1, but at timepoint 3 was significantly lower for the bean-meal than the non-bean-meal (respective mean liking (SD) = 3.49 (1.38) vs. 4.17 (1.02), 95% CI [-1.2, -.13], though average bean-meal liking remained above the scale midpoint (3="okay"). There were no significant differences between children in Year 4 and Year 5 on any outcome.

Conclusions: UK-grown beans can be added to a variety of school meals, and consumption and liking were generally comparable to standard offerings. There was no discernible additive impact of bean-based educational activities. Findings indicate that UK-grown bean-meals can be offered and are accepted in primary schools as part of a whole-school approach to healthy, sustainable food.

Individual papers 4.2

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TUKFS Investment: Sustainable Nutrition, Environment and Agriculture, Without Consumer Knowledge (SNEAK)

All Authors: [Taro Takahashi](#), Annika Flynn, Jeffrey Brunstrom

Title

Dish swap across a weekly menu can deliver health and sustainability gains – a new approach to improving menus in public procurement settings

Abstract

Background: In the UK, 42% of workers dine in a canteen and 7 million lunches are served to children daily. Here, efforts to improve health and sustainability often rely on punitive measures (e.g., taxation) or education (e.g., labelling). Diners typically select one meal from a daily menu that rotates weekly (e.g. 3 dishes x 5 days). In this context, overall nutritional and environmental performance depends not only on the healthiness and sustainability of individual dishes but also on how options are grouped together. Thus, changes to inter-dish competition structure might be used as a novel choice architecture intervention. In the SNEAK project, we tested this hypothesis, or more specifically whether health and environmental benefits could be achieved by simply rearranging weekly menus based on preferences and meal attributes.

Methods: In a proof-of-concept intervention at a University of Bristol catered hall, food choice was monitored over four weeks (~5,000 meals). Using an exhaustive search of potential weekly menus (~1.4 million permutations), we implemented an optimised menu that was mathematically predicted to minimise carbon footprint and saturated fatty acid intake across the study period at the population level. In a follow-up study to assess the feasibility of our approach across wider public sectors, we modelled the efficacy of similar dish swaps using menu data from 11 NHS hospitals and preference data from a nationwide online food-choice task (n=550). In both cases, no recipe was altered, and no dish was withdrawn from the weekly offering.

Results: In the proof-of-concept intervention, mathematically optimised menus achieved 30.7% and 6.3% reductions in carbon footprint and saturated fatty acid intake, respectively, without students noticing. In the simulation analysis for NHS hospitals, joint optimisation of carbon footprint and saturated fatty acid intake showed predicted reductions of the two variables by 9.1–29.3% and 5.0–26.5%, respectively, across 11 hospitals.

Conclusions: To roll out this approach in workplace canteens, hospitals, schools and other public settings at scale, further investment and research are needed. These include, amongst other areas, stakeholder engagement to identify barriers and enablers including logistical, financial and labour constraints, and development of a user-friendly interface allowing catering providers to use our algorithm without coding skills.

Individual papers 4.2

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TUKFS Investment: Sustainable Nutrition, Environment and Agriculture, Without Consumer Knowledge (SNEAK)

All Authors: [Annika Flynn](#), Taro Takahashi, Alex Sim, Christian Reynolds, Charlotte Hardman, Jeffrey Brunstrom

Title

Using computational modelling to reset the concept of cuisine and to re-imagine healthy and sustainable meals

Abstract

Background: Recipe reformulation, or substitution of ingredients within a cooked dish, is a common strategy to improve health and environmental impacts of food. However, reformulation alters the sensory and affective properties of the dish, and because people hold strong views on what constitutes an 'ideal' or 'perfect' dish, radical changes are likely to be rejected by consumers. However, history teaches us that novel dishes can be widely adopted; Coronation Chicken, created to celebrate the coronation of Queen Elizabeth II (1953), is a quintessential example. Founded on this observation, the SNEAK-i project asked: rather than modifying existing dishes and risking consumer rejection, why not introduce entirely new recipes that are unconstrained by the limits of a pre-existing cuisine? Here, we tested a mathematical approach to develop novel, healthy, and sustainable dishes that could be adopted widely in the UK.

Methods: To compile a list of candidate ingredients, we extracted all ingredients from 30 dinner recipes at a University of Bristol hall of residence. We computationally generated all possible 5-ingredient combinations (~10 million 'baskets') and grouped them into meat, vegetarian, and vegan categories. For each category, we then selected a basket that jointly minimises carbon footprint and saturated fat content and held a cooking competition, chaired by a trained judge, where five professional chefs were asked to create a novel dish. Winning dishes from each category were further assessed alongside commercially available dishes in a wider tasting session. All tasters were meat eaters.

Results: All winning dishes were popular at the tasting session, with substantial health and environmental benefits. In the hall of residence ~90% of students select a meat dish daily. By contrast, 54% of our tasters indicated they would choose the vegetarian winning dish over a standard meat dish. In this context, this 'meal swap' would reduce carbon footprint by 78% and saturated fat intake by 69%.

Conclusions: Creating novel dishes using computational modelling holds promise as a method to address longstanding challenges associated with product reformulation. The approach has the potential for application across a range of settings, encompassing both public (e.g. schools) and private (e.g. supermarkets) sectors.

Individual papers 4.2

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TUKFS Investment: Realigning UK Food Production and Trade for Transition to Healthy and Sustainable Diets

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Title

Estimating food consumption changes for transition to healthy diets in the UK

Abstract

Background: Our vision for transformation of the UK Food System is one where the consumer transition towards healthy and sustainable diets (HSD) is supported by environmentally sustainable and resilient food production and trade patterns. The realignment of consumption, production and trade for the transition is driven by coordinated fiscal and trade policy measures, structural changes in the supply chain, voluntary industry-led initiatives and public health and regulatory interventions. In this paper we map the consumption changes required in for transition to HSD in the UK using a novel programming approach.

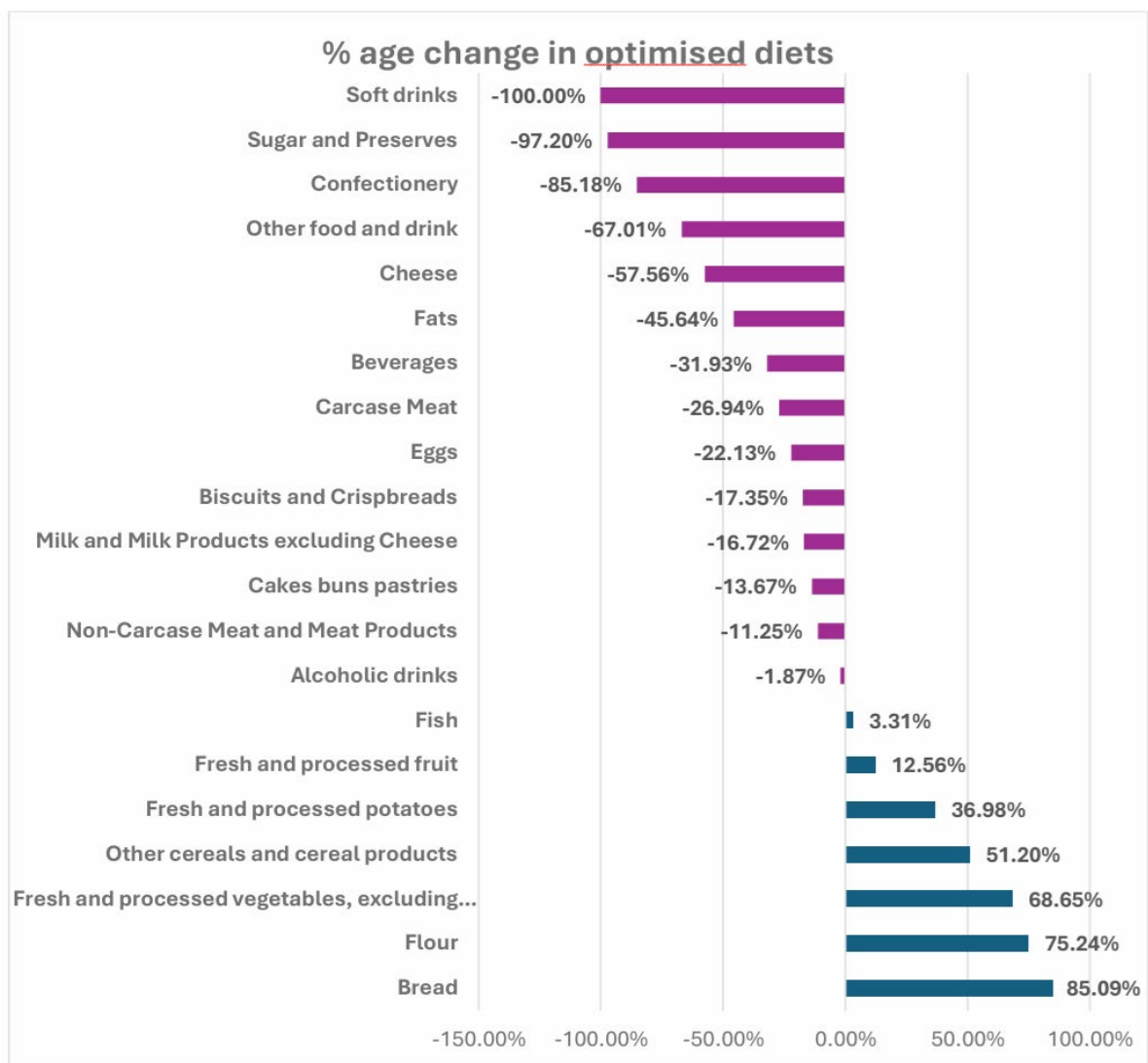
Methods: Using data from DEFRA's Family Food survey, we estimate a Quadratic Programming-based Diet Optimisation model to estimate the changes required in the consumption of different food products in the UK for transition to diets that adhere to the UK dietary guidelines. We assume that UK consumers would like to adhere to the UK dietary guidelines, whilst making the minimum possible changes to their existing diets.

Results: The key results are summarised in Figure 1 below. The transition to healthier diets will involve the following key changes to UK dietary patterns:

- Reduction in consumption of milk and milk products (11.6%) – offsetting changes – reduction in cream (60%) different types of milk (15-30%) offset by increase in the consumption of skimmed milk (18%).
- Reduction in cheese consumption of 52.5%; reduction in different types of cheese ranges from 14-60%.
- Reduction in consumption of carcass meat (23%), beef (21%), mutton (41%), pork (15%). Reduction in poultry, offal and takeaway meat (11.6%).
- Near elimination of soft drinks, sugar and preserves. Reduction in confectionery (85%), cakes, buns, pastries (13%), biscuits and crispbreads (15%).
- Substantial increase in consumption of vegetables (53%), overall increase in fresh and processed fruits is only 3.3% - large increases in some fruits offset by decreases in fruits with high sugar content.
- Large increase in the consumption of bread (89%), flour (76%), cereal products (54%)

Conclusions: Transition to healthier diets can be accomplished while minimising changes to current diets. Diets optimised in this way are not more expensive than existing diets (cost increase from 2-5%). However, the transition to healthier diets will still involve large changes (reduction) in the consumption of certain “unhealthy” products. These products should be the principal focus for regulatory and policy intervention.

Figure 1: Results: Changes in Consumption of Food Products for Transition to Healthy Diets in the UK



Individual papers 4.2

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TUKFS Investment: Realigning UK Food Production and Trade for Transition to Healthy and Sustainable Diets

All authors: [Sherry E](#), Binfield J, Caskie P

Title

International trade and the environmental benefits of diet change in the United Kingdom

Abstract

Background: The research presented in this report focuses on how, in the context of transitioning consumption patterns motivated by improving health and environmental sustainability, an internationally integrated agriculture sector provides both opportunities and challenges. The analysis contributes to a broader objective: developing a coordinated set of policy interventions to support the transition to healthy and sustainable diets in the United Kingdom (UK).

Methods: An economic (partial equilibrium market) model is used to anticipate how production, prices, and international trade in agricultural commodities could change if the population adopted alternative eating patterns over the next ten years. The analysis compares results across a range of diet transitions and compares the impact of unilateral UK adoption with outcomes when the European Union (EU) follows these diet changes, but to a lesser extent. The production and trade impacts of diet change in the UK are then evaluated against global and local environmental risk factors, namely greenhouse gas emissions and soil nutrient surpluses. In addition to checking sensitivity to dietary pattern, and geographical scope of diet change, the emissions-intensities of agricultural commodities imported to the UK are also varied across each scenario.

Results: (1) Price signals will not always be in line with the desired direction of dietary change. For example, foods considered 'over-consumed' in current diets, that are targeted for reduction in the transition, could become more affordable compared to substitutes. (2) Production changes tend to be driven by the indirect effects of changing diets. For instance, livestock production will be impacted by changes to the UK's international trade position, and cereal and oilseed production will be impacted by changes to livestock feed demand. (3) UK integration within international commodity markets moderates price signals. Aligning the diet transition across trade partners generates more positive outcomes in terms of reducing environmental risk factors within the UK.

Conclusions: Overall, diet change in the UK may not produce a proportional or desirable response from the domestic agricultural sector, raising significant policy implications for food security, environmental sustainability, and consumer affordability.

Individual papers 4.3

Submitting Author: Jessica Bosseaux

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TUKFS Investment: FoodSEqual

All Authors: [Jessica Bosseaux](#), Eugene Mohareb

Title

How allocation rules shape the environmental story: mass versus economic allocation in environmental life cycle analysis

Abstract

Background: Small scale fisheries around Plymouth land mixed catches, including low value species that may be discarded due to weak markets. FoodSEqual is developing a value-added route by transforming underutilised fish into fish fingers for a local market. This creates a methodological challenge for environmental life cycle assessment (LCA): how should environmental burdens be allocated when an intervention shifts fish from discarded to marketable?

Methods: We will conduct an attributional LCA of selected Plymouth small scale fishing trips and downstream handling and processing routes relevant to the Plymouth Fish Finger. The functional unit will be 1 kg edible fish ingredient delivered to the processor. Primary data will be collected with fishers and supply chain partners on catch composition, fuel use, landing, storage, transport and processing, supplemented with secondary life cycle inventory data where required. The study will follow ISO 14040 and ISO 14044. We will compare mass-based allocation and economic allocation, using landing prices and run sensitivity analyses for alternative price windows. Where feasible, we will test system expansion for co products. Impacts will be calculated in SIMApro using ReCiPe 2016.

Results: Preliminary results indicate that allocation choices materially affect estimated impacts and can change the direction and strength of conclusions for low value and underutilised species. Early findings also suggest a potential environmental gain from management approaches that reduce the discard of edible fish. Data collection is scheduled to finish in February, and analysis will be completed by March. We will report comparative impact estimates across allocation methods and identify which assumptions most influence conclusions for low value and underutilised species.

Conclusions: The study will provide policy relevant evidence on how allocation choices shape the apparent environmental performance of management changes in mixed fisheries. The findings have methodological implications for LCA practice and political implications for fisheries governance, because they show how best management practices, alongside new market opportunities such as local value added processing, may support near term solutions to reduce edible fish discards. Key limitations are expected to include uncertainty in prices used for economic allocation and the representativeness of a limited number of trips and routes.

Individual papers 4.3

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TUKFS Investment: Mandala

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Title

Keep your friends close and your enemies closer: exploring channel development opportunities between fresh produce wholesale markets and dark kitchens as two-sided B2B platforms

Abstract

Background: Fresh produce wholesale markets (FPWM) in the UK have long been perceived as a declining sector. Unsurprisingly, the rise of digital disruptors such as delivery-only—or “dark”—kitchens (DK) and online marketplaces is perceived as a threat to these traditional channels, among fears that they be eventually sidestepped. In this work we challenge such perception and investigate whether (1) wholesale markets that develop physical and digital business-to-business (B2B) platform capabilities might identify untapped network externalities; and (2) the presence of such externalities could enable channel development opportunities between mature and emerging actors in the UK food system.

Methods: We test a recently proposed theoretical lens outlining archetypal value creation dynamics as B2B platforms evolve. Following an empirical simulation study protocol, we developed a “model laboratory” environment based on System Dynamics (SD) interactive modelling principles to explore new channel development opportunities between FPWM and DK. By implementing a participatory model-building approach, we elicited experienced practitioners’ insights into key structural and behavioural aspects that may affect participation and value creation dynamics in both FPWM and DK.

Results: Our research is ongoing and preliminary results are encouraging. We developed an exploratory SD model, which was piloted during a group model building workshop involving participants from the largest integrated FPWM in the UK. The workshop led to an expert-validated model structure and the preliminary identification of the variables at play for: (1) a current state scenario where standalone and same-side value creation dynamics accrue from participating in either FPWM or DK; and (2) a future-state scenario where cross-side value creation dynamics, and fresh produce throughput, is affected by the interplay between FPWM and DK participants on both sides of a physical and digital B2B platform.

Conclusions: This study offers a novel methodological approach to evaluate future development scenarios that are likely to impact substantially the reliable access to high-quality, affordable fresh produce in urban food systems. To our knowledge, ours is the first application of a B2B platform perspective and value creation lens to model either FPWM or DK. Yet further work is required to engage with DK informants regarding aspects of our model which are still reliant on secondary data and assumptions.

Individual papers 4.3

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Title

Revitalising wholesale markets for resilient food systems: a model-based approach to evaluate strategy interventions

Abstract

Background: Fresh Produce Wholesale Markets (FPWM) represent a critical piece of infrastructure in urban settings. However, their role in securing accessible, affordable food, especially during shortages in conventional retail, is often overlooked. Indeed, during the recent pandemic, their function as a critical shock absorber in the food system became more evident. Nevertheless, their commercial viability is challenged by various economic factors, changing channel structures and consumer shopping habits, and the complexities of international trade. These factors challenge tenant-traders' participation in FPWM and, hence, the long-term viability of this critical urban infrastructure.

Methods: This research deploys System Dynamics (SD) techniques to explore strategy options to revitalise FPWM within urban food systems. Our selected context is the Birmingham wholesale market, representing one of the largest integrated FPWMs in Europe. Specific physical and digital interventions are explored through co-creation of system dynamics models that support co-competition, market diversification, infrastructure sharing, and channel development including online marketplaces. Model creation involved strategy innovation workshops with a range of stakeholders to identify potential interventions and how they might enhance the wholesale market value proposition, as measured by tenancy occupation and fresh produce volume. Initial models were shared in face-to-face workshops for sense-making and parameter selection. Subsequent model design and validation activities adopted the group model-building approach to refine intervention choices.

Results: Specific interventions identified include value proposition enhancements driven by product differentiation (spice markets), downstream sorting (restaurants) and processing (food surplus hubs), waste management, and dark kitchens. The SD model includes a balancing loop around the number of traders, and three reinforcing loops that support their attraction and retention.

Conclusions: This research uniquely applies SD principles, specifically the co-flow modelling approach, to FPWM strategy development. The preliminary model enables the evaluation of scenarios co-created with traders and management, which could reveal the complex interplay between potentially competing demand-side interventions and productivity enhancements.

Individual papers 4.3

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Title

Coordinating surplus food redistribution hub in a wholesale food market setting in the UK: a Social Practice Theory perspective

Abstract

Background: There is ongoing concern about environmental cost of the substantial amount of food waste generated at various stages of the food supply chain. This concern is often paired with concern about the high prevalence of food insecurity, thus underscoring food waste as particularly inexcusable. Although research on food hubs has expanded in recent years, limited attention has been paid to the everyday practices, operational mechanisms, and material resources that underpin their implementation and functioning.

Methods: This study adopts a social practice theoretical framework to examine the practices and experiences associated with a surplus food hub located within a wholesale food market in the United Kingdom. A multi-modal methodological approach was employed, comprising participant observation, in-depth interviews, and the collection of unstructured routine data on quantity of surplus food and types of food to analyse how food redistribution hub work in practices. Observations included a range of stakeholders (including traders, CFS organisations, food hub coordinator) engaged in surplus food redistribution.

Results: The findings highlight the diverse ways in which material resources, infrastructure, and actors' skills are integrated to support the operation of the food hub. The study further maps the pathways through which surplus food moves from market traders to the food hub and subsequently to other stakeholders, revealing the complex networks or pathways underpinning surplus food redistribution systems. Despite the availability of surplus food within the market, much of it fails to reach the surplus food hub.

Conclusion: Overall, the study concludes that well-coordinated surplus food redistribution systems are capable of operating effectively but require navigation of complex dynamics / integration of resources, infrastructure. Despite effective coordination, there is a need to establish the impact on social and environment outcomes and how practices could support increased recovery of available surplus food.

Poster abstracts

Poster 1

TUKFS26 Abstract Submission Form

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Title

Alternative proteins in culinary education: understanding knowledge, attitudes, and barriers among chef trainees and educators

Abstract

Background: Chefs influence food choices and play a crucial role in shaping transitions toward more sustainable protein systems. As plant-based, fungal, fermentation-derived, cultivated and other emerging protein sources gain visibility, chef trainees and their educators must be prepared to work with them. Yet little is known about how alternative proteins (APs) are defined, understood, or taught in UK culinary education, creating a risk of inconsistent training and missed sustainability opportunities.

Methods: This networking project, funded by NAPIC, Flourish Food Science and Brunel University, engages culinary educators and trainee chefs through 2–3 co-creative consultation sessions across UK colleges. A mixed methods design combines baseline and exit surveys with focus groups and online workshops to explore knowledge, attitudes, barriers, and enablers surrounding AP teaching. Thematic analysis of qualitative data informs the development of a prototype training module for UK chef education.

Mixed methods will be used: entry/exit surveys to capture baseline attitudes and shifts in perception. Focus groups and online workshops to explore barriers, enablers, and desired characteristics of future APs. Thematic analysis of qualitative data will inform the design of a prototype training workshop for culinary education of chef trainees.

Results (preliminary): A scoping review revealed no shared definition of APs and significant geographical and cultural variation in how they are categorised, alongside a scarcity of research focused on chefs or culinary educators. Survey responses from 11 educators across 8 providers showed that plant-based proteins—such as tofu, tempeh, seitan, mycoprotein/fungi, and pulses—are the most integrated into curricula. Exposure to precision fermented proteins, cultivated meat, underutilised animal meats, insects, algal proteins, and novel aquaculture was limited. Barriers to inclusion included curriculum constraints, time pressures, cost and access to products, allergen and safety considerations, low lecturer confidence, and perceived misalignment with awarding body specifications. Educators taught across NVQ/VRQ, City & Guilds, CTH L4, and BA/MA programmes, with weekly teaching loads ranging from 6–40 hours, typically dominated by practical sessions.

Conclusions and Implications: Findings highlight the need for clearer definitions, improved educator support, and greater alignment between curricula, training standards, and emerging protein innovations. Insights will inform the codesign of a dedicated AP teaching module aimed at strengthening chef education and bridging gaps between product innovation, sustainability goals, and real world teaching environments. Planned outputs include a publication, an industry-facing report, and an open access workshop toolkit.

Keywords: alternative proteins, culinary education, chef trainees, sustainability, codesign

Poster 2

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Title

Social connectivity and diet: a quantitative study of 137 interviewees in Whitley, Reading, exploring ways in which their social connections, including community group connections, correlate to self-reported diets and wellbeing

Abstract

Background: Spurred on by austerity, stagnant wages and Covid-19, food poverty and inequality have been rising in the UK. FoodSEqual co-produced research with community researchers discussing food on a budget, the pressures shaping choices, and aspirations for change. This involved questionnaires and workshops with 500+ people in Whitley (Reading). The top policy priority identified was developing trusted community spaces offering social connections. Moreover, the research revealed diets are often driven by circumstances, not lack of interest or knowledge about healthy eating. Change requires an altered food environment in which people are able to select healthier foods that are an affordable, accessible, and easy-to-manage part of every day life. But how to get to this? We agree that change is more likely when 'done by' and 'done with' communities instead of being 'done to' or 'done for' them. A capacity to connect and cooperate is key to change, resilience and wellbeing.

Methods: Based on this, our research uses quantitative methods (linear regressions with 95% confidence intervals) to explore links between social connections and various aspects of diet. We surveyed and interviewed 137 people, their additional qualitative responses helping us to interpret the findings. Half the sample were interviewed at local community centres and half outside (at the school gate or using the informal networks of community researchers). The sample captured the views of many who found finances a big consideration.

Results: Statistically significant links were found between social connections, including community group connections and (1) self-reported diet (2) views on food (barriers to access, intentions, satisfaction) (3) sense of connection, belonging and support within the community (4) trust on various levels (5) giving (i.e. doing instead of being done to) (6) stigma (a barrier to accessing help and to wellbeing) (7) wellbeing. Community group connections, even of light touch, appear to play a role over and above that of social connection more generally.

Conclusions: Within the historic and currently evolving landscape of austerity, food poverty, and community solidarity responses to them, food system transformation can be advanced by place-based initiatives. Delivering initiatives with community partners, and designing them to support positive social connection appears likely to offer additional benefits in terms of reducing diet and health inequalities.

Poster 3

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TUKFS Investment: Thinking beyond the can: mainstreaming UK-grown beans in healthy meals (BeanMeals)

All Authors: Charlotte Hardman, Lisa Didier, Natasha Bayes

Title

“Food is not rubbish!” Tackling food waste in UK primary schools via collaboration and codesign

Abstract

Background. Food waste in schools is a significant environmental, health, social, and economic challenge which occurs, at scale, predominantly in kitchens and dining halls. In the UK, there is a dearth of evidence-based interventions or policies for reducing school food waste and this creates a critical knowledge gap. In this impact-focused mixed-methods project, we aimed to synthesise evidence and generate insights that can begin to support schools and stakeholders with implementing evidence-based strategies and interventions to reduce food waste.

Methods. Semi-structured interviews were conducted with stakeholders (N=19), comprising staff from schools, local authorities, caterers and third-sector organisations, to understand a range of perspectives and experiences of reducing school food waste. We also partnered with two primary schools to conduct codesign work with pupils (N=32, aged 6-11 years) which enabled brainstorming of waste-reduction ideas via “dotmocracy” (an age-appropriate visual voting method where participants place dot stickers next to preferred ideas).

Results. Findings from the interviews indicated the need for repeated multi-lever interventions, and the importance of embedding food waste education into the school curriculum and taking a broader food-system approach. Resource constraints (e.g. time, staffing) around school lunchtimes were a key barrier. Children were keen for greater choice at lunchtime, for example with choosing side portions, serving sizes, and for more taster opportunities.

Conclusions. These findings highlight logistic challenges experienced by schools but also opportunities for action. Schools may benefit from a suite of interventions that can be customised to suit individual needs. Actively engaging pupils in menu planning, food-related decision-making, and food-waste strategies could also foster ownership and potentially promote long-term behaviour change.

Poster 4

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Published paper: Griffiths JC, Nikolaou CK, Adams JM. (2026). Seaweed on my lunch tray: challenges and opportunities for including macroalgae in Welsh school meals. *Applied Phycology*, 7(1). <https://doi.org/10.1080/26388081.2025.2605065>

Title

Seaweed on my lunch tray: challenges and opportunities of including macroalgae in Welsh school meals

Abstract

Background: The inclusion of seaweed in Welsh school meals is an atypical practice but offers a great opportunity to enhance childhood nutrition, support local livelihoods, preserve the use of traditional foods and contribute to sustainability targets. Seaweeds particularly provide a source of iron and B vitamins whilst being low in fat, sugar and calories; they are also a whole-food, animal-free food providing umami flavouring.

Methods:

- Literature search and gathering of official datasets
- Consultation of targeted groups (caterers, wholesalers, parents)
- Data manipulation

Results:

- 5g seaweed, particularly *Porphyra* species (laver), would enhance the provision of protein, fibre, potassium, calcium, magnesium, iron, zinc and vitamin B12 in the diets of school children. Literature suggests biotin, folate and pantothenate may also be high but insufficient data is available through the UK official nutrition (CoFID) dataset to quantify its dietary significance.
- Sodium and iodine may be exceeded
- Purchase options are limited to one product for caterers and not within budget

Recommendations & Conclusions: A significant contribution to the nutritional value of school meals may be possible through increasing supply and demand, thus bringing it within budget (Figure1).

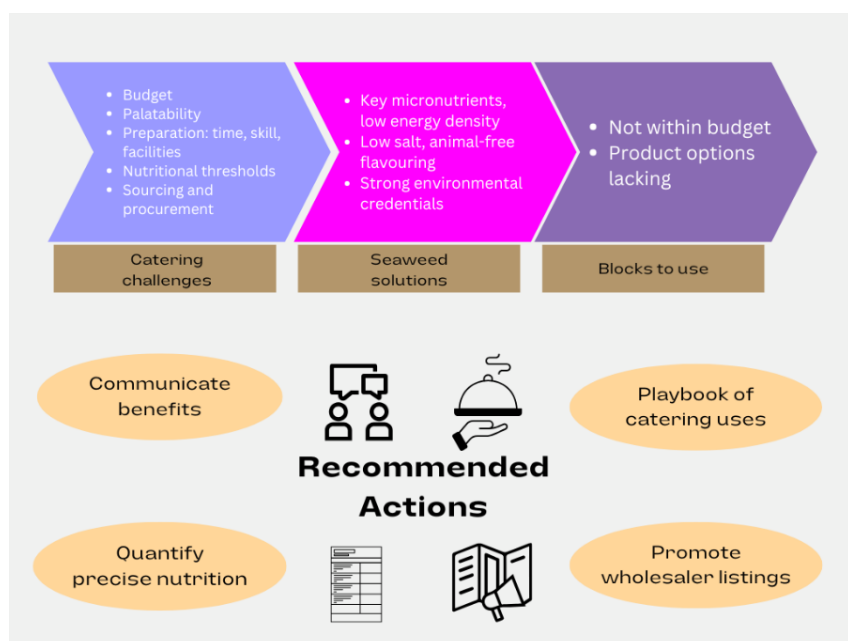


Figure 1 Graphical abstract: the main challenges facing greater inclusion of seaweed in school meals and the key recommended actions needed to achieve this

Poster 5

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Title

Food impacts on species extinction risks can vary by three orders of magnitude

Abstract

Agriculturally driven habitat degradation and destruction is the biggest threat to global biodiversity. Yet the impact of different foods and where they are produced on species extinction risks, and the mitigation potential of different interventions, remain poorly quantified. Here we link the LIFE biodiversity metric—a high-resolution global layer describing the marginal impact of land use on extinctions of ~30,000 vertebrate species—with food consumption and production data and provenance modelling. Using an opportunity cost framing, we estimate that the impact of producing 1 kg of different food commodities on species extinction risks varies widely both across and within foods, in many cases by more than an order of magnitude. Despite marked differences in per capita impacts across countries, there are consistent patterns that could be leveraged for mitigating harm to biodiversity. In particular, animal products and commodities grown in the tropics are generally much more impactful than staple crops and vegetables. Further, I will discuss recent extension and improvements on this analysis, exploring the impacts of different countries and commodities through time on species extinction risks.

Poster 6

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Title So you're thinking about becoming a community researcher? A handbook of insights and learning (including case studies), co-created by 19 community researchers and 2 community coordinators from FoodSEqual

Abstract

Background: FoodSEqual was a five-year project aiming to coproduce changes to the food system which will work better for low-income communities with people connected to those communities. As part of this FoodSEqual employed, trained, and supported local people to become community food researchers (CFRs) and co-deliver research. They were employed across four locations (Brighton & Hove, Plymouth, Reading, Tower Hamlets). No one had undertaken such a role before, and many coordinators also had not delivered this type of participatory research. Over cups of tea and slices of cake we felt our way through the process. As the project entered its final year the CFRs were invited to collate their learning to form a handbook as a resource for others in the future who may be new to a community research role, or curious about it.

Methods: Our co-design process was as follows. CFRs across two FoodSEqual locations held a meeting to agree questions which would be used to form the handbook content. Those were answered by the CFR groups in three of the project locations. A coordinator formed this into an initial handbook draft. An iterative process of feedback and adaptation followed in which content was changed and added, including adding new sections. All four locations were involved. Finally, discussion was held for CFRs to input into the design. A draft was collated and feedback given by CFRs before it was finalised.

Results: Insights which emerged from this include the value of learning by doing, the importance of supportive coordinators, regular check-ins, and playing to people's strengths and transferrable skills. Our case studies also highlight how people built confidence, trust, enjoyed working together, and overcame challenges such as academic jargon.

Conclusions: The community researcher model is a useful way to gain insight into people's lives. It can also offer personal benefits and growth to the people involved in it. However, it needs proper funding and support to succeed, including a dedicated coordinator.

Poster 7

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Title

Co-creating pulse-based snacks: a UK innovation journey

Abstract

Background: Fava bean is a crop that is ideal for cultivation in the UK, it is rich in micro and macronutrients and a natural nitrogen fixer. Due to its properties, there is a potential of developing snacks with the inclusion of fava bean flour. This could also tackle the challenge of food security, which is more prominent among less affluent, culturally diverse communities across Southern England.

Methods: In our case, participatory action research with the Whitley community in Reading, indicated aspirations for snacks that were a healthier and more satiating alternative to potato crisps, with the same shelf-stable, taste and convenience attributes. As such, we focused on the bench scale development of pulse-based snacks, as a potential substitute, after assessing various processing technologies, such as baking, air frying, and extrusion, in order to create a range of textures. Snacks were analysed for texture, colour, moisture and water activity.

Results: After optimisation, we developed an extruded prototype containing fava bean, yellow pea, green pea and rice flour, which could hold protein, fibre and gluten free claims and responds to the product brief attributes.

Conclusions: This research demonstrated the feasibility of using fava bean flour in the development of savoury snacks, which aligns with community's aspirations towards food security, as well as filling a gap in the UK market. It also showcased our work focusing on food systems, utilising UK grown crops, while being interdisciplinary in nature with multiple food system stakeholders. Future work will try to optimise the pulses inclusion and processing method in savoury snacks based on physicochemical changes and sensory properties, as well as community's preferences. Further funding will also be pursued towards the snack's commercialisation.

Poster 8

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TUKFS Investment: Healthy Soil, Healthy Food, Healthy People (H3)

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Title Introducing a Comprehensive ai-enabled food data catalogue: leveraging data infrastructure to address the challenge of feeding all people well

Abstract

A chronic poly-crisis driven by climate change, geopolitical instability, economic volatility, and structural inequality increasingly challenges the capacity to feed all people well. This article proposes a comprehensive, metadata-rich food data catalogue to strengthen the data foundations for resilient, fair, and anticipatory food systems governance. Food system decision-making is constrained not only by fragmented data, but also by persistent data gaps, overlapping datasets from different sources, and indicators that frequently contradict one another. These inconsistencies obscure risks, complicate policy debates, and weaken timely responses. A well-designed data infrastructure, augmented by artificial intelligence and governed as a global public good, can address these challenges and improve food system performance and resilience.

The study develops a federated data infrastructure using open standards, interoperable metadata, and a shared conceptual ontology to link heterogeneous public datasets. By explicitly documenting data gaps and overlaps across sources, the catalogue makes inconsistencies visible rather than hidden. The study operationalises the concept of “feeding well” across nutrition, access, sustainability, risk, governance, justice, and transformation pathways, drawing on multiple academic frameworks and institutional reports. A multidomain food system ontology enables cross-sectoral and cross-scale analysis, addressing long-standing problems of data comparability, transparency, and usability.

The catalogue’s core strength lies in its ability to translate complex, multidimensional, and sometimes conflicting, data into actionable policy and planning insights. By integrating realtime and longitudinal indicators, it supports monitoring, scenario analysis, and anticipatory governance, allowing decision-makers to identify vulnerabilities, blind spots, and systemic hazards early. AI-enabled decision support is used to interpret large volumes of climatic, biophysical, and socio-economic data, helping reconcile contradictory evidence before shocks escalate into crises.

Beyond its technical contribution, the article frames the food data catalogue as a governance intervention. Treating food system data as a public resource ensures that AI-driven insights reduce rather than reinforce inequality. By exposing data gaps, overlaps, and contradictions, and enabling coordinated interpretation across institutions and scales, the catalogue supports proactive, systems-based policymaking in an increasingly uncertain world.

Poster 9

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Title

Update on UK Food Systems Centre for Doctoral Training

Abstract

The UK Food Systems Centre for Doctoral Training (UKFS-CDT) is a part of the Transforming UK Food Systems (TUKFS) Programme. The UKFS-CDT is undertaken by a consortium of nine universities and research organisations bringing together a diversity of interdisciplinary expertise on food systems research led by the Natural Resources Institute of the University of Greenwich. The ambition of the UKFS-CDT is to train the next generation of food system transformation leaders for a healthy and sustainable food future.

The programme's approach has been to enable the development of interdisciplinary doctoral research projects that combine social and natural science research to address a priority research issue in the UK food system. In the first year of study, each student received training in interdisciplinary food systems research including participation in the Interdisciplinary Food Systems Teaching and Learning (IFSTAL; ifstal.ac.uk) programme. Each doctoral researcher also undertook two short research projects in their first year from topics proposed by academic researchers in the consortium. The topics proposed by the academic researchers addressed food system research priorities identified by associate partners of the programme from industry, government or civil society who were part of the UK Food Systems Academy. It was a requirement that one of these research projects was social science based whilst the other was natural science based. These short projects provided foundations for the main thesis work by providing research experience in a specific subject area, research skills or opportunities to interact with potential supervisors. In some cases these short research projects provided opportunities to work with Associate Partners. Development of the final PhD proposal was codesigned with the doctoral researchers, potential supervisors and in some cases associate partners from the UK Food Systems Academy.

Each PhD programme is supervised by supervisors with both social and natural science backgrounds to support the undertaking of interdisciplinary research. It is also a requirement that each doctoral researcher undertakes a 3 month Professional Internships for PhD Students (PIPS) programme.

Fifty five doctoral researchers have been recruited to the programmes from diverse background over three cohorts. Doctoral researchers are either funded by the CDT Programme or co-funded with a consortium or associate partner.

In this poster we will reflect on the progress made by the programme including the challenges and opportunities.

Poster 10

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TUKFS Investment: FoodSEqual

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Title

Towards a comprehensive stakeholders and hotspots categorisation: a Delphi Method contribution to post-productivist social life cycle assessment

Abstract

SLCA is increasingly used to discuss social impacts in value chains, yet hotspot identification remains methodologically heterogeneous. Studies differ in stakeholder definitions, hotspot themes, and indicator framing, with overlapping terminology and non-exhaustive coverage. This limits comparability across case studies and constrains cumulative knowledge building. It also raises a practical philosophical question with methodological consequences: is hotspot identification in SLCA an essentially contested concept, where reasonable experts disagree on boundaries and what 'must' be included, even under good faith and shared evidence? This study develops an exhaustive list of meta-stakeholders and meta-hotspots intended to cover most potential hotspots in SLCA, while explicitly testing whether convergence is feasible. It aims to (i) identify inevitable stakeholders, including whether animals should be treated as stakeholders in their own right and whether supply chain actors should be divided into additional categories to capture relevant specificities, and (ii) define unavoidable meta-hotspots as a minimum starting set. The list is intended to inform subsequent development of a quantitative method to assess and rank hotspot importance, and to specify design requirements for a replicable pre-screening survey, without erasing legitimate plurality. We implement a three-round online Delphi process (administered via Qualtrics), followed by moderated focus groups scheduled for completion by March 2026. The panel initially comprised 15 experts from public policy, industry, and research, with geographic diversity. During the online rounds, some participants withdrew, citing misalignment with how they interpret SLCA and its underlying assumptions, including differing views on whether universal categorisations are appropriate. We treat this attrition as an empirical signal of paradigm-level divergence, and a rationale for the focus group stage. Preliminary findings indicate partial convergence on a core set of stakeholder groups and hotspot themes, alongside persistent disagreement on contested categories and boundary judgements. Some elements may be stabilised into a shared exhaustive list, while others remain context dependent. The anticipated impact is to strengthen validity, credibility, and policy-relevance by clarifying what can be standardised, and what comparisons must remain explicitly contextual.

Poster 11

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TUKFS Investment: FixOurFood

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Title

Mapping influences on school food consumption across deprivation levels: relational content analysis of pupil and school leadership perspectives

Abstract

Background: Over the past two decades the number of year 6 children living with overweight and obesity has increased to more than one in three by the time children leave primary school. Over the same period, health and diet-related inequalities have widened. Combined, this can have considerable impact on individuals, the healthcare system and the economy. Schools provide an early opportunity to intervene, through the provision of school food, where children consume 30-50% of their total daily energy intake. However, preliminary analysis of FixOurFood consumption data (n= 5166) reveals a gap between the food mandated by School Food Standards, the food offered by schools and the food consumed by children. Reductionist approaches to understand this gap focus more on the tangible influences on consumption (e.g. food presentation) and less on the intangible influences, such as leadership priorities, peer norms and power dynamics. Consequently, there is a limited understanding of how factors across the whole school food system can interact to shape consumption behaviours, and how they differ by socioeconomic deprivation. This study aims to explore the factors that shape school food consumption across the whole school food system in primary schools, and whether these differ between areas of high and low deprivation.

Methods: This exploratory research will apply relational content analysis to data obtained through qualitative focus groups (n=21), leadership interviews (n=21) and data capture forms (n=21). Concepts and relationships will then be visualised through cognitive mapping, in this instance, to visualise how focus group and interview participants view different influences on school food consumption and how these influences relate to one another.

Results: Full results will be presented, though initial observations suggest the following influences on consumption: meal cost, child confidence and persistence in trying new foods, encouragement, supplemental funding, meal composition, family dynamics (including parental influence and discussions about school food), food satiety, perception of food served and logistical influences on eating time.

Discussion: This research will identify factors across the entire school food supply chain that can influence consumption, and whether these vary by deprivation level. By examining these potential disparities, this research may inform policy expansions and adaptations to effectively tackle diet-related inequalities.

Poster 12

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Title

Estimating global and UK uncertainty in GHG and land use impacts of substituting pulses for poultry for beef, from Poore & Nemecek LCA data

Abstract

Background: Quantifying uncertainty in environmental impact estimates is rare, even though uncertainty about distal outcomes is unavoidable. We use publicly available figures from Poore and Nemecek's 2018 global meta-analysis to estimate global and country-specific uncertainty in greenhouse gas (GHG) emissions and land use impacts for selected foods, and quantify uncertainty in substitution benefits relevant to UK diets.

Methods: Using the database, we analyse beef, poultry, and beans and pulses; estimating global mean impacts for GHG emissions and land use using random effects meta-analysis, with uncertainty intervals. We then derive country-specific deviations from these pooled values. Finally, to estimate substitution benefits relevant to UK consumption, we compare UK beef and poultry impacts; and UK poultry with Indian beans and pulses (reflecting a major source of UK chickpea imports).

Results: Estimated global mean GHG emissions were 84 kgCO₂ eq for beef (95% CI: 43 to 124), 11 (8.2 to 13) for poultry, and 1.9 (1.4 to 2.4) for beans and pulses. Corresponding land use estimates were 190 m² year (130 to 250), 16 (10 to 22), and 10 (5.2 to 16). These results indicate at least 20% uncertainty around global averages. UK-specific substitution estimates suggest that replacing 1 kg of beef with poultry reduces GHG emissions by 44 kgCO₂ eq (26 to 61) and land use by 120 m² year (110 to 140). Replacing UK poultry with Indian beans and pulses yields much smaller and more uncertain benefits: 9.7 kgCO₂ eq (-7.5 to 27) and 9.1 m² year (-8.2 to 27). As land in different contexts is not interchangeable, this comparison is to illustrate uncertainty rather than actual land use benefit.

Conclusions: Substitution benefits estimated from publicly available LCA data carry substantial uncertainty, at the global and country level, even before farm-level variation is considered. Our results therefore provide a lower bound on uncertainty in substitution effects on environmental outcomes. Our work highlights the importance of uncertainty quantification in food system modelling and suggests that policy or dietary recommendations based solely on point estimates risk suboptimal deployment of interventions of uncertain effects. Key limitations include the use of pre-harmonised data and incomplete supply chain specificity.

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Title:

Bridging theory and practice for actionable change in transforming food systems (BRIDGE-ACT): Impact Planner Toolkit

Abstract

The Bridge-ACT Toolkit is a digital dashboard and hands-on tool to support learning about the food systems approach. This resource has been developed and tested to facilitate systems-thinking as a printable resource designed to support local authorities in Scotland to design, plan and justify structural interventions, particularly within complex systems approaches, including the food environment. It guides stakeholders through a structured process (REF): mapping the problem using stocks, flows and feedback loops; identifying leverage points; and translating insights into actionable, evidence-informed interventions aligned with statutory duties and local outcome improvement plans.

The toolkit adopts a whole-systems framing that maps interconnected domains - health, economy, society, politics and environment - into a coherent structure for analysing food system challenges and identifying points for coordinated action, building on the conceptual foundations set out by Parsons, Hawkes and Wells (2019). This framing enables participants to move beyond single-issue responses and consider cross-sector impacts, trade-offs and co-benefits.

Designed for workshop use, Bridge-ACT produces tangible outputs - using annotated system maps, prioritised leverage points and defined commitments - that can be incorporated directly into strategic plans or funding bids. With adaptation, the toolkit has potential for national scale-up, offering a consistent yet locally adaptable method for participatory, systems-based intervention design.

References:

1. Parsons, K., Hawkes, C. & Wells, R. (2019). Brief 2: Understanding the food system: Why it matters for food policy. London: Centre for Food Policy. Available online: <https://openaccess.city.ac.uk/id/eprint/22795/>
2. The Bridge-ACT dashboard (2026). Available at: <https://sbx-bridge-act-1.abdn.ac.uk>

