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**A rapid evidence assessment  
of UK citizen and industry  
understandings of  
sustainability**

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**Why our understanding of sustainable  
food is important when making food  
choices.**

**June 2022**

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# Executive Summary

The Food Standards Agency (FSA) commissioned the Centre for Food Policy at City, University of London and collaborative partners to carry out a Rapid Evidence Assessment (REA) on UK citizen perceptions of food sustainability. This Executive Summary presents the findings of this REA, along with academic definitions of food sustainability (and how citizen definitions compare to these), and a rapid review of industry and NGO approaches to sustainability amongst a small random selection of 21 organisations across the food system. Please refer to the full report and appendices for detailed findings and methodology.

The main research question addressed is: What does sustainability mean to UK citizens when it comes to food and diet? The report addresses the following secondary questions: How does the UK academic literature define sustainability, 'sustainable food' and 'sustainable diet'?, how do citizens' perceptions compare to this, and 'What does sustainability mean to industry when it comes to food and diet?'. A number of sub-questions and themes were explored to answer the main research question, such as understanding and importance of sustainability and its impact on food choices, trade-offs, drivers and barriers to sustainable food choices and differences across demographic groups.

To note: In this Executive Summary we refer to communities and individuals in the UK as "UK citizens", rather than UK consumers. The use of the term citizen is not meant to be a reference to citizenship either directly via birth in the UK or through the process of naturalization.

## Research methods

This review uses multiple methods to answer these research questions. These include a general review of literature, a Rapid Evidence Assessment of 102 papers in the UK academic literature published between 2020 and 2022, and a review and coding of 21 industry and NGO websites and related sustainability documents.

The 102 papers were coded with 225 keywords developed from the academic definitions of sustainability. The five most used keywords include Consumer information, Environment or environmentally friendly, Meat, Food behavior/behaviour, and Health/healthy.

15 keywords were not linked to any papers. Keywords not used include concepts for consumer food safety (such as Allergens, Illness, and Hand washing) although the keyword of Safety was been linked to 18 (18%) papers. This lack of use of these keywords does not imply that UK citizens do not relate to these keywords. Rather, there may be a bias in the academic literature towards specific established keywords and concepts.

The 102 papers identified in the REA were wide ranging in methodological approach. However, **no papers were classified as Economic studies (e.g. Cost Benefit Analysis)**. It is important to note the absence of economic studies engaging in sustainability within the current literature. Economic studies are needed to understand the economic benefits and trade-offs of different food-sustainability solutions and innovations.

## Key Findings

### Definitions of Sustainability, ‘sustainable food’ and ‘sustainable diets’ in the academic literature

Currently, **sustainability** is depicted in academic literature as an interaction between three pillars: economy, environment, and society, with the fourth pillar of human health sometimes being included, as something that is in the interest of “future generations”. Since the emergence of the [UN Sustainable Development Goals \(SDGs\)](#) in 2015, there has been a trend in the literature towards increasing focus on how to measure sustainability, and identification of indicators and metrics to assist monitoring, measuring and reporting on sustainability initiatives and interventions.

While the literature recognises food as a leading driver of climate change, papers tend to define **sustainable food** in terms of production, and there is a lack of discussion around sustainable consumption habits. ‘Planetary boundary’ theory and the limits of the natural environment have emerged as key concepts in the context of sustainable food

production. Most papers avoid specifying exact foods that can be considered sustainable, but sustainable food is seen as that which has positive impacts on human and planetary health.

The concept of **sustainable diets** in the literature considers the interplay between food, health, culture and environment. The FAO definition of sustainable diets (FAO, 2012) is drawn upon in many papers, and encompasses human and planetary indicators such as biodiversity/ecosystems, dietary health, access, and safety, to guarantee future food and nutrition security while optimising resources. The definition of sustainable diets is evolving to include cultural, ethical and economic indicators, and to recognise that regional cultural and dietary variances may present limitations to a global framework of sustainable diets.

**Sustainable food systems** are also a key concept in the academic literature, described as complex interacting and interconnected systems generating global food production and supply, and being a major contributor to GDP in both high and low-income countries. Sustainable food systems are recognised as having an integral role to the delivery of the UN SDGs and have the potential to meet global nutrition demand, ecosystem stability and economic security, while mitigating health issues.

**Sustainability metrics and indicators** are identified in the literature as key to evaluating social, economic, environment, and political sustainability. Most indicators in the literature relate to the environment pillar of sustainability, for example 'per-capita land use' and 'per-capita GHG emissions', while social indicators, such as 'poverty index' or 'child labour', are less frequently referenced. Holistic indicators are required to assess sustainability from more than one viewpoint. A limitation of many metrics is their assumed universal applicability, whereas some scholars recognise that metrics need to be flexible and adjusted to varying socio-economic and regional circumstances.

## **UK food industry and NGO approach to sustainability in food and diet**

Based on analysis of sustainability commitments and resources of 21 UK food industry organisations and NGOs along the food chain, it appears that they tend to focus on a small range of sustainability topics which they perceive as being within their ability to act on. For the most part, their sustainability strategies do not go beyond their organisational

boundaries or core business; for example, only organisations directly involved in primary production, and some citizen-facing ones, mentioned primary production impacts. Similarly, transport was not addressed where it was not part of the core business, except for supermarkets and restaurants doing home delivery who articulated intent to switch to electric vehicles.

Most organisations do not provide any definition of sustainability. The top areas addressed in company/NGO sustainability documents, in order of frequency mentioned, were food waste, carbon footprint, recycling, environment/environmentally friendly, and energy, followed by packaging, plastic, water use, and greenhouse gas emissions.

Only one third of the organisations sampled appeared to link their sustainability plans to the wider food system context. While many goals were outlined, and some had science-based targets, specificity of action was often lacking, as were commitment of resources and targets, and many goals were aspirational in nature. Less than half of the organisations sampled provided timeframes, and only two organisations committed budget to sustainability actions.

Collaboration with other actors is common and external accreditation for sustainability appears to be growing. The research shows that many of the membership organisations/industry bodies have produced a wide range of resources on sustainability, and much of these resources are publicly available beyond their membership. UK supermarkets appear to be leading the way in terms of communicating their sustainability goals and targets to citizens.

## **UK citizen understanding of sustainability in food and diet**

### **Current understanding of sustainability and its impact on food choices**

- Challenges are identified around the definition of and knowledge of what constitutes sustainability and sustainable food. Overall, the evidence shows limited citizen understanding of sustainability when making food choices, with understanding mostly related to one aspect of sustainability (e.g. either environment or health, or both health and environment jointly ('good for you and good for the planet', or ethics).



- While health and environment are both key topics associated with sustainability in the literature, far more studies in this review are concerned with environmental drivers of food choices than with health drivers.
- Health appears to be a stronger driver of individual food behaviour than environment, and several studies indicate that high concern with health factors corresponds to lower concerns with environmental factors in the minds of citizens. Price, taste and individual health are stronger drivers of food choice than sustainability, but health is often mentioned as a reason for sustainable eating, linked to consumer psychology and processes of self-construal, and the public health guidance on healthy eating, alongside public concerns for meat reduction for reasons of cost, animal welfare and food safety.
- Evidence reviewed suggests that UK citizens have low awareness of the environmental impact of food. There are also gaps in understanding between citizen perceptions of what are sustainable foods versus scientific evidence based on life-cycle assessments, for example, citizens underestimating high impact foods, and overestimating low impact foods.

### **Sustainability Attributes**

This is an unranked summary of citizen understanding/attitude towards some of the most common sustainability attributes that appear in the results.

#### **Local**

- Local has emerged as a key concept often equated with environmental sustainability. Citizens tend to associate environmentally sustainable food with low food miles, locally produced meat, and trusted nationally recognised standards, as well as with organic.
- Local is also perceived as being better for farmers and the local economy.

#### **Organic**

- Organic production methods are sometimes equated with Local in some citizens minds, even if this is not the case.
- Organic labels have a high level of trust, but UK citizens favour national standards (for example, Soil Association) and are less trustful of the EU organic mark.

- One study found that buying organic was not viewed as having high environmental benefit.
- Organic production is viewed as having higher animal welfare standards than conventional production, and being better for human health due to low/no use of chemicals.

### **Animal Welfare**

- Animal welfare is a key driver towards sustainable diets, with citizens motivated to renounce meat mainly due to environmental, health and animal welfare reasons.
- However, the concept is complex, and citizens have varying perceptions of animal welfare and unequally distributed concerns about different species.
- Some citizens perceive the need to increase animal welfare in farm animals, but have low knowledge of farming and welfare conditions.
- Citizens see welfare as a food quality attribute, but there is inconsistency in willingness to pay (versus ability to pay) for enhanced animal welfare.
- Animal welfare is associated with better human health benefits and this is the main motivation for buying high animal welfare products. But high animal welfare products are also seen as higher quality, tastier, more hygienic, safer, acceptable, authentic, environmentally friendly and traditional.

### **Meat and Dairy Consumption/Reduction**

- Limiting meat and dairy intake has been shown to be a way for citizens to reduce their dietary environmental impacts.
- The environmental impact of meat production is not well understood and even doubted. However, when citizens understand the impact, reduction is seen as important.
- There is a lack of clear vision/understanding of what 'less and better' means in terms of meat and dairy consumption.
- Evidence shows a slow shift towards more plant-based diets and a willingness to eat less meat if it is attractive, convenient, and accessible.
- There is a perception of meat being culturally important across all demographics in the UK diets, yet one study suggests the strong social desirability of meat reduction.

## **Plant-based alternatives and other innovations**

- Evidence points to a halo effect around plant-based food and diets, which tend to be perceived by citizens as healthy and environmentally friendly. This is despite these foods sometimes being ultra-processed and having a higher environmental impact than minimally processed plant-based foods.
- An emerging trend towards eating highly processed plant-based convenience foods may be a public health concern. Younger people and those who have been vegetarian for a shorter time eat significantly more ultra-processed plant-based foods.
- Citizens are more accepting of meat alternatives when they replicate processed meat products (e.g. burgers) as opposed to imitating cuts of meat (e.g. escalope, steak).
- Citizens are also more open to using alternative sustainable ingredients, such as upcycled sunflower flour (Grasso and Asioli, 2020), when incorporated in processed foods, but food neophobia (a fear of new, or novel foods) is a barrier to accepting some foods (such as insects).

## **Food Waste**

- Minimisation of waste is a key concern for perceived food sustainability.
- Citizens are aware that throwing away food wastes money, but are unaware of the extent and impacts of systemic food waste.
- In studies of citizen acceptance of upcycled ingredients (Grasso and Asioli, 2020), citizens were not aware of the term and what it means in food, but once aware, were willing to try products made with upcycled ingredients, e.g. biscuits.
- Citizens generally respond positively to foods that contribute to waste reduction (for example, made from upcycled ingredients or food surplus) .

## **Packaging**

- Citizens are aware of the possible negative effects of packaging and the importance of recycling.
- There is a potential gap in understanding between the perceived and actual environmental impacts of different packaging materials.

## Health

- Health is identified as a stronger driver of food behaviours than environmental concerns.
- Studies found that citizens are often unsure of what ultra-processed foods (UPFs) are. They perceive most processed foods to be unhealthy and most perceive UPFs as highly processed products with additives, artificial ingredients and low nutritional quality. However, some processed foods, culinary ingredients and minimally processed foods (such as pasteurised milk, flour, cheese, meat, bread) were wrongly perceived to be UPFs.

## Importance and Impact of sustainability perception on food choices

### Trust and Labelling

Trust is important in citizens' understanding of sustainability when making food choices.

- Eco-labels, sustainability labels, and front of pack labels were identified as trusted information sources across various demographic groups and food product types. However, citizen preconceptions around sustainability impacts play a role in their level of trust in sustainability/eco labels, and varying perceptions of the meaning of labels also informed their understanding of the sustainability of the product.
- Labels that influence citizen understanding of sustainability impacts of products include: provenance/locality, organic certification, free-range, health information, ethical labels (e.g. Fairtrade), feed standards, and carbon footprint labelling. Citizens value 'free range' as an attribute and believe packaging should reflect animal welfare.
- 4 studies also raised citizen concerns, scepticism and distrust around labelling and certifications, with varying levels of trust for different labels/certifications. Citizens cited fear of 'green-washing' in current labelling due to lack of sustainability criteria used to create them. Foodservice professionals were shown to be distrustful of the data used to calculate carbon footprint labelling.

- UK citizens were shown to have a high level of trust in the Soil Association's organic certification and low levels of trust in the equivalent EU organic standard, possibly due to historic presence and citizen awareness.
- Distrust may be reduced through increased education from the food industry around the problem or issue that the novel product seeks to solve, such as through marketing strategies.

### **Eco-labels and Omni-label**

- Lack of a single definition of what eco-labels show, or consistency in how sustainability of food is measured, contribute to lack of certainty and mixed effects.
- Some studies show hesitancy to accept or trust eco-labels, yet the need for labels that simplify complex data is expressed, and labels such as traffic light symbols appear effective in helping citizens interpret data. The evidence in this review indicates an absence of a single definition of what an ecolabel shows. This infers the development of labels of this type has not yet concluded, and is still being considered, and tested with citizens. However, their impact on decision-making was not reported.
- The priority that citizens place on health attributes supports the case for omni-labelling to indicate both health and environmental sustainability, and may support citizens to consider the environmental impact of their food choices, particularly when making purchasing decisions under time constraints.
- Local production, transport method, organic status, and ethical production methods were aspects of sustainability citizens considered important. However, no studies were found that incorporate these aspects in labelling choice experiments.

### **Social Norms and Influencing behaviour**

- One study showed that adding a greater number of vegetarian options to a menu has limited effect on people choosing vegetarian. Another study showed that 75% of menu options needed to be vegetarian in order to significantly shift behaviour, positing social norms relating to eating meat as the reason for this.
- Social learning and changing norms within social networks are identified as being powerful in changing citizen eating behaviour.

- o Social and cultural norms are important to food choices in out of home environments. In university settings, reducing meat consumption was seen as a positive social attribute.

### **Citizen dissonance and say-do gap**

Broadly there appears to be an issue of perception versus reality regarding issues of environmental sustainability and food, and a potential gap between intention and action.

- o Intention to act was a significant predictor of sustainable behaviours, but citizen behaviour may be influenced primarily by personal beliefs, values and attitudes, and impacted by material and structural factors
- o Although citizens may intend to be environmentally sustainable, their shopping baskets may not reflect this, and environmental self-image does not always translate to the construction of a low-carbon shopping basket. Social desirability bias may also mean that participants' responses in surveys may not reflect their actual purchasing behaviour.
- o Citizens are aware that the food system has impacts on the environment but may not understand impacts of specific dietary behaviours.
- o There is some divergence between citizen perceptions and scientific evidence of the environmental benefits of certain food behaviours; in one study citizens believed the largest environmental benefit could be achieved from 'reduce consumption of air-freighted foods', 'reduce food waste' and 'buy locally grown produce' but deemed the actions 'prioritise plant-based proteins' and 'choose organic produce' to be of low environmental benefit. However, life-cycle assessment data indicates avoiding air-freighted food, choosing organic, and consuming a plant-based diet are the actions that have larger environmental benefit.
- o Environmental self-image may not correlate to real world behaviours, unless under conditions of social scrutiny. For example, in one study citizens said they considered themselves environmentally conscious and would like to see more sustainable packaging on the market but yet stated that packaging was not on their list of considerations when purchasing at a different stage of the process.
- o One literature review found that while citizens recognised sustainability attributes, they believed that sustainability does not yet influence their food choices.

## Affordability

- o Citizens consider price, taste and health more influential in food choices than environmental sustainability. Health and environment, as two key elements of sustainability, are treated differently by citizens, and health is given priority alongside price over environmental concerns.
- o Citizens perceive fruit and vegetables, ethical foods, and low carbon foods to be high cost. However, one study shows that increased consumption of fruit and vegetables over a sustained period is used as a strategy by citizens to save money and address food insecurity.
- o In one study citizens believed that sustainable food, which they defined as local food, should be required in public procurement practice, but a separate study in a university environment showed that citizens and businesses believed sustainable food to be too expensive to include on café menus.
- o In out-of-home environments, social norms appear to be stronger than price as a driver of reducing meat consumption. Reduction of meat tends to be motivated by environmental concerns rather than as a cost-cutting measure. However, while citizens value proscribed standards for meat production, they are not always willing to pay for them.
- o Citizens perceive food waste as impacting on the affordability of sustainable diets (changes to diets possibly resulting in waste). In one study, the lack of clarity about food sustainability meant that food waste was understood as an economic issue rather than an environmental issue, and perceived to be a barrier to affordable sustainable diets.

## Trade-offs

- Perceived trade-offs against sustainability found in the literature include, in order of frequency: cost, taste/sensory attributes, nutritional content and quality, health, familiarity and food/technology neophobia, provenance and sustainable production/ethical concerns, disgust at the production method (for example, lab-grown meat, eggs from chickens fed on insects), availability, animal welfare, environmental concerns about alternative foods, pleasure, social pressure not to change diets, and maintaining individual freedom of choice.

- Quantitative estimates of citizen trade-offs were scarce.
- Some studies showed willingness to pay more for local production of meat, organic meat, and sustainability certification and health claims on fish, but mixed evidence for willingness to pay for low carbon footprint.
- Trade-offs exhibit differently for different groups, for example those on low-income or with strong attachment to familiarity, or with existing environmental concern.
- Overall, where sustainability is not the citizen's priority, they will make trade-offs in favour of health, taste, convenience and other personal factors. If these priorities can be aligned with sustainability objectives, they may present an opportunity to nudge citizens towards sustainable choices.

## Barriers to sustainable food choices

- Cost, including high price of organic or sustainable options, lack of knowledge and awareness, and lack of availability are identified as key barriers to sustainable food choice.
- Individual barriers include: personal preference, time constraints, lack of cooking skills, misconceptions about convenient cooking process, healthiness of unsustainable foods, mistrust of food labels, disinterest in environmental impacts, and belief that their choices don't make a difference.
- Lack of knowledge/understanding: One choice experiment showed that citizens did not associate meat content with carbon footprint and reduced meat content was associated with reduced willingness to pay.
- Culture and Attitudes:
  - established messaging around the nutrient quality of dairy milk shapes citizen attitudes and appears to limit the reach of dairy alternatives. Concern about loss of nutrients was shown to be a barrier to reduced meat consumption.
  - habitual purchasing behaviour is a barrier to food waste reduction
  - perception of meat alternatives (such as plant, cultured meat, and insect-based meat) being less appealing appears to affect food choice



- food neophobia and social and cultural norms make some citizens uncomfortable with alternative food choices.

## Drivers of sustainable food choices

Key Drivers and motivating factors of sustainable food choices can be divided into 5 categories:

1. Psychological factors: perceived well-being and healthiness, citizen knowledge, information (for example, eco-label), personal preference and desire to eat sustainably, and awareness of sustainable food choices.
2. Intrinsic factors: nutrient properties, taste, and visual attractiveness .
3. Extrinsic factors: freshness and naturalness, production method, and lower prices for organic/sustainable products .
4. Socio-cultural factors: attitude towards pro-environmental behaviour, animal welfare, citizen habit, intent and emotion towards sustainable food choice options, food safety concerns, income, social motivation, and trust in certifications and labels, and sometimes religion.
5. Demographic and physical factors: gender and age can be important in preference for sustainable food choice, with various studies associating sustainable food behaviour with being female, young, middle-class, educated. Increased availability, access and convenience positively impact sustainable food choice.

Education and awareness raising is identified as key to driving sustainable food behaviour:

- Motivations and learning rooted in nutritional knowledge are essential to drive behaviour change towards more sustainable behaviours.
- Knowledge can change behaviour; in an intervention with a large UK retailer, promotion of food systems thinking, practices, products and knowledge, achieved sustained behaviour change amongst citizens of varying age, including reduction in meat consumption, reduction in food waste, and cooking from scratch. This study supports transforming citizens to food systems citizens who understand the challenges and have the knowledge to respond.

## Demographic and Socio-economic factors

### Gender:

- Gender is a significant predictor of sustainable behaviours with women more likely than men to be more open to meat replacement with non-meat protein sources, more likely to be currently prioritising plant proteins, and more sensitive to environmentally friendly products. While both men and women consider carbon footprint important, female adults with higher incomes have a more positive attitude towards carbon footprint labels than males.
- Women, millennials, and high-income earners have the highest plant-based meat alternative food consumption.
- Drivers of female preference for plant-based foods appear to be animal welfare and environmental concerns.
- Gender stereotyping may play a role in sustainable food choice; studies found being vegetarian and having ethical consumption habits are perceived as more feminine, which may inhibit men from displaying these behaviours.

### Age

- There are varying results regarding age and sustainable food practices.
- Young people are more likely to be considering change to organic or to sustainable fish, young urban dwellers of high socio-economic status are more likely to eat sustainably, and 18-24 year olds are most likely to consume processed plant-based convenience foods.
- Older people are more likely to be concerned about the impact of food waste, and upper-middle class people over 55 are more likely to purchase sustainable fishery and aquaculture products.
- In an intervention study at different life stages, pre-family stage participants reported eating meat more frequently, family stage reported cooking from scratch less frequently, and retired participants were more likely to opt for vegetables than plant-based meat alternatives.

## Other factors:

- Education is an important driver for sustainable lifestyles, food choice and vegetarianism, with higher education levels associated with more sustainable food behaviours.
- Higher socio-economic background is associated with sustainable behaviours.
- There are differences between countries in behaviour and attitudes: in a study of European countries, EU origin of meat was valued positively and favoured over New Zealand imports, except in the UK where there was no significant difference in willingness to pay between EU and NZ meat. The UK also had lower willingness to pay for organic and low carbon footprint food despite these being positively valued.

# Recommended actions for the FSA

The FSA's vision of the food system over the next five years is one in which (1) Food is safe, (2) Food is what it says it is, and (3) Food is healthier and more sustainable. This REA highlights key evidence gaps around citizen and industry understanding of UK food sustainability.

Although the FSA does not hold direct policy responsibility for health and sustainability of food (apart from nutritional standards and labelling in Northern Ireland), in line with the organisational roles identified in the 2022-2027 Strategy, the FSA could play a significant role in advancing UK food sustainability, particularly through evidence generation and as a convenor and collaborator across sectors.

**The FSA as an evidence generator:** The FSA can play a leading role in continued evidence synthesis of rapidly evolving research on UK food systems and citizen and industry perceptions of sustainability. This is due to the FSAs commitment to publish all its research outcomes, thus providing transparent and objectivity evidence for external and internal (UK government) stakeholders. There is already ongoing FSA research contributing to this agenda: laboratory analyses of new food products and FSA work on assessing alternative proteins. Future primary research led or commissioned by the FSA should address: the safety and sustainability of new food products and practices; developing a working definition, criteria and suite of indicators for sustainable UK food;

improving data quality and methodological reporting within sustainability metrics; further engagement with a broader range of the UK population; generating evidence for intervention effectiveness on behaviour change for sustainability; qualitative evidence to improve industry and policy support for citizen choices; economic studies of sustainable food system adaptations.

**The FSA as a policy maker:** Providing support, evidence and expertise to other government departments leading in, and working on sustainable food system policy to ensure food safety and regulation are adequately considered and managed. This links with the FSAs role as an evidence generator.

**The FSA as a regulator:** Inclusion of sustainability considerations in existing FSA work with meat, dairy and wine industries and in recommendations for local authorities and port health authorities. Regulation and support of industry commitments for sustainability and regulation of sustainability claims and eco-labelling, once best practices are established through working groups and or industry/government commitments.

**The FSA as a watchdog:** Horizon scanning and monitoring of developments within the UK food system geared towards sustainability to ensure safety and transparency for citizens, and to increase trust in sustainable products. Reporting and communicating findings direct to citizens and in annual reporting on UK food systems to Parliament.

**The FSA as a convenor and collaborator:** Convening stakeholders and collaboration will be crucial across all FSA roles:

- In order to generate robust inter-disciplinary evidence for safe, healthier and more sustainable food,
- to engage with citizens to increase awareness of food sustainability issues,
- to encourage greater sustainability commitments and transparent reporting in industry,
- to develop criteria for regulating sustainability claims and to support policy development for more sustainable UK food.

Collaboration should include actors within the UK food system and internationally, in line with the FSA Strategy 2022-27.

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# 1. Introduction

*“...sustainability is, I think it's like, producing enough for your generation without impacting future generations' ability to do the same, and ultimately, this is not sustainable.”* Citizen quotation from Round 1 of National Food Strategy Independent Review, The Public Dialogue. (Hopkins Van Mil, 2021).

In this section we outline the context in which this work was commissioned and delivered, our key objectives, and the methods and samples used in our rapid evidence assessment. Please see Appendix A, Document 1 for the full methodology, Appendix G, Document 2 for a summary list of reviewed papers, and the Executive Summary standalone report for a short version of this document.

## 1.1 Background to this research

The Food Standards Agency (FSA) is an independent government department tasked with ensuring ‘food we can trust’ for people in the UK. Beyond food safety, their work also supports wider public interests around food - issues such as food price, availability, standards, and (some elements of) standards around environmental and animal welfare concerns.

As part of the Wider Consumer Interests programme, the FSA is committed to being guided by consumer interest in the food system and continuing to explore and understand the public’s views, needs and priorities in relation to food and what they would like the FSA and government to do.

In 2022, the new FSA five-year strategy reflected these greater responsibilities towards health and climate change, including the goal to make food “healthier and more sustainable.”

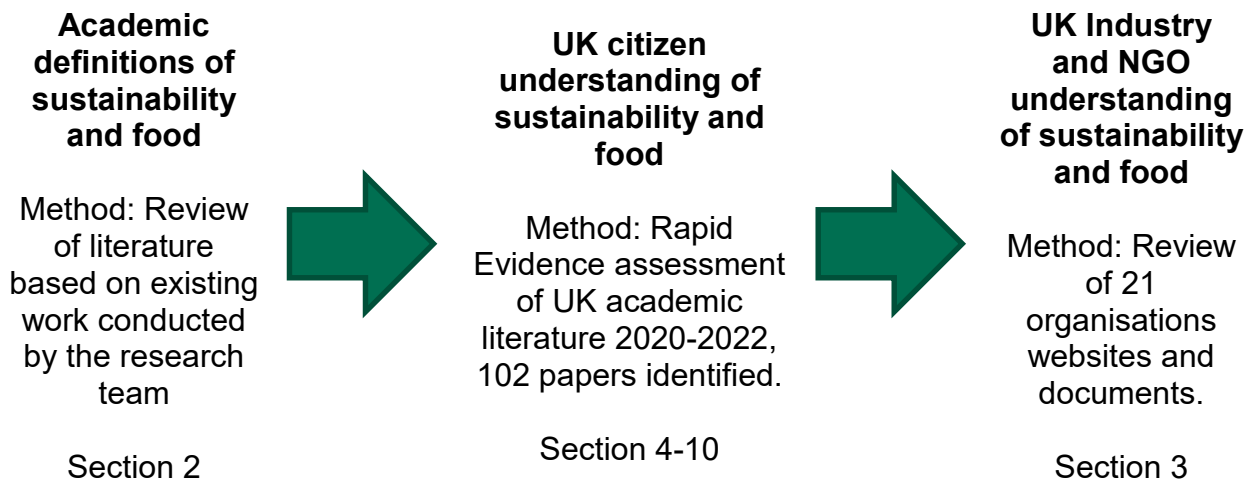
The FSA have amassed a rich evidence base on what matters to the UK public in relation to food and food governance, including how their views, behaviours and needs have changed over time. This evidence base has shown that the UK public have strong views on food sustainability related concepts and concerns.



In line with developing strategic thinking, the FSA wants to explore what sustainable food and a sustainable diet mean to citizens and industry (for example retailers, food producers/manufacturers, suppliers, food brands, restaurants/take-aways and delivery services). Furthermore, the FSA would like an indication of the public's level of understanding, to uncover how well people think they understand the term. The FSA would also like to assess how important sustainability is when making food choices, and the trade-offs that citizens face when making these decisions.

The FSA have some existing evidence around citizen attitudes and behaviours relating to sustainability e.g.: [Our Food Future](#); citizen poll on [Healthy and Sustainable diets, Food and You 2](#) and [Psychologies of Food research](#). In particular, [the Consumer insights report](#) in November 2021 (n=2,046), indicated that 62% of participants were concerned about Sustainability. This was equal in concern to animal welfare, with only food prices being higher in concern (71%). Likewise, the [Food and you 2, wave 3](#) survey in April-June 2021 (n=6,271 adults from 4,338 households) found that 73% of respondents were Highly (31%) and Somewhat (42%) concerned about food being produced sustainably. These findings are again comparable to 78% of respondents who were Highly (39%) and Somewhat (39%) concerned about animal welfare in the production process. In relation to the UK public's interests, needs and concerns around food, [The Public Wider Interests in Food](#) online survey in January 2022 (6,175 respondents) found evidence to suggest that many UK citizens do not trust the information provided by food businesses, and that on-pack information about environmental impact and animal welfare are not currently easy to interpret. The survey found the key sustainability issues that UK citizens would like the food regulator to work on with partners are to: 'ensure high standards of animal welfare including imports' (57%), 'ensure fair treatment of workers, farmers and small producers' (48%) and 'set standards to minimise food waste in the food chain' (46%).

This document combined multiple reviews to answer the above questions asked by the FSA, a summary of which is shown in Figure 1 below. A full description of the methods used is provided in Appendix A.



**Figure 1: Summary of reviews undertaken by the research group for this report.**

## **Note on the use of the term ‘citizen’ in preference to the term ‘consumer’**

The Food Standards Agency has begun to explore how it can involve the UK communities it serves when building the evidence-base on which policy decisions are made, [Citizen science and food](#).

For the purposes of this report, we refer to communities and individuals in the UK as “UK citizens”, rather than UK consumers. The use of the term citizen in this report is not meant to be a reference to citizenship either directly via birth in the UK or through the process of naturalization.

Instead, the term citizen is wholly inclusive, and highlights that all individuals in the UK have multiple meaningful roles in the food system beyond simply the purchase and consumption of food. This recognises that everyone is a contributor and collaborator within a safe, healthy, and sustainable food system.

We highlight that the terms ‘citizen’ and ‘consumer’ are both used throughout academic literature, although the term consumer was more popular.

The term consumer was used in the database search terms in the review process and so we have left the word consumer in the search terms so as to retain research replicability.

## **2. How does the academic literature define sustainability, ‘sustainable food’ and ‘sustainable diets’?**

### **2.1 Sustainability**

Sustainability is an amorphous term, however the concept can be traced back to the Enlightenment period (1600s – 1800s) and concerns over the finite nature of resources (Sharpe, 2016, Du Pisani, 2006). This has led to sustainable diets and sustainable food production being discussed by thinkers such as Thomas Malthus, Thomas Tryon, and Erasmus Darwin (Stuart 2007). The modern iteration of ‘sustainability’ is widely acknowledged as originating from The Brundtland Report (WECD 1987) published in 1987 by the World Commission on the Environment and Development. Other notable definitional contributions come from The Club of Rome (1972) (McGinnis et al., 1973), the IUCN (1980) (IUCN, 1980), and the World Summit on Sustainable Development (2002) (Un.org, 2014).

Sustainability is usually depicted as a relationship or interaction between three focal areas or pillars (Clapp et al 2021; Miller et al, 2021) with the majority of academic papers identifying these pillars as economy, environment, and society (van Bussel et al, 2022; Eme et al, 2019; POST, 2012), some including a fourth pillar: human health (Ahmed et al 2019; Fanzo, 2019; Ingram, 2011; Ericksen, 2008; Berrt et al., 2015; Schipanski et al., 2016; Béné, et al. 2019; Béné, 2020). This modern definition of sustainability also introduces a new set of stakeholders, “future generations” in whose interests’ sustainability is acted upon (United Nations, 2018; WCED, 1987; POST, 2012). In reviewing the academic literature, we observed a trend in papers published in the last six years which focus on how to measure sustainability, and the identification of indicators and metrics to assist monitoring, measuring, and reporting on sustainable initiatives and interventions (van Bussel et al, 2022; Gustafson et al, 2016; Chaudhary, Gustafson, and

Mathys, 2018; Eme et al, 2019; Clapp et al, 2021; Willet et al, 2019; Jones et al, 2016). This can be seen as a reaction to the development of the Sustainable Development Goals (SDGs) in 2015 by the United Nations, which require indicators and metrics to be adopted by national governments in order to review their progress against their commitments (United Nations, 2018). Table 1 below sets out the dynamic of key academic definitions and how they have informed current academic thought and literature.

**Examples of academic definitions of Sustainability, sourced from the wider literature, not exhaustive. Source: Author, 2022.**

*Sustainability is ‘a multidimensional integrative concept. Among other aspects, sustainability links the human and bio-physical, present and future, local and global, active and precautionary, critique and alternative vision, concept and practice, and universal and concept-specific. In addition, proper sustainability implementation engages together participants covering the full range of public, corporate and civil society organisations and institutions, as well as individuals with their various capacities and inclinations’ (Gibson 2006: 262) cited in (Sharpe, 2016).*

*Sustainability is ‘the long-term maintenance and enhancement of human wellbeing within finite planetary resources. It is usually considered to have environmental, economic and social dimensions’ (POST 2012: 1) cited in (Sharpe, 2016)*

*“Development that meets the needs of the present population without compromising the ability of future generations to meet their own needs for a resilient future for both people and the planet. To this end, there must be promotion of sustainable, inclusive and equitable economic growth, creating greater opportunities for all, reducing inequalities, raising basic standards of living, fostering equitable social development and inclusion, and promoting integrated and sustainable management of natural resources and ecosystems” (UN (2015)) cited in (Fanzo, 2019)*

*“Humanity has the ability to make development sustainable –to ensure that it meets the needs of the present without compromising the ability of future generations to meet their own needs.” (WCED 1987: 8-9 (Brundtland Report)) cited in (Sharpe, 2016)*

*Sustainability implies a state whereby the needs of the present and local population can be met without diminishing the ability of future generations or populations in other*

*locations to meet their needs or without causing harm to the environment and natural assets.* (WCED 1987 (Brundtland Report)) cited in (Fanzo, 2019)

## 2.2 Sustainable food

Food is acknowledged as a leading driver of climate-change (Willett et al, 2019) with academics identifying food production and consumption as routes towards achieving the UN's SDGs (Clapp et al, 2021; Fanzo, 2019). Whilst there has been a lack of discussion around sustainable food consumption habits, papers focussed on the definition of sustainable food in relation to its production (Willett et al, 2019; Gustafson et al, 2016; Miller et al, 2021). Within the context of sustainable food production, the notion of boundaries and/or limits is touched on (Willett et al, 2019; Chaudhary, Gustafson, and Mathys, 2018; Jones 2021), most notably in reference to the 'Planetary Boundaries' theory (Rockström et al, 2009): a seminal theory that identifies the existence of natural environmental limits and defines the boundaries of the "planetary playing field" for humanity if we want to be sure of avoiding major human-induced environmental change on a global scale (Rockström et al, 2009).

Whilst the majority of papers reviewed evaded specifying exact foods that are considered sustainable, Miller et al identified metrics that could indicate food sustainability properties, for instance; degree of processing, locality/proximity to food production, freshness, price and nutrient density (Miller et al, 2021). Only one paper, (Willett et al, 2019) discussed what sustainable food looks like, defining it as plant-based, produced using environmentally positive agricultural methods and/or sustainable intensification, with reduced food loss and waste (both up and down stream).

Sustainable food in the academic literature is seen as that which has positive impacts on human and planetary health (Gustafson et al, 2016; Willett et al, 2019; Miller et al, 2021) with sustainable diets described as a 'win-win' for sustainability (Willett et al, 2019). The key academic definitions of sustainable food are set out in Table 2.

**Academic Definitions of Sustainable Food, sourced from the wider literature, not exhaustive. Source: Author, 2022.**

*Sustainable food production needs to include the role played by food production in regulating the state of ecosystems, the biosphere, and ultimately the Earth system. This*

*means considering the complex systemic interactions from local to global scales, and identifying global boundaries within which the global food production needs to stay in order to safeguard biophysical processes that support a stable Earth system. (Willett et al. 2019).*

*“must not only be nutrient dense and produced in a way that is respectful of the environment, but accessible and affordable to all consumers.” (Miller et al. 2021)*

*“sustainably-produced, nutritious food in the face of human population pressure, resource scarcity, ecosystem degradation, and climate change.” (Gustafson et al. 2016)*

*the definition of sustainable food production requires setting planetary boundaries for food production impacts on the climate system, land systems, freshwater, biodiversity, and nutrient cycles of nitrogen and phosphorus. (Willett et al. 2019)*

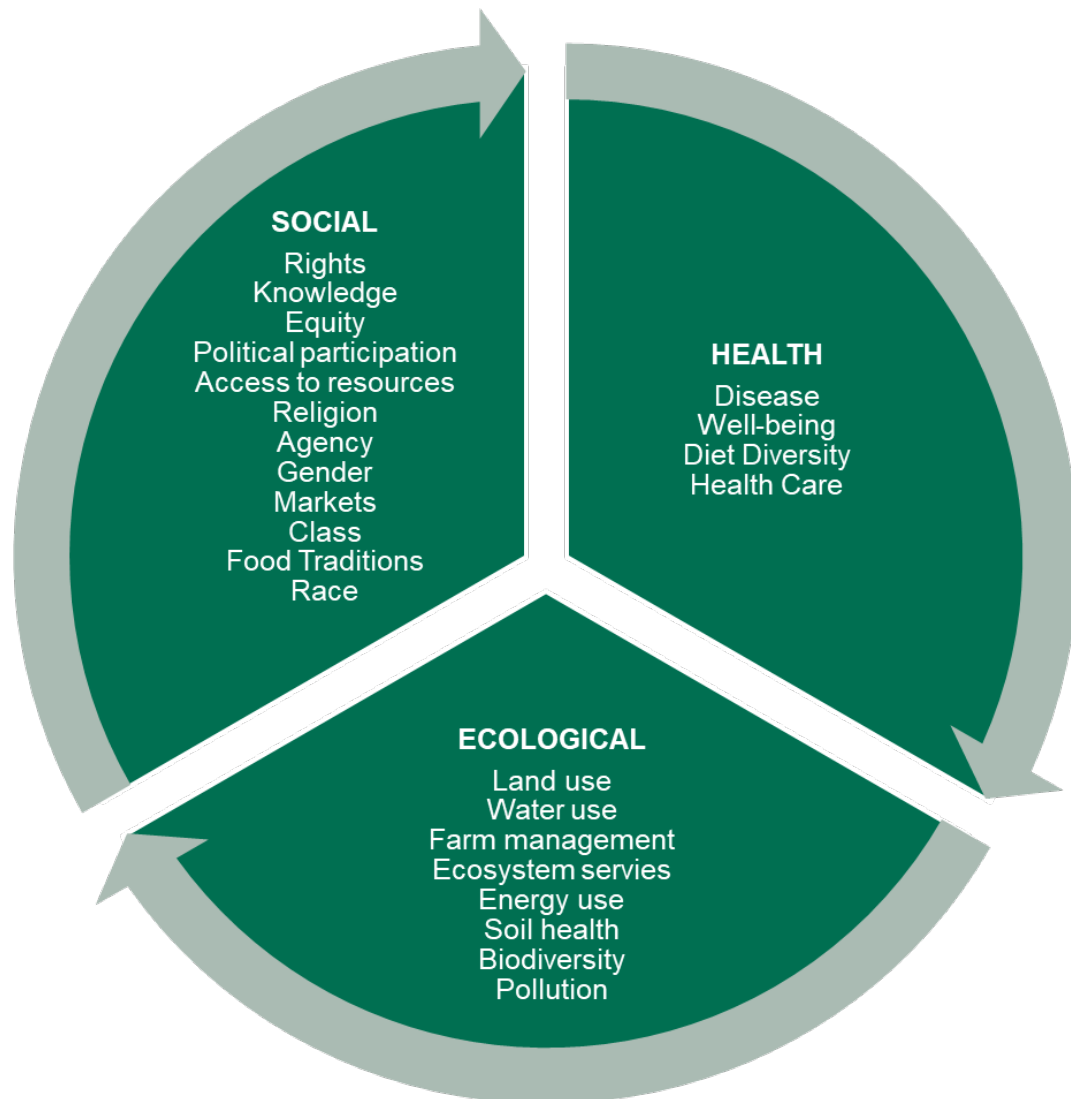
## **2.3 Sustainable diets**

The concept of ‘sustainable diets’ began to emerge in the academic domain a few decades ago. In 1986, Gussow and Clancy were among the earliest to discuss the interplays between diet, health and nature, describing “maintaining long-term health [while] avoiding excessive degradation and consumption of natural resources” (Gussow and Clancy, 1986). The notion of food production and consumption in consideration of planetary impacts, i.e. ‘boundaries’ or ‘limits’, leads contemporary academic definitions to discuss complex interplays between food, health, culture and the environment.

The FAO definition of sustainable diets encompasses a number of human and planetary indicators, such as biodiversity and ecosystems, dietary choice, affordability, access, safety and health, to guarantee future food and nutrition security while optimising resources (FAO, 2012). This is set out visually in Figure 2, and is cited in Bussel et al (2022), Eme et al (2019), Chalmers et al (2019), Jones et al (2016), Miller et al (2021), Fanzo, (2019) and alluded to or drawn upon in many other definitions.

We have shown that academic definitions of ‘sustainable diets’ evolve over time, as evidenced in Table 3, but there are also limitations to presenting a consistent global framework for sustainable diets. These limits are in-part due to two factors 1) regional cultural and dietary variances and 2) reconciling cultural, ethical, environmental and

economic indicators, while at the same time focusing on a reduced suite of indicators to measure sustainability (Chaudhary et al, 2018; Clapp et al, 2019; Willett et al, 2019).



**Figure 2 ‘Conceptual framework of the components of sustainable diets’. Adapted from FAO (2012).**

**Academic Definitions of Sustainable Diets, sourced from the wider literature, not exhaustive. Source: Author, 2022.**

*“diets with low environmental impacts which contribute to food and nutrition security and to healthy life for present and future generations. Sustainable diets are protective and respectful of biodiversity and ecosystems, culturally acceptable, accessible, economically fair and affordable; nutritionally adequate, safe and healthy; while optimizing natural and human resources”.* FAO, (2012). Sustainable diets and biodiversity: directions and solutions for policy, research and action. International Scientific Symposium, Biodiversity

and Sustainable Diets United against Hunger. FAO, Rome, Italy. cited in van Bussel et al (2022), Eme et al (2019), Chalmers et al (2019), Miller et al (2021), Fanzo, (2019).

*“sustainable diets’ is an encompassing term. Truly sustainable diets are those that prioritize nutrient-dense foods produced using sustainably sourced ingredients and not a diet solely comprising foods with the lowest carbon footprints.”* Miller et al (2021)

*Sustainable diets are protective and respectful of biodiversity and ecosystems, culturally acceptable, accessible, economically fair and affordable; nutritionally adequate, safe and healthy; while optimizing natural and human resources”.* FAO, 2012 cited in Jones et al (2016)

*Sustainable diets are protective and respectful of biodiversity and ecosystems, culturally acceptable, accessible, economically fair and affordable; nutritionally adequate, safe and healthy; while optimizing natural and human resources”.* FAO, 2012 cited in Jones et al (2016)

*“maintaining long-term health [while] avoiding excessive degradation and consumption of natural resources”.* Gussow and Clancy (1986) cited in Jones et al (2016)

*“diet as the set of food, beverages, and nutrients that are consumed by an individual or by a community of individuals during a certain period. A number of environmental, health-related, and socioeconomic factors can influence diets. The consideration of the interrelationships between these factors, particularly in the context of environmental resource limits, led to the concept of sustainable diets.”* Eme et al (2019)

*“in order for a diet to be sustainable, it must be healthy”.* Chalmers et al (2019)

*“truly sustainable diets comprise foods that are affordable, nutritious, developed with ingredients produced in an environmentally friendly manner, and consumer preferred.”* Miller et al (2021)

*“captured the complexity of sustainable diets, where aspects of nutrition and health, culture, pleasure, equity, well-being and health, environment, and biodiversity protection”.*



Johnstone et al (2014) cited in Miller et al (2021)

*concepts of “sustainable diets” are those that promote environmental and economic stability through low-impact and affordable foods, while at the same time improving public health through adequate nutrition.* Johnstone et al, (2014) cited in Fanzo, (2019)

## 2.4. Sustainable food systems

The role of global food systems is defined in the academic literature in terms of their contribution to the global food production and supply, and contribution to a major portion of gross domestic product (GDP) in both high and low-income countries. The role of food systems in promoting and maintaining sustainable diets confronts multiple contextual factors, and the literature refers to “complex systemic interactions” between multiple stakeholders and across global regions (Willett et al, 2019). Academic definitions identify the integral role of sustainable food systems in the successful delivery of the UN SDGs (Chaudhary et al, 2018), and call for a holistic approach to integrate sustainability frameworks within food systems (FAO, 2016; Gustafson, 2016; Willett et al, 2019).

Many academic papers reviewed expressed ideas around inter- and intra-food system connection, interaction and food choice, i.e., between food system actors (Chaudhary et al, 2018), producers and consumers (Miller et al, 2021), temporal contexts (Clapp et al, 2021); spatial contexts (Gustafson et al, 2016; Willett et al, 2019) and societal contexts (Eme et al, 2019; Willett et al, 2019). Thus ‘sustainable food systems’ simultaneously deliver adequate global nutrition demand, ecosystem stability and economic security, while mitigating food-related health issues, and acknowledge the interconnectedness of actors through global food systems (Chaudhary et al, 2018; Clapp et al, 2021; Fanzo et al, 2019; Willett et al, 2019) We bring our evidence for this together in Table 4.

**Academic Definitions of Sustainable Food Systems, sourced from the wider literature, not exhaustive. Source: Author, 2022.**

*“solutions to deliver healthy, sustainably sourced foods must occur within the context of the consumer who values taste, cost, and convenience above all other food attributes”.*  
Miller et al (2021)

*“In our increasingly interconnected world, strengthened agriculture and food systems*

*have a critical role to play in achieving the targets of the Sustainable Development Goals of eliminating poverty and hunger, and increasing our resilience to climatic and economic shocks”* Byerlee and Fanzo (2019); FAO (2016) cited in Fanzo, (2019)

*“global food systems need to ensure improved economic security of actors involved and combat existing malnutrition/obesity-related health problems, while keeping the environmental impacts low enough so as not to transgress the planetary boundaries of biophysical processes and further destabilize Earth systems”*. Chaudhary, Gustafson, and Mathys (2018)

*Sustainability refers to “food system practices that contribute to long-term regeneration of natural, social, and economic systems, ensuring the food needs of the present generations are met without compromising food needs of future generations”*. HLPE (2020) cited in Clapp et al (2021)

*“The planetary boundaries framework, which serves as a guide throughout the report, is useful because it expands the definition of sustainable food production to include the global nature of food production’s environmental impacts, connecting scales from local to global.”* Willet et al (2018)

*“both sustainably meet human nutrition needs and comply with planetary constraints”*. Gustafson et al (2016)

*“the concept of sustainable diets is not limited to food and nutrition but that it is used across multiple fields, which includes environment, agriculture, animal sciences, social and economic sciences.”* Eme et al (2019)

*“A transformation of the global food system must ultimately involve multiple stakeholders, from individual consumers to policy makers and actors along the food value chain, working together toward the shared global goal of healthy and sustainable diets for all.”* Willet et al (2018)

*sustainable food production needs to include the role played by food production in regulating the state of ecosystems, the biosphere, and ultimately the Earth system. This*

*means considering the complex systemic interactions from local to global scales, and identifying global boundaries within which the global food production needs to stay in order to safeguard biophysical processes that support a stable Earth system. Willet et al (2018)*

## **2.5. Metrics and indicators used**

Metrics and indicators are identified as necessary for measuring, monitoring, and mitigating sustainability interventions/initiatives. Indicators can be identified as tools for evaluating social, economic, environmental, and/or political sustainability (Clapp et al, 2021; FAO, 2012). Within a sub-sample of 13 papers reviewed, the pillar/concept that had the most developed indicators for measurement was environment, with 20 indicators dedicated to measuring impact.

There were 39 indicators of sustainable diets identified in the academic literature review. 23 of these indicators were identified as originating in Gustafson et al (2016). Gustafson et al created a methodology of indicators to allow for a holistic overview of sustainability interventions in order to minimise unintended consequences, and drew on indicators already available within global publicly available data-sets. Many of the papers identified the conceptual framework from which an indicator originated, for instance social, health, environmental and/or economic. Holistic indicators allow sustainability to be assessed from more than one view-point, e.g. “food affordability” which allows social and health assessments to be made. Table 5 shows the 14 most cited indicators of sustainability in the 13 papers reviewed, ordered by frequency.

A recurrently identified limitation of the metrics and measures suggested in the papers is their assumed blanket applicability. Whilst all authors agree that there are health and environmental co-benefits to many of the indicators, these benefits will vary based on the socio-economic circumstances of the population/location that they are measured in. Chalmers et al are most insistent on this, concluding that all indicators and frameworks used to assess sustainability must be flexible in the “indicators, dimensions, metrics, and or measures” that allow “granular detail” to be assessed (2019).

**Table 5: Indicators of Sustainable Diets in the 13 papers reviewed. This is not exhaustive or representative of the full literature, but provided to show the variety of indicators used. Source: Author, 2022.**

Conceptual Framework	Indicators	Frequency of References	Papers
Ecological, Social	Per-Capita Land Use	7	Gustafson et al, 2016; Chaudhary, Gustafson, and Mathys, 2018; Eme et al, 2019; Chalmers et al, 2019; Clapp et al, 2021; Willet et al 2018; Jones et al 2016
Ecological	Per-Capita Greenhouse Gas (GHG) Emissions	6	Gustafson et al, 2016; Chaudhary, Gustafson, and Mathys, 2018; Eme et al, 2019; Chalmers et al, 2019; Willet et al 2018; Jones et al, 2016
Ecological, Social	Per-Capita Net Freshwater Withdrawals	6	Gustafson et al, 2016; Chaudhary, Gustafson, and Mathys, 2018; Eme et al, 2019; Chalmers et al, 2019; Willet et al 2018; Jones et al, 2016
Health, Social	GFSI Food Availability Score	6	Gustafson et al, 2016; Chaudhary, Gustafson, and Mathys, 2018; Chalmers et al, 2019; Clapp et al, 2021; Miller et al, 2021; Jones et al 2016

Conceptual Framework	Indicators	Frequency of References	Papers
Health, Social	Food Affordability	5	Gustafson et al, 2016; Chaudhary, Gustafson, and Mathys, 2018; Chalmers et al, 2019; Clapp et al, 2021; Miller et al, 2021
Health, Social	Gender Equity	5	Gustafson et al, 2016; Chaudhary, Gustafson, and Mathys, 2018; Eme et al, 2019; Chalmers et al, 2019; Jones et al 2016
Ecological	Ecosystem Status	4	Gustafson et al, 2016; Chaudhary, Gustafson, and Mathys, 2018; Eme et al, 2019; Chalmers et al, 2019
Ecological	Per-Capita Non-Renewable Energy Use	4	Gustafson et al, 2016; Chaudhary, Gustafson, and Mathys, 2018; Chalmers et al, 2019, Jones et al 2016
Ecological	Pre- & Post-Consumer Food Waste & Loss	4	Gustafson et al, 2016; Chaudhary, Gustafson, and Mathys, 2018; Chalmers et al, 2019; Clapp et al, 2021
Ecological, Health	ND-GAIN Country Index Food	4	Gustafson et al, 2016; Chaudhary, Gustafson,

Conceptual Framework	Indicators	Frequency of References	Papers
	Production Diversity		and Mathys, 2018; Eme et al, 2019; Chalmers et al, 2019
Ecological, Health	Foodborne Disease Burden GFSI Food Safety Score	4	Gustafson et al, 2016; Chaudhary, Gustafson, and Mathys, 2018; Chalmers et al, 2019; Jones et al 2016
Health	Non-Staple Food Energy	4	Gustafson et al, 2016; Chaudhary, Gustafson, and Mathys, 2018; Eme et al, 2019; Chalmers et al, 2019
Health	Modified Functional Attribute Diversity	4	Gustafson et al, 2016; Chaudhary, Gustafson, and Mathys, 2018; Chalmers et al, 2019; Jones et al 2016
Health, Social	Income Equality	4	Gustafson et al, 2016; Chaudhary, Gustafson, and Mathys, 2018; Eme et al, 2019; Chalmers et al, 2019

## 2.6. A bias in the UK academic literature

The Rapid Evidence Assessment (REA) process identified 102 academic papers as being in scope (published between 2020-2022, with data from the UK). The 102 papers were coded with 225 keywords developed from academic definitions of sustainability.

The five most used keywords include Consumer information, Environment or environmentally friendly, Meat, Food behavior/behaviour, Health/healthy. A full analysis of the data is provided in the Appendix.

15 keywords were not linked to any papers. Keywords not used include concepts for consumer food safety (such as Allergens, Illness, and Hand-washing) although the keyword of Safety has been linked to 18 (18%) papers.

The absence of these 15 keywords in the REA does not necessarily imply that UK citizens do not relate to these keywords. Rather, there may be a bias in the academic literature. This bias might be due to divergent research questions and/or bias towards specific established keywords and concepts, with the research community not yet examining themes that have only recently begun to emerge in wider sustainable food literature. The absence of those keywords within the literature might also be explained as bias from researchers, publishers, and UK funders defining research priorities and what research is funded or published.

### **2.6.1. A lack of economic studies in the REA**

The 102 papers identified in the REA were wide ranging in methodological approach. However, **no papers were classified as Economic studies (for example, Cost Benefit Analysis)**. It is important to note the absence of economic studies engaging in sustainability within the current literature.

### **3. What does sustainability mean to UK industry and industry membership organisations when it comes to food and diet?**

This section of the report provides an assessment of the meanings of sustainability used by the UK food industry and industry membership organisations. We describe in the Materials and Methods Section (Appendix A), how we randomly selected 21 UK food industry organisations, split into 5 Market Leaders (in food manufacturing), 3 supermarkets, 3 dining brands, 3 farming co-ops, and 7 Industry memberships bodies for assessment. The codes used to identify these organisations are described in Appendix A.

The assessment was undertaken through evaluation of information available on the organisation's website (and any other supporting documentation) of those organisations included in this small sample, and by coding the types of information found. Due to some organisations being international in scope, their sustainability documents and targets feature information beyond the UK.

The information from 21 organisations was coded into seven different overarching overall categories: 1) production, 2) transportation, 3) product, 4) product group, 5) consumer, 6) waste and 7) contextual factors, with 225 keyword codes split between these categories. However only 127 keyword codes were used out of 225 keyword codes. These codes are used to simultaneously highlight discrete topic areas of sustainability, and main themes found in each organisation sampled.

The top ten keywords are as follows: Food waste (n=15,(71%)), Carbon and carbon footprint (n=14,(67%)), Recycling (n=14,(67%)), Environment or environmentally friendly (n=13,(62%)), Use of energy (energy footprint) (n=13,(62%)), Packaging material (n=12,(57%)), Plastic (n=12,(57%)), Use of water (water footprint) (n=11,(52%)), Amount of packaging (n=11,(52%)), and Greenhouse gas emissions (environmental impact) (n=9,(43%)).



### 3.1. A wide range of industry concern

From the evidence we gathered, it appears that whilst there is much activity within industry concerning sustainability, this is not always focussed within a wide span of themes as identified by the academic literature, but rather within narrow boundaries organisations perceive themselves as being able to act. The exception to this is the NGO and industry membership organisations (NGO1 – NGO7) who provide resources for their members on a wider range of topics related to sustainability. The topics of greatest convergence include carbon and carbon footprint (n=14, (67%)), environment or environmentally friendly (n=13, (62%)), use of energy or energy footprint (n=13, (62%)), use of water or water footprint (n=11, (52%)) and greenhouse gas emissions or environmental impact (n=9, (43%)). ‘Climate’ is ranked equal 6<sup>th</sup> in this list (n=7, (33%)), alongside biodiversity (n=7, (33%)).

**Primary production** was not mentioned by organisations other than those directly related to it (F1 – F3, and NGO5), or that are customer facing (SP1 – SP3; R1 – 3) which illustrates the boundary issues some organisations introduce because of the direct relationship they perceive themselves to have with the parallel notion of responsibility for tackling issues of sustainability. Transport is another example, which, because it is a function that the food production industry might largely outsource, is not perceived to be part of their core business, and so outside the scope of company responsibility for sustainability. This contrasts, however, in the directly customer-facing supermarket sector, all the organisations in their sustainability plans articulated intent to switch to electric delivery vehicles within their chosen timescale. This course of action was echoed in the restaurant sector where home delivery is undertaken (R1).

Conversely, **packaging materials** (n=12, (57%)) and **plastic** (n=12, (57%)) are issues wholly perceived to be within the domain of the food production industry. This is reinforced in the supermarket sector sample (SP1 – SP3), who also set targets to reduce the amount of plastic and packaging of their (own brand) products, as did all the organisations in the restaurant sector sample (R1 – R3).

In a similar vein, **sustainable sourcing** was highlighted by the supermarket sample (SP1 – SP3) regarding their own brand products, although not the other brands they stock. In one example of action beyond horizontal business boundaries in the restaurant sample, Nando’s (R2) asserted that its chicken has high welfare standards, and that they are

investing in studies to advance understanding of how the organisation can further reduce the impact of chicken feed on its carbon footprint.

Of all the organisations sampled, only one third (n=7, (33%)) provided evidence that the changes they were making or planning to make were judged to link their actions to the **wider food system context**. Fewer organisations still were considered to link their work to theories of change (n=2, (10%)), and none were perceived to link to food policy theory. These findings echo the earlier remarks, concerning organisational boundaries and the limitations of a single organisational strategy regarding sustainability within the food system.

There is a lack of specificity of actions on sustainability being taken by the majority of organisations we sampled, or the resources devoted to the achievement of the targets. For example, less than half of the complete sample cohort, across primary production, manufacturing, retailing, hospitality, and the industry bodies, assigned timeframe targets to sustainability challenges they planned to tackle (n=10, (48%)), and only one market leader and two supermarkets assigned costs or budgets to plans.

Of the category of market leader, sustainability was not defined by any entity, with one exception (ML2) who linked the concept to the values of the company founder. Similarly, with the NGO category, the membership organisations made no attempt to define sustainability, focussing instead on making resources available to their membership, and others, to respond to the many faceted social understandings of the term, tailored to the particular position in the food system applicable to their membership.

## 3.2. Collaboration within Industry

There were many goals within these market leader organisations, some with science-based metrics, and working with academics directly on such matters, most indicating what the organisation plans to do, what it is doing, and with whom. Collaboration with other actors was a key finding, and this category of food system actor embraced both environmental and human health impacts in their plans. Not only was collaboration apparent with national food system actors, but also internationally, with multinational corporations setting baseline international standards, in effect. Progress was uneven, however, on the integration of financial resources and plans with those for issues of sustainability, with greater progress being understandably made on this front with

companies of European origin with less pressure to deliver financial results. A further difference observed in this small sample between European led company groups and those led in other international territories seems to be in the advocacy of the use of the Nutri-score labelling system for the benefit of European citizens in front of pack information.

There appeared to be a relationship between the production of resources on this matter and the size of the organisation. External accreditation is becoming more widespread in use by organisations in regard to sustainability. As the data evidences, there are key overlapping issues where sustainability is being tackled by market leading organisations in the international food industry, notably in regard to food waste, recycling and in making products healthier for the citizen, by processes of minor or major reformulation. Some, but not all, promote sustainable diets directly, which suggests conjecture remains in this community about this issue on a local, national and on an international basis.

In relation to the membership organisations for food producers, processors, manufacturers and retailers analysed, the resources available to their members, and non-members, were comprehensive, and covered the key issues concerning sustainability matters currently under political and public scrutiny currently, and went some way beyond this. These resources were, in some organisations, very publicly available and not behind the members' paywall. As such, the resources are available to the small business community in the UK, whether they are aware of that or not. Indeed, this has been the outcome of purposeful activity by one NGO (NGO3) working directly with one of the devolved nations to ensure information provision is available to small businesses.

A function that all the websites sampled provide is the ability to self-serve information for the interested citizen, citizen or professional. However, one UK member organisation (NGO5) also provides information for teachers for inclusion in lesson plans in schools. There are no indications of the extent to which these resources are used, with the exception of the use of specific case studies on the website.

### 3.3. Summary

In summary, UK production and manufacturing industry appears to share its meaning of sustainability with parent companies based internationally where they are the market

leader of branded food products. There is evidence of a more cautious approach, and the absence of a shared position, when it comes to diets in this group of food system actors. Both the industry membership bodies and the food production industry in the UK share a social understanding of sustainability, and its multiple dimensions, rather than utilising a single definition. As such, it would appear some system effects are in operation which lead to the evolution of sustainability as a topic within groups of food system actors. The application of boundary issues by some industry actors would seem to be a good example of a legacy system effect in this assessment. Our review suggests that within UK industry, the UK supermarket retailers are leading the way in communicating to UK citizens about their specific goals and targets to tackle particular issues, challenges and local problems of sustainability, with the market leaders following suit on a more international basis. Membership organisations are placing resources at the disposal of all, not just their members, to encourage take up and wider action from the whole of the business community on matters of sustainability. Membership organisation resources include those that might educate and inform citizens of any age about food production and the food system generally. From this small sample of organisations, it seems that there is more action required in parts of the hospitality sector on sustainability issues, post-pandemic. However, it is encouraging that science-based targets are present in the work being undertaken across the system sample as a whole.

## **4. What does sustainability mean to UK citizens when it comes to food and diet?**

### **4.1. How does the current UK public understanding compare to the Academic definition of sustainable food?**

15 studies were identified as having some link to this research question, 6 reviews, 3 psychology studies, 2 independent quantitative analysis of aspects of existing large data sets, 1 qualitative interview study with Food for Life Scheme participants, 1 study which looked at acceptance and views on products made from seafood by-products, 1 study on sustainable food purchasing behaviour and lastly 1 study which asked respondents to rate the importance of 9 sustainable food behaviours. All the studies (except one of the least relevant reviews) were robust and any limitations such as population sampled or size clearly identified. Of the six reviews two had concrete information about citizen perceptions of sustainability.

One systemic review (van Bussel et al, 2022) was identified prior to the literature review. Authors found that environmental impact (locally and organic) food choices and ethical production were the most frequently mentioned by citizens in high income countries, of the US, Europe including the UK (where most studies were conducted), New Zealand, Australia, Canada and the United Arab Emirates. It concluded that citizens still lack key knowledge about some aspects of sustainability and find the term difficult to define, while some citizens deny connection between food choice and environmental sustainability.

Locally produced, seasonal, organic food and reduced packaging are all considered 'environmentally friendly'. The impact of meat production was not well understood and negative effects of meat production were doubted. However, when citizens were aware of the impact of meat, reduction was seen as important.

Citizens are aware of the possible negative effects of packaging and food waste; the importance of sorting and recycling, and that throwing away food was a waste of money, but are unaware of the extent of systemic food waste. Price, taste and individual health are more influential than sustainability on food choices. Health was the most often mentioned reason for sustainable eating, with environmental sustainability being the secondary reason given for sustainable eating. Some citizens are of the view that healthy eating is more sustainable. The studies underpinning this evidence concern consumer psychology. This includes Banovic and Borone (2021), who assert that the process of self-construal determines health as a priority for the individually-minded, and sustainability as a priority for the family-minded. This is under-scored in the work of Panzone, et al. (2021) where carbon levels in the shopping basket are demonstrated to be habitual, despite environmental sustainability awareness and desirability. So, if health is a driver for the consumer, lower carbon shopping will follow, reinforcing the findings of Willett et al (2019) of eating food that is good for human health is also good for the planet, and the public health Eatwell guidance (Lonnie and Johnstone, 2020). Lonnie and Johnstone's evaluation of the Eatwell guidance sits alongside other reasons consumers gave for reducing meat intake for health reasons, including saving money, animal welfare and food safety concerns. Meat reduction is also illustrated to be a social desirability factor (Patel and Buckland, 2021).

Of the literature reviews (Otto et al, 2021; Steenson and Buttriss, 2020; Deroover et al, 2021; Pinto et al, 2021; Lonnie and Johnstone, 2020), a gap in understanding was identified by one review (Otto et al, 2021) (academic and grey literature) on citizen perceptions compared with scientific rating of food packaging and sustainability. Paper cardboard and metal packaging were rated similarly scientific metrics but the sustainability of plastic packaging was underestimated while glass and biodegradable plastics packaging was overestimated.

One paper concerning implementing a sustainable diet (Steenson and Buttriss, 2020) did not directly reference the direct citizen or citizen voice. A systemic review on perceived healthiness of foods found intersection of issues of health and environmental sustainability as important but did not investigate sustainability perspectives. Public health rationale for promoting plant protein as an important part of a sustainable and healthy diet was investigated (Lonnie and Johnstone, 2020) but little was mentioned on UK citizen's perceptions of

sustainability, only those environmental reasons for vegetarian diet, were not as popular as other reasons, for example, health.

As mentioned briefly previously, three papers (Banovic and Barone, 2021; Patel and Buckland, 2021; Murphy et al, 2022) described robust quantitative studies in the field of psychology, two EU and one UK based. One (Banovic and Barone, 2021) sustainable behaviour was associated more with a self-construal of interdependence (that is the way one sees oneself is with family, rather than seeing oneself purely as an individual), with a focus on health. A UK (university based) study (Patel and Buckland, 2021) examined the attitudes toward three groups; meat eaters, meat reducers and vegetarian groups. Meat reduction was associated with being healthy and eco-conscious, and meat reducers were perceived more favourably than either habitual meat eaters or vegetarians. Vegetarians were perceived more favourably than the authors expected, perhaps due to increasing levels of awareness of sustainable food issues.

Of the two studies analysing of pre-existing data, one used complex modelling (Biondi, Castiglione and Mazzocchi, 2021) and analysed food expenditure and carbon emissions for food prepared at home which reduced by 8.3% over the period 2000-2019, considered to be beyond any effects from the earlier recession. No citizen perspectives were investigated directly and eating out was not counted in the modelling for this study. Analysis of Eurobarometer data (de Boer and Aiking, 2021) found that 75% of NW Europeans surveyed (inc. UK participants) were concerned about climate change and species views strongly related to local food purchasing (33%) and adopting more sustainable diets (10%).

One UK qualitative study interviewed stakeholders involved in procurement or provision of the Food for Life Scheme (Morley, 2020). A notable theme that emerged from interviews, was that citizens equated local with sustainable procurement. This may be partly because one of four sustainability categories in the scheme is local (alongside organic, high animal welfare and Fairtrade). Goods made with seafood by-products (Altintzoglou et al, 2021) described as helping minimise food waste were viewed positively by citizens. No data was collected on general perspectives of sustainability.

UK respondents rated the importance of a number of food and dietary behaviours on their environmental benefit; low medium or high (Culliford and Bradbury, 2020). Behaviours considered to offer the largest environmental benefit were 'reduce

consumption of air-freighted foods', 'reduce food waste', and 'buy locally grown produce'. Additionally, 'Consume seasonal fruits and vegetables', 'limit red and processed meat', 'avoid excess packaging' and 'choose sustainable fish' were also perceived to have a high environmental benefit by most participants. Conversely, participants deemed 'prioritise plant-based proteins' and 'choose organic produce' to have a lower environmental benefit. The authors comment that studies using LCA to determine GHG emissions and overall environmental impact of foods demonstrate that avoiding air-freighted foods, choosing organic produce and consuming a plant-based diet are the dietary behaviours which have the largest environmental benefit. Behaviours such as packaging reduction which have recently been heavily discussed in the media were seen to be important by participants and rated as having relatively high impact, and more participants said they were active in those behaviours. The population studied was unrepresentative of UK population, having a higher proportion of females (66% vs. 51%) and those with some higher education (85% vs. 50%). Respondents were primarily employed adults, so adults  $\geq 65$  years old and children  $\leq 18$  years old were unrepresented.

In summary, the answer to this research question is complex and not straightforward. Citizen input into understanding sustainability is limited, with their behaviour being far more likely to be analysed than their understanding of sustainability attempted to be discovered. This is reflective of the central challenge of multiple definitions of sustainability in an academic context and trying to make sense of what this means to citizens within this frame, which may not be the same frame always used by citizens. Analysis of individual aspects of citizen behaviour - how citizens are able to, and do, respond to notions of what sustainability is in particular contexts is valid and enables the limits of understanding to be teased out. There are consequently gaps in the citizen voice(s) and perhaps understanding this evidence assessment points out that are important for the FSA to be aware of in relation to their strategic plan.

## **4.2. The impact of the different metrics and measures used**

There were several studies highlighting the impact of the metrics and measures used to measure what is understood by sustainable, and to compare the studying of sustainability and food choices (n=10).



The quantitative studies (n=7) were all assessed as being robust. A conference paper (n=1), in the form of a review of the literature, was identified as less robust, with the qualitative studies (n=2) being judged to be the least robust in relation to measurement, but are included due to the evidence and indicators they present for future work.

In this diverse set of studies, framing of metrics and measures is key to the issues of relatability and reliability. This is highlighted particularly in the experimental psychology study in this section concerning spill over effects of notions of health and environmental sustainability in participants. Metrics are used to make sense of sustainability and the studies that looked at how these are used by citizens in relation to food and diet do so in multiple ways – through groups as well as individually, and can be visual, cognitive or kinaesthetic in behavioural impact. Metrics are also used in the act of comparison, or benchmarking, central to the act of triangulation and the use of data as evidence. These phenomena are present in the summaries of each paper. One study (Morley and Morgan, 2021) reminds us how metrics are important in the context of managers who, in effect, make food choices and purchasing decisions on behalf of colleagues or clients. This underlines the need for good metrics and indicators of quality and standards in relation to matters of sustainable food and diets, in one study referred to as omni-labelling (Macdiarmid et al, 2021). This is further supported in a different study which demonstrated that even with hypothetical carbon taxation, citizens seemed unable to transfer intentions to live sustainably to choosing no prompt, low carbon, sustainable food shopping baskets (Panzone et al, 2021).

There are contradictions in the results from the studies in these sections, in that habitual food choices manifesting themselves reveal a “say-do” gap when it comes to sustainable food intentions and behaviours in some citizens (for example Panzone et al, 2021 and Pechey, Hollands and Marteau, 2021). Similarly, the assessment of the use of plant based ultra-processed foods can be said to not maximise the sustainable diet ethos for citizens in another study (Macdiarmid, 2021). Citizen perceptions on purchasing eggs from hens fed with insect-based feed were both acceptable to some and wrought feelings of disgust in others (Spartano and Grasso, 2021).

More key takeaways from the evidence presented in studies in this section are that a reduction in eating meat is showing signs in some social groups of being dominant socially desirable behaviour (Patel and Buckland, 2021). Also, where young children are

concerned, practical engagement with food influences food behaviour more than only engagement on an academic basis (Brennan et al, 2021).

Table 6 denotes the types of metrics used in each study analysed in respect of this research question.

**Table 6: The types of metrics used in each study analysed in respect of this research question.**

<b>Study</b>	<b>Metric(s) Used</b>
Pechey, Hollands and Marteau, 2021	Visuals, perceptions
Brennan et al, 2021	Group, visual, kinesthetic, cognitive, emotional wellbeing, behaviour
Patel and Buckland, 2021	Visuals, perceptions, group (membership)
Rondoni and Grasso, 2021	Visuals, labels, logos (of organisations/standards)
Morley and Morgan, 2021	Organisational standards, school meal standards, economics of school meal provision, standards of deprivation
Macdiarmid et al, 2021	Willingness to pay, carbon foot print, healthiness, meat content
Panzone et al, 2021	Carbon footprint data, citizen purchasing data
Macdiarmid, 2021	Group (membership), consumption of plant-based, ultra-processed foods
Shreedhar and Galizzi, 2021	Perception (Spillover effect theory)
Spartano and Grasso, 2021	Perceptions and attitudes

### 4.3. How does the UK citizens' current understanding of sustainability impact their food choice decisions?

The discrete topics of 'health' and 'environment' in sustainability can be clearly seen at work as is to be expected in relation to this research question. There were 56 studies (60 with four duplicates) identified as relating to this research question. There were a variety of methods used in the studies in this section, with the majority (n=31) being of quantitative experimental design to test citizen perceptions. This contrasts to use of mixed method studies (n=7). This summary is therefore pitched at a high level for sake of brevity.

There were far more studies in this research question concerned with environmental drivers of food choices (n=33) than there were with health drivers (n=7). Of the studies concerned with environmental drivers of food choices (n=33), local produce, the (linked) concept of food miles, and national food standards (as opposed to international food standards) were mentioned by citizens repeatedly in different studies. A few studies were concerned with the messaging to citizens about sustainable behaviour (n=5). Yet the driver of individual food behaviour was shown in one study to relate to the issue of health, with the notion of family eating behaviour linked to the issue of environmental sustainability in matters of self-construal (Banovic and Barone, 2021). Linked to this, one study used anthropomorphism to link the two facets in the mind of the citizen (Do, Wang and Guchait, 2021), and increased willingness to pay for sustainable attributes in doing so. One study investigated Twitter posts (Brzustewicz and Singh, 2021) and found that sentiment in a relatively small tweet sample (n=13,645) is more positive than negative overall towards sustainability, and identified clusters of user content discretely concerning energy use, renewable energy, and responsible consumption. Another complex study (Armstrong et al, 2021) evaluating the citizen perception of carbon and energy measurements found in food revealed these metrics were not used by citizens in their judgements and decision-making.

One study provided insight into the behaviour of citizens around sustainable eating, which indicated citizens in the study were willing to undertake sustainable eating at home, but not when eating out (Filimonau et al, 2021). Although this effect was observed in a study concerning COVID-19, doubts were expressed whether this attitude will persist. Interestingly, these findings were echoed in an observational analysis paper

based on household food metadata over a 15 year period (Biondi, Castiglione and Mazzocchi, 2021). It is unclear if this effect is one of increased awareness of sustainability or a citizen reaction to the economics of food in the UK.

There are many studies in this section which provide insight into citizen perceptions concerning sustainable attributes and different products, for example dairy, or eggs, which must be appreciated on an individual basis linked to the product sector. No attempt has been made to accurately assess this against sales and/or volume data for the business sectors concerned. However, one study provides insight on the practices of international trade in relation to product sales of farmed salmon – this example is related to UK supermarkets reasoning not to buy Norwegian salmon (and so protecting Scottish product) (Gulbrandsen, Vormedal and Larsen, 2022).

Note that similar issues around the importance of the impacts of sustainability are on citizen food choices is discussed in Section 7 of this report.

## **4.4. The importance of current UK citizen understanding of sustainability to citizens when making food choices**

Of the many papers (n=39) analysed to answer this research question, the majority (n=19) were quantitative studies. A relatively high number of reviews of the literature were identified also (n=10), with qualitative (n=5) and mixed methods studies (n=5) also included.

To address the research question directly, the evidence in this review suggests that UK citizens have both low awareness of the environmental impact of food (n=10) and a tendency to equate environmentally sustainable food with low travelled, low food miles, locally produced meat and organic produce to nationally recognized standards (n=8). These are not, however, the only challenges around citizen perception.

Challenges around the definition of and knowledge of what constitutes a healthy and sustainable diet (n=7), result in identified anxiety around food production in one instance (Ares, Ha and Jaeger, 2021). In identifying these challenges, parallels were drawn with the Public Health Eatwell dietary guidance produced in the UK for citizens, and there

being no explicit link to the issues of environmentally sustainable diet in this guidance. Indeed, this resonates with the findings of several studies in this section where high concern with health factors saw corresponding lower concern with environmental factors in the perception of citizens.

Where the link to sustainability can be seen being related to matters of economy, citizen perceptions were linked in studies to having high concerns to the minimisation of waste (n=3). It is believed the studies refer to pre and post fork food waste in articulating their findings, although this is not always explicit in the study.

An interesting study using 'Decoy Affect' theory indicated that having a greater number of vegetarian options available when eating out had limited effect on vegetarian options being taken, (Attwood, Chesworth and Parkin, 2020) with another study (Parkin and Attwood, 2021) asserting that 75% of menu options need to be vegetarian in order to significantly shift citizen behaviour. The impact of social norms as regards to meat eating were posited as the reason for this, which resonated with a different study where injunctive social norms introduced by a social network member were advanced as being most powerful in changing citizen eating behaviour, as part of the social learning process (Schubert, de Groot and Newton, 2021).

Interestingly, where food packaging is concerned, citizens in one study (Oloyede and Lignou, 2021) stated that packaging was not on their list of considerations when purchasing a product despite 95% of them saying they considered themselves environmentally conscious individuals and would like to see more sustainable packaging on the market. This example of citizen dissonance seems to be a reliable broad positioning of citizen perceptions set against reality regarding issues of environmental sustainability and food presented in the studies reviewed, heavily influenced by social desirability.

## **4.5. The importance of trust in citizen understanding of sustainability**

Evidence for the importance of trust in citizen understanding of sustainability when making food choices was identified in 8 studies of mixed design and quality. There were qualitative studies (Graham et al., 2020; Spartano and Grasso, 2021), quantitative

studies that included experimental design (Cubero Dudinskaya et al, 2021; Murphy et al, 2022; Macdiarmid et al, 2021; Panzone et al, 2021), and systematic reviews (n=2).

The demographic groups studied encompassed food service professionals (Graham et al., 2020), University students (Sullivan et al, 2021; Macdiarmid et al, 2021; Panzone et al, 2021; Graham et al., 2020), food service customers (Sullivan et al, 2021), red meat eaters (Cubero Dudinskaya et al, 2021), and population representative citizens (Murphy et al, 2022; van Bussel et al, 2022; Spartano and Grasso, 2021). The studies focused on an array of food products; eggs (Spartano and Grasso, 2021), meat (Cubero Dudinskaya et al, 2021; Murphy et al, 2022; Sullivan et al, 2021; Macdiarmid et al, 2021), fruit & vegetables (Murphy et al, 2022; Sullivan et al, 2021), fats & oils (Macdiarmid et al, 2021). Agricultural production methods were also studied; free range (Spartano and Grasso, 2021), natural (Spartano and Grasso, 2021). Citizen dietary trends were covered; meat reduction (Sullivan et al, 2021; Macdiarmid et al, 2021), vegan (Sullivan et al, 2021), health/healthy (Macdiarmid et al, 2021), ready meals (Macdiarmid et al, 2021) and vegetarian (Sullivan et al, 2021).

In three of the studies citizen preconceptions around the sustainability impacts of certain ingredients played a role in their level of trust in a sustainability and/or eco-label (Cubero Dudinskaya et al, 2021; van Bussel et al, 2022; Spartano and Grasso, 2021) whilst in another 3 of the studies citizen's perceptions of the meaning of label informed their understanding of the sustainability of the product (Murphy et al, 2022; Graham et al, 2020; Macdiarmid et al, 2021). Labels most reported in the studies as used by citizens to inform their understanding of the sustainability impacts of ingredients/products were; "provenance" or "locality" labelling (van Bussel et al, 2022; Sullivan et al, 2021; Murphy et al, 2022; Cubero Dudinskaya et al, 2021; van Bussel et al, 2022), organic certification (Cubero Dudinskaya et al, 2021; Murphy et al, 2022; van Bussel et al, 2022; Spartano and Grasso, 2021), free-range certification (van Bussel et al, 2022; Spartano and Grasso, 2021), health information (Macdiarmid et al, 2021), ethical labelling e.g. Fairtrade (van Bussel et al, 2022), feed standards (Spartano and Grasso, 2021) and carbon footprint labelling (Cubero Dudinskaya et al, 2021; Macdiarmid et al, 2021; Panzone et al, 2021).

Citizens were shown to be distrustful of labelling and certification standards in 4 papers, (van Bussel et al, 2022; Spartano and Grasso, 2021; Graham et al, 2020; Murphy et al, 2022). In Murphy et al, (2022), UK citizens were shown to have high levels of trust in the

Soil Association's organic certification juxtaposed with their low levels of trust in the equivalent E.U. organic standard. The paper concluded that the high levels of trust generated by the Soil Association standard could be traced to its historic presence on the UK market and citizen awareness of its meaning. In Graham et al, (2020), food-service professionals were found to be distrustful of carbon footprint labelling due to the aggregated nature of the data used to calculate footprints (which does not allow the particularities of a product to be accounted for). In van Bussel et al, (2022), citizens were found to be concerned about the risk of "greenwashing" present in current labelling citing this as due to a lack of sustainability criteria used to create these labels. In Spartano and Grasso, (2021), the citizens' distrust of the product's sustainability impact was shown to diminish after the study participants were educated not only on the product's sustainability impact, but on the food-system issue that the product tackled; in this case using insects in poultry feed to reduce deforestation and carbon footprint of traditional poultry feeds. The impact of information and education on sustainability and the food system in diminishing distrust in new products and processes used in production was clearly seen in one study (Spartano and Grasso, 2021). In this study, this effect was related to the reduction in deforestation and carbon footprint of poultry feed where insects were substituted for soyabean meal.

## 4.6. The Say-do gap

The say-do gap refers to concerns or intentions not being followed up by actions. Evidence for say-do gaps in sustainable behaviours was identified in 6 studies of mixed quality, including surveys on citizen perceptions and attitudes (n=2), systematic reviews (n=2), qualitative interviews (n=1) and one experimental study. The majority of the studies were focused on sustainable diet (n=3). There were also individual studies which focused on organic food, carbon footprint and ethical food consumption. Evidence from two of the studies (Jia and Linden, 2020) showed that the intention to act was a significant predictor of sustainable behaviours. Oke, Ladas and Bailey, (2020) found that beliefs and attitudes towards the importance of pro-ethical actions influence outcomes related to ethical food purchasing, however citizens have perceived values and so intrinsic beliefs may therefore influence behaviours irrespective of conscious consumption behaviours. Additionally, both (Culliford and Bradbury, 2020) and (Panzone et al, 2021) found that although citizens intended to be environmentally sustainable their actions and shopping baskets didn't necessarily match this. The stated reasoning behind



this from Culliford and Bradbury, (2020) is that although citizens are aware that the food system impacts the environment, they may not understand the impact of specific dietary behaviours as their perceptions are not in line with actual environment benefit. For example, Culliford and Bradbury, (2020) found that despite buying local and seasonal produce and avoiding air-freighted foods being perceived as important aspects of a sustainable diet, citizens found these behaviours difficult to affect with 30-50% in the contemplation and planning stages. Some barriers to adopting these actions include a lack of availability of local and seasonal food in the UK as over half the food is imported, a lack of knowledge of seasonal food, and the encouragement of UK citizens to consume a Mediterranean diet for health reasons despite many of these foods not being native to the UK (Culliford and Bradbury, 2020).

(Panzone et al, 2021) found that environmental self-image in citizens does not correlate to the construction of a low carbon shopping basket in this study, indeed the authors claim there is no link between the two. This suggests that citizen dissonance is related to environmental awareness amongst this group and is not translated to supermarket shopping. Consistent with this, the authors find that carbon levels in grocery shopping are habitual. In addition to this, van Bussel et al, (2022) found in their systematic literature review of citizen perceptions on sustainability, that although environmental impact, (locally and organic) food choices and ethical production are the most frequent categories mentioned by citizens, citizens believe that sustainability does not (yet) influence their food choices. Currently, citizens consider price, taste and individual health more influential than sustainability.

Biasini et al, (2021) concludes that motivations and learning rooted in adequate nutritional knowledge are essential determinants to drive behaviour change towards more sustainable behaviours. The authors of this paper (Panzone et al, 2021) posit that use of a carbon tax would manipulate purchasing decisions more in online retail environments than in store, concluding that food sustainability perceptions are likely to be orientated towards better sustainability outcomes in online retail environments rather than in store, but they express doubt over the continuation of this effect over the long term. Culliford and Bradbury, (2020) observed that it is important to note the potential for social-desirability bias in surveys and that participants' responses may not reflect their actual purchasing behaviour.



## 4.7. Affordability of healthy sustainable diets

The studies included in response to this research question were a combination of quantitative studies (n=8), Literature reviews (n=5), and mixed methods n=3) predominantly. Articles circulated in the food system (n=2) and qualitative methods (n=1) were less popular methods employed in addressing the issue of affordability of healthy and sustainable diets.

To address the research question directly, one study (Oke, Ladas and Bailey, 2020) found that citizens consider price, taste and individual health more influential than sustainability when making food choices. This sees the two elements of sustainability being treated differently by citizens, with health ranking alongside price, and having greater priority than environmental concerns.

This finding was supported by several studies. One (Sullivan et al, 2021) that found nutritional values and ingredients are of primary importance to citizens, related to concerns for health, and another study that found food product reformulation for healthier and affordable products is more likely to bring about positive behaviour change (Buttriss, 2020). A large pan-European citizen survey found older people with less worries about living costs are more likely to consume fish and aquaculture products for health reasons, in addition to taste (Cantillo, Martín and Román, 2021).

Several studies recorded citizen perceptions of fruit and vegetables, ethical foods, and foods with carbon footprint labels being of high cost. Variations of the price of fruit and vegetables across the country have also been identified by citizens as impacting upon their affordability (Haydon et al, 2020). Interestingly, businesses, as well as citizens, in a university environment perceived sustainable food as too expensive to include in café menus (Graham et al, 2020). When this is considered in relation to the finding of another study (Attwood, Chesworth and Parkin, 2020) that social norms are stronger than price drivers in reducing meat consumption when eating out, it would appear that behaviour seems to be anchoring social norms through the vehicle of the economic system of food consumed in out of home environments. Conversely, when asked about public procurement practice, citizens demanded sustainable food, which they defined as local food, be a requirement outcome (Morley, 2020).

There are also contradictory findings in the studies, for example one study (Biondi, Castiglione and Mazzocchi, 2021) found that increased consumption of fruit and vegetables in the UK over a sustained period of time may be an economy measure, for some as an attempt to manage issues of food security, whilst another study (Trewern, Chenoweth and Christie, 2022) asserts that meat reduction is an environmental motivation, not a cost cutting measure. There is also an economic aspect to the concept of sustainable food seen in a study (Wakefield and Axon, 2020) that found citizens perceived the macro-economic impact of food waste would impact directly on the affordability of sustainable diets.

The contradictions within citizens can be identified in the study (Cubero Dudinskaya et al, 2021) that says that whilst citizens value proscribed standards in red meat production, they are not always willing to pay for them.

## **4.8. Local, British/UK, Scottish, and Welsh food**

There were distinct voices identified in respect of the devolved nations, with studies identified in Northern Ireland (n=1) and Scotland (n=1). No unique studies were identified for Wales, and 'English' voices (as opposed to England) were present (n=4) in the studies analysed relating to this research question. The identity most commonly used was the UK (n=9) and this related to studies wholly undertaken in the UK and where international studies were undertaken.

'Local' food could be identified as playing a part in studies in NI, England and the UK. The study in Scotland related to ethical food and its cost, but may have been implicitly local.

In one study (Verfuert et al, 2021), consumption of local food was considered to be a quick win for pro environmental behaviour, and easier to achieve than reducing meat consumption. In another study (van Bussel et al, 2022) there also appears to be a degree of overlap in the perceptions of UK citizens with those of the US and EU, where local produce is equated with food miles, and organic production methods. Local food is also perceived to be better for farmers as a distinct actor in the food system, and for the local economy. This appears to be echoed in the findings of the study (Murphy et al, 2022) that identified both the UK and German citizens favouring national organic standards and certification schemes, identifying them both as low trust nations in regard to EU organic

certification and standards processes. It also appears to be mirrored in the study (Morley, 2020) undertaken with the Soil Association that found that UK citizens equate local produce with sustainable food and see this as the standard for public procurement models for food.

Sustainable food behaviours were achieved in a study (Trewern, Chenoweth and Christie, 2022) which saw citizens at all stages in the life course in an intervention from a large UK retailer working with subject support specialists and with free products to try. This intervention reported reductions in meat eating, reduction in food waste and more cooking from scratch in the citizen cohort sustained over time, and is indicative of how retailers might enable food system change with citizens in discrete localities. By the promotion of food system thinking, practices, products and knowledge, this study evidences how food system citizens can be transformed into food system citizens at the local level in the UK, who understand the challenges and have knowledge to respond to them for themselves.

## 4.9. Animal welfare

Evidence relating to animal welfare and sustainability when making food choices was identified in 11 studies of mixed quality, including systematic and non-systematic literature reviews (n=4), experimental studies (n=2), surveys on citizen attitudes and perceptions (n=2), and a discrete choice survey, one qualitative interview and qualitative study conducted through focus group discussions. Studies primarily considered red meat and dairy reduction and plant-based alternatives (n=3), attitudes towards eating meat (n=2), a study on sustainable diet practices, one on the willingness to pay for red meat labelling attributes, a study on citizen perspective of insect fed hens, as well as one study which looks directly at concerns and perceptions of farm animal welfare (Alonso, González-Montaña and Lomillos, 2020). Evidence showed that animal welfare was a key driver towards a sustainable diet and that many citizens were motivated to renounce meat products mainly due to environmental, health and animal welfare considerations (Pakseresht, Kaliji and Canavari, 2021; Anusha Siddiqui et al, 2022).

Cubero Dudinskaya et al, (2021) found that although the average citizen is concerned about animal welfare, previous studies showed heterogeneous preferences. This variety of results is a product of the complexity of the animal welfare concept, which is highly

dependent on citizen perception, their inferences on the diverse animal welfare levels, as well as how the message is communicated. This is echoed in the study (Alonso, González-Montaña and Lomillos, 2020) which found that citizens perceive the need to increase the level of welfare in farm animals, despite the fact that their level of knowledge about farming and animal welfare issues is relatively low. Citizens' concerns are not equally distributed among the different farm species, nor is there consistency in the willingness to pay to enhance animal welfare. Therefore, farmers, businesses, and members of the food chain need to be informed of the evolution of public perceptions and consumer concerns to make informed decisions that help them improve their sustainability, social responsibility, and public credibility, which will allow them to maintain their social license through social ethical approval.

Citizens were found to have largely positive attitudes and perceptions towards eggs from insect-fed hens (Spartano and Grasso, 2021). Acceptance is determined by environmental benefits, food waste and animal welfare. Price, production, taste, quality and trust also influence willingness to buy. Citizens had positive attitudes towards insect-fed hens: reducing food waste, reducing environmental impact and perceptions of natural feeding methods which were perceived as influencing higher animal welfare conditions. All participants mentioned the importance of 'free-range' and that packaging should reflect the importance of animal welfare. The research suggests framing sustainability in this regard - rather than reducing reliance on soybeans or other feeds - could influence customer uptake.

In one study (Skelhorn et al, 2020) 'welfare or ethical' reasons (such as slaughter age) for not eating rosé veal were mentioned by 17% of respondents, which could mean that an underlying reason for reluctance of retailers to stock veal is the perceived difficulty of creating a market due to welfare concerns. In particular, respondents who had welfare or ethical concerns in the present study appeared less likely to change their stance on rosé veal. There is a lack of a shared vision for what 'less and better' looks like for the meat/dairy industry, and there is a real opportunity for policy intervention to bring about a more holistic industry which can improve biodiversity, animal welfare, public health and livelihood (Trewern, Chenoweth and Christie, 2022).

## 4.10. Processed foods

Evidence for the perceptions of processed foods in regards to sustainability was identified in 7 studies of mixed quality, including systematic and non-systematic reviews (n=2), quantitative surveys (n=2), an experimental design, a secondary data analysis and a mixed method design which consisted of a survey followed by a 3x3 factorial between group design. Studies primarily considered the use of more sustainable ingredients in processed foods (n=3), plant based alternative foods (n=2), a study on the perceived healthiness of processed foods, and a study on citizens' food choice.

Macdiarmid, (2021) points to a halo effect around plant-based food and diets, where they are perceived as being 'healthy' and 'environmentally-friendly' but many being produced are ultra-processed foods that are high in energy, fat, sugar and salt and have a higher environmental impact than minimally processed plant-based foods. The trend towards eating more highly processed plant-based convenience foods is a concern with regard to both public health and the targets set to reduce greenhouse gas (GHG) emissions. The 'modern day' plant-based diet emerging is very different to a more traditional one comprising pulses, vegetables and wholegrain. Studies show that those who are younger and have been vegetarian for a shorter duration are eating significantly more ultra-processed plant-based foods. While there is a place for convenient, desirable and affordable plant-based food to encourage dietary change, care should be taken so that this does not subconsciously set a path which may ultimately be neither healthy nor sustainable. Evidence does suggest (Macdiarmid, 2021 and Alae-Carew et al, 2021) that with the increasing availability of plant-based convenience foods, there is a slow shift towards eating a more plant-based diet. This further suggests a willingness to eat less meat if it is attractive, convenient and accessible. The challenge is how to ensure that dietary changes to reduce meat consumption will improve health and it does not become the vehicle for high fat, sugar and salt foods, which could also create more environmental damage. Anusha Siddiqui et al, (2022) found that participants preferred plant-based burgers to meat burgers and were also more accepting of meat alternatives when they replicated processed meat products instead of imitating things like an escalope or steak.

Evidence showed that citizens were open to using more sustainable ingredients in processed foods. A study (Yang et al, 2020) which investigated citizens acceptability to crackers and biscotti made with standard ingredients and also the more sustainable

Bambara flour, found there was no significant difference in overall liking observed between standard and Bambara products, indicating UK citizens accept the sensory properties of products that contain Bambara flour. The second part of the study introduced the participants to the key sustainability features and nutritional benefits of the Bambara plant, interestingly, the extrinsic information shifted citizen emotional response towards more positive emotions and less negative emotions when consuming products containing Bambara flour. It also made them feel less guilty, suggesting citizens engage with the idea of sustainable ingredients. Grasso and Asioli, (2020) used a questionnaire to ascertain citizen acceptability of using an upcycled ingredient in biscuits that impacted upon carbon reduction in comparison to a biscuit without upcycled ingredients. It was clear that the citizen group were not aware of the term 'upcycled' and its meaning, but claimed that they would try products made in this way, once aware of it. Citizens with a more traditional attitude towards food had the strongest rejection for upcycled sunflower-flour whilst citizens who were more aware of environmental issues had the strongest preference for biscuits with Carbon Trust Labels. The findings in Altintzoglou et al, (2021) indicate that citizens in general responded positively to the product (nutritional supplement, processed foods, cosmetic) when told that it contributes to food waste reduction.

Macdiarmid et al, (2021) found that when buying processed ready meals citizens perceived health as a more valuable determinant than carbon footprint. Thus, when it comes to processed ready meals, citizens do not necessarily associate carbon footprint with meat content and are possibly reluctant to reduce meat intake.

## **5. The difference in perceptions of eco-labels**

The evidence in this review indicates an absence of a single definition of what an ecolabel shows, or indeed how (sustainable) food is consistently measured. This review has seen the use of carbon labelling and carbon footprint data but it is not clear if these measures are the same or are different. Of the few studies analysed in response to this research question (n=6) there are some mixed effects to report.

One study (Graham et al, 2020) shows hesitancy on the part of citizens to accept or trust a label of this type, and of businesses to use them because of the impact this might have on business custom, principally because of the perception of negative social desirability effects.

Another study (Sullivan et al, 2021) found that sustainable food initiatives in university environments have positive outcomes, but still advocate utilising the technique of nudging to persuade citizens towards more sustainable food choices. This seems to underpin citizen skepticism in the notion of sustainable or eco labels, and the choice restriction they seem to infer or indicate, principally related to meat consumption. Yet the need for labels that condense complex numerical data associated with carbon data and calorie data is argued for in another study (Panzone et al, 2020), using traffic light labels, and is shown to be more effective at helping citizens interpret data of these types. The impact of this method of data analysis on decision-making and choice is not reported in this study.

One study (Macdiarmid et al, 2021) emphasised the centrality of meat in diets currently, and advocated the use of omni labelling to indicate both health and environmental sustainability to the citizen in order that informed decisions might be taken. Indeed, this recommendation would seem to assist the citizen in remembering the impact of environmental sustainability when making food choices. This apparent gap was highlighted in a study which imposed a carbon tax on habitual food decisions made whilst shopping (Panzone et al, 2021) in a different discrete choice experiment. Whilst perhaps being perceived as indicating a deficit to the citizen, omni labelling would appear to help those citizens who wish to use data of this type in food purchasing decisions made under time constraints in store, and are unable to currently.

The final qualitative study (van Bussel et al, 2022) indicated that other aspects of sustainability citizens considered and said were important were local foods, i.e. food not transported far from the place of production, the method of transportation, organic status, and ethical production methods. This evidence review has not found studies that incorporate these aspects into any labelling choice experiments with citizens yet.

## 6. Trade-offs made against sustainability when making food choices

This literature review identified 34 studies relevant to understanding the trade-offs that citizens make against sustainability when making food choices. Studies conducted directly with UK participants included experimental studies (n=8), surveys of citizen perceptions and attitudes (n=5), with two secondary data analyses of survey data, and qualitative research mainly conducted through focus group discussions (n=6). We also identified six systematic reviews, six non-systematic literature reviews and one conference summary that provided some evidence for citizen trade-offs. The focus of these studies in terms of sustainability in food choices was varied. Most studies sought to understand citizen responses to animal source food alternatives including plant-based meat, dairy and egg substitutes (n=11 studies). Nine studies considered 'sustainable diets' in a broader sense that included plant-based diets and sustainable dietary recommendations. Six studies focused on environmental and sustainability food labels, followed by specific concerns around organic foods (n=4), carbon footprints (n=3), local food (n=3) and 'other' sustainability topics including new plant breeding technologies, vertical farming, purchasing 'ugly' foods and ethical food choices (n=4).

The evidence for trade-offs provided by these studies was divided into three categories: (1) evidence for citizen priorities in making food choices, (2) evidence for citizen perceived trade-offs for or against sustainability, (3) actual value choices made by citizens for or against sustainability.

The most frequently cited factors in citizen priorities around food choices for or against sustainable products were health (n=8 studies), price (n=5) taste and other sensory attributes (n=4). Availability, nutritional concerns, habits and familiarity, animal welfare and the environment were all highlighted equally often (n=2 studies respectively), and convenience, provenance, religion, weight loss and mistrust of environmental claims were each raised in one study. Personal health in particular was frequently prioritised over environmental concerns. These factors are not necessarily opposed to sustainable



choices, for example evidence suggests sustainable diets are also healthier, but may indicate possible trade-offs that citizens make if priorities do not align in the same food products.

In terms of perceived trade-offs relating to sustainable food items and sustainable diets, these studies show citizens were most frequently concerned with cost (n=14 studies), followed by taste and other sensory attributes (n=9), nutritional content and food quality (n=7), health (n=5), familiarity and food or technology neophobia (n=5), provenance and sustainable methods of production and ethical concerns (n=4), disgust in the production process (for example for laboratory grown meat or eggs from chickens fed on insects bred on food waste (n=4), availability (n=3), animal welfare (n=2), environmental concerns about alternative foods (n=2), pleasure of food (n=2), social pressure not to change diets (n=1) and maintaining individual freedom of choice (n=1). In the latter case, one participant felt that restricting personal freedom was not a justified trade-off, whereas another suggested this was acceptable and even the only way to achieve more sustainable choices. These factors are not necessarily based on evidence for real trade-offs in opting for sustainable foods but were perceived by citizens to be possible trade-offs, in some cases that they were willing to consider and in other cases acted as barriers to sustainable choices.

Actual citizen value choices all centred on trade-offs based on financial cost (n=6), including interventions with cost manipulation to encourage sustainable choices (n=2) and willingness-to-pay analyses based on different environmental information provided to citizens (n=4) in experimental studies.

In an experiment with 260 UK students, cost manipulation included a carbon tax at a rate of £70 per tonne of carbon placed on food items in a simulated weekly shop (Panzone et al, 2021). Carbon taxation reduced the average carbon footprint of shopping baskets by 2.5 - 3.3 kg CO<sub>2</sub> equivalents, equating to savings of 130 - 172 kg CO<sub>2</sub> equivalents per year per household. This indicates that price is a trade-off for citizens in terms of purchasing decisions that can be manipulated in favour of sustainability. Manipulating prices in restaurant menus, through including a higher priced vegetarian option alongside lower priced vegetarian and meat-based options, found no evidence for an effect on food choices though the study likely did not sufficiently incentivise vegetarian options through this financial manipulation (Attwood, Chesworth and Parkin, 2020).

In willingness to pay analyses, studies provided evidence that citizens were willing to pay premiums for local production, organic food, sustainability certification in fish and health claims with mixed evidence across studies on willingness-to-pay for low carbon footprint labelling. One study with 414 UK participants found evidence of citizens willing to pay premiums of £0.433 ( $p=0.038$ ) for local meat (UK source meat compared to meat from New Zealand) and £0.491 ( $p=0.004$ ) for organic labelling but no statistical evidence was found for willingness-to-pay for carbon footprint labelling (£0.047,  $p=0.681$ ) (Cubero Dudinskaya et al, 2021). In another study, conducted using 90 individual interviews across five countries, UK respondents were willing to pay a premium of €0.75/kg for fish with sustainability certification and €0.65/kg for fish with nutrition and health claim labelling ( $p<0.001$ ). The exchange rate used in the UK case was £1 GB=€1.16 (Menozzi et al, 2020). A third study with 105 university participants found that based on a health traffic light label (with no additional information), participants were willing to pay more for green label (+£1.47) and amber label (+£0.87) compared to red in lasagne ready-meals. Participants were willing to pay a premium of £1.87 for lasagne with a green carbon footprint label but no more for amber, compared to red (Macdiarmid et al, 2021). The final study demonstrated willingness to pay for 'ugly' foods though did not estimate a premium (Do, Wang and Guchait, 2021).

## 7. Important aspects of sustainability when making food choices

The literature relevant to this research question included 21 papers of varying quality. Quantitative research ( $n=12$ ) was the most common research approach found in this evidence review, compared to qualitative ( $n=5$ ) and mix-method ( $n=4$ ) research.

Online surveys ( $n=11$ ) were predominantly used, followed by choice experiments ( $n=6$ ), literature reviews ( $n=4$ ), systematic literature reviews ( $n=3$ ), individual interviews ( $n=2$ ) and focus group interviews ( $n=1$ ). Just over half of the studies used UK-focused data ( $n=12$ ). Most of the non-UK-focused papers were literature reviews.

This evidence review covers a wide range of topics related to citizens' perceptions, including (1) their perception of specific products (n=6) e.g. by-products, fish, meat, ready meals; (2) sustainable diet (n=6) e.g. vegetarian or plant-based diet; (3) interventions promoting sustainability (n=7) – especially in hospitality services (n=3) but also through labelling and food reformulation and innovation; (4) production methods (n=2) e.g. vertical farming, organic production.

It is worth noting that most studies did not use an overall sustainability approach when studying citizens' perceptions. Only 8 used an overall and inclusive approach of sustainability, combining at least 3 dimensions of food sustainability. The Tu et al, (2021) paper studied, for example, its social, health and environmental dimensions, while the Modica et al, (2018) paper approached sustainability through its economic, social and environmental aspects.

Sustainability was limited to its environmental and health aspects in 5 papers, to solely its environmental benefits in 3 papers, and to waste issues in 4 studies. As a consequence, this strong research bias in the definition of sustainability limits the quality of the evidence found in this literature review. In particular the sense of priority that citizens have concerning different aspects of sustainability is biased by the themes investigated in the literature. The categories used most commonly are unsurprisingly those that are reflected back by citizens as important .

Results are heterogeneous. Sustainability is understood by citizens to be related either to its health and environmental aspects (n=7), personal and health-related benefits (n=5), environmental aspects (n=1) or social and ethical aspects (n=4). Overall, this evidence review shows the limited understanding of sustainability when making food choices, as it is mostly related to one of its aspects.

It is suggested that this limited understanding of sustainability is linked to a lack of knowledge. A systematic literature review on citizens' perceptions of food-related sustainability (van Bussel et al, 2022) showed that citizens still lack key knowledge beyond the environmental and ethical food-related aspects of sustainability. One qualitative study, involving ten semi-structured interviews of young adults regarding their ethical food consumption in the northeast of Scotland (Dangi, Gupta and Narula, 2020) suggested that one of the barriers to organic food choice is the lack of information and lack of trust in labels. One quantitative study exploring UK citizens' preferences for

ethical attributes of floating rice (Tu et al, 2021) argued that the lack of understanding of sustainability concepts, such as agroecology or biodiversity, may be challenging for UK citizens who are geographically distant from the paddies. In a choice experiment, in which participants from a university-setting were exposed to choice tasks related to the carbon footprint, healthiness and price of lasagna ready-meals (Macdiarmid et al, 2021), participants did not necessarily associate carbon footprint with meat content, and information about lower meat content was associated with reduced willingness to pay.

In one literature review on emergent research themes around meat and milk alternatives (Lonkila and Kaljonen, 2021), it was found that citizen attitudes in the UK continue to be shaped by decades of messaging about the nutrients in dairy products, thus limiting the reach of dairy alternatives. The literature review on plant-based food trends suggested that one of the barriers for meat reduction included concerns about loss of nutrients (Macdiarmid, 2021).

Overall, the evidence identified in this review shows that the understanding of sustainability is mostly limited to one of its food-related dimensions, either its environmental-, health-, both environmental and health-, or ethical-related aspects. However, its health and environmental benefits appear to be the most important drivers of sustainable food choices. This literature review suggests that increasing the availability of information related to food-related sustainability aspects could enlarge citizens' own understanding of sustainability when making food choices.

## **8. The key drivers and barriers to making sustainable food choices**

The literature review identified 53 studies relevant to the key drivers and barriers towards sustainable food choices by UK citizens. Most of the identified studies were quantitative in nature (n=24), including both experimental and observational study designs followed by systematic and non-systematic reviews (n= 17), qualitative research conducted through focus group discussions (n = 6) and mixed-method designs (n =4). There was also one initiative article and one conference summary. Overall, the studies discussed reducing meat consumption as a significant sustainable food choice. Other key topics around sustainable food choices included perceptions of alternative protein sources,

environmentally friendly food and beverage choices, plant-based foods, protein diet and hybrid products, organic foods and vegetables, suboptimal foods (food products with abnormal appearances and/or other deviating product attributes (for example, feel, smell) as well as products that are close to or have passed their expiration date but which are still unreservedly consumable). Sustainable food waste practices, rosé veal consumption, carbon reduction, consumption of floating rice, wine innovation products, and eco-labelling were graded on their robustness, minimization of bias and focus on citizens' perceptions of sustainability were also topics investigated.

## 8.1. Key drivers

The evidence extracted from these studies regarding the key drivers of sustainable food choices can be divided into five categories: 1) psychological factors, 2) intrinsic factors, including sensory attributes of products, 3) extrinsic factors related to production and naturalness of the products, 4) socio-cultural factors, and 5) demographic and physical factors. Perceived healthiness and well-being were identified as key psychological factors (n = 25) that motivated citizens towards purchasing of sustainable food choice options followed by citizens' knowledge (n = 12), information about food packaging along with eco-labelling (n = 9), personal preference and desire to consume sustainable food options (n = 6) and awareness (n = 6) about the sustainable food choice options. A need for uniqueness was also identified as a significant motivator of citizens' acceptance of plant-based diet (Aschemann-Witzel et al, 2020) and food waste reduction behaviour (Altintzoglou et al, 2021). Different sensory attributes such as nutrient properties (n = 9), taste (n = 12), and visual attractiveness (size, colour, and appearance) (n = 3) were identified as key motivating factors for citizen behaviour, perceptions, and preferences towards sustainable food choice options. Extrinsic product characteristics, such as freshness or naturalness of the products (n = 6), production method (n = 1), or lower prices of organic/sustainable diet options (n = 7) could drive citizen behaviour and perceptions toward sustainable options like reduction of meat consumption, adoption of a plant-based diet, food waste reduction, or purchasing of eggs produced in cage-free systems. Several socio-cultural drivers of sustainable food choices were identified and highlighted in different studies, including: attitude towards pro-environmental behaviour (n = 25) and animal welfare (n = 9), citizens' habit, intention, and emotion towards sustainable food choice options (n = 5), food safety concerns (n = 6), income and food budgeting concerns (n = 4), social motivations (n = 6) and trust in certification and eco-

labelling (n = 3). One study (Rondoni, Asioli and Millan, 2020) reported that UK citizens who expressed concerns about animal welfare conditions on farms also showed higher willingness to pay for cage-free eggs. This increased when the animal welfare label was accredited by an external third-party institution or by the federal government. Two studies (Kowalska et al, 2021; de Boer and Aiking, 2021) reported that citizens' social welfare attitude also has significant influence on motivating towards organic and sustainable food consumption behaviours. Religious beliefs can sometimes act as a driver for vegetarianism, organic and low-carbon food consumption (de Boer and Aiking, 2021; Eker et al, 2021).

Several studies have reported that citizen gender and age can be important demographic factors impacting the citizens' preference for sustainable food choice options. For instance, one study reported that British women tended to buy more free-range eggs than other types of cage-free or caged eggs than British men (Rondoni, Asioli and Millan, 2020). Another study (de Boer and Aiking, 2021) conducted in the European Union countries reported that 25–34-year-old middle class females had the highest odds of reporting consumption of more sustainable diets and more local foods. Another study (Eker et al, 2021) used Facebook user data to analyse the drivers of low-carbon diets, finding that education was the most important factor in vegetarian interest in the sampled Facebook audience, followed by gender, gross domestic product (GDP), age, and religion. The study also noted that vegetarians tended to have a higher level of education than non-vegetarians. Further specific demographic details are highlighted in section 9 and 10.

Some studies reported that increased availability and access to food outlets (n = 5) and citizens' convenience (easy preparation and no new skills are required for cooking) (n = 4) have positive impacts on sustainable food choice behaviours. A systematic review (Boulet, Hoek and Raven, 2021) aiming to develop a multi-level framework of household food waste and citizen behaviour reported that in retail and other physical settings like schools, legal frameworks can act as macro-level factors that influence food waste reduction by citizens. They also found that food waste was positively associated (increases) with GDP and levels of urbanization, and negatively associated with food security and the number of supermarkets and grocery stores (decreases). Citizens' perceptions about fair trade attributes (Tu et al, 2021) and food assistance to disadvantaged families (Ravikumar et al, 2022) can also influence their food choice decisions towards more sustainable options.

## 8.2. Key barriers

The key barriers to making sustainable food choices were high price of organic foods or sustainable options (n = 17) and lack of knowledge and awareness (n = 17). Citizens' poor knowledge about sustainable food options and the associated health and environmental benefits could be one of the reasons for the low familiarity with sustainable food options (n = 3). A lack of availability (n = 10) of sustainable food options due to a lower number of supermarkets and grocery stores was cited as another barrier. Citizen attitudes of sustainable food choice behaviours can also be influenced by social marketing strategies. One study reported that social marketing strategies have impact on low awareness amongst citizens about visualizing food growth and production (Wakefield and Axon, 2020) whereas another study found that lack of accessibility can be complexified by the marketing and information dissemination strategies (Oke, Ladas and Bailey, 2020). Some individual barriers such as personal preferences (n = 9), time constraints (n = 5), lack of cooking skills (n = 4), misconceptions about convenient cooking process (n = 4) and healthiness of unsustainable foods (n = 6), mistrust of existing food labels (n = 4), disinterest in the environmental impacts of sustainable options and beliefs that their choices will not make a difference (n = 6) were also reported by several different studies. One study (Hartmann, Jahnke and Hamm, 2021) examining the barriers to purchasing and marketing options for suboptimal foods, at the retail level reported that citizens who possess a greater degree of egoistic value orientation (i.e., self-interest) can also act as a barrier and make them less open to suboptimal food purchase. Habitual purchasing of more food than needed for a household, as well as the inability to finish food prior to expiry date were also cited as barriers to food waste reduction (Trewern, Chenoweth and Christie, 2022). Perceptions about sustainable options such as meat alternatives like plant, cultured meat and insect-based meat having less appealing flavours or appearing less attractive or appealing (n = 5) also appeared to affect food choice behaviours as quality related barriers that were related to strong negative attitudes towards sustainable food choices (Papies et al, 2020; Pakseresht, Kaliji and Canavari, 2021; Aguirre Sánchez et al, 2021; Anusha Siddiqui et al, 2022; Hartmann, Jahnke and Hamm, 2021). Food neophobia (n = 3) along with social and cultural norms (n = 13) may lead to doubts about situational appropriateness or lead individuals to uncomfortable situations among other people (n = 5). Altogether, the aforementioned factors can act as barriers to sustainable food choice behaviours, such



as consumption of a plant-based diet, reduction of meat consumption, purchase of organic food, and reduction of food waste.

## 9. The differences in attitudes between socio-demographic groups

Evidence for differences in attitudes between socio-demographic groups (e.g. gender, socioeconomic grade and region) were identified in 23 different studies of mixed quality, including experimental studies (n=4), quantitative surveys (n=8), qualitative focus groups (1), systematic/literature review (n=5), secondary data analysis's (n=4) and one discrete choice experiment. Studies primarily considered animal source foods and alternatives to reduce meat consumption, sustainable diets and dietary recommendations, food waste, multi-component approaches to sustainability, sustainability food labelling, organic foods, carbon footprints as well as other aspects such as vertical farming and aquaculture. Evidence showed that there were differences between socio-demographic groups. These differences included differences in gender (n=8), age (n=7), level of education (n=4), level of income (n=8), nationality (n=6), whether they were urban or not (n=1) and culture (n=1).

### 9.1. Gender

Gender was found to be a significant predictor of sustainable behaviours in many of the studies with women more likely than men to be more open to the replacement of meat with non-meat protein sources than males (Eckl et al, 2021), and more likely to be in the action/maintenance stage of change for prioritising plant proteins and being more sensitive to environmentally friendly products when compared to men (Culliford and Bradbury, 2020). Studies (Alae-Carew et al, 2021; Broeckhoven et al, 2021) found that women, millennials, and high-income citizens had the highest plant based alternative food consumption and highest change over time, indicating financial, social and gender barriers. (Aguirre Sánchez et al, 2021) found a higher proportion of men who prefer red meat burgers than woman when compared to poultry burgers. Except for food waste



being female was reported as a factor related to sustainable food consumption, but situational factors moderated this association (e.g., time, pressure) (Aguirre Sánchez et al, 2021). Some possible drivers for these gender differences were shown in Anusha Siddiqui et al, (2022) being that females prefer consuming more plant-based foods because of the animal welfare and environment concerns, while males consume the alternatives due to the taste and price.

Concerning carbon footprint, one of the studies found that female adults with a higher income have a more positive attitude towards carbon footprint labels than males (Rondoni and Grasso, 2021). Although Macdiarmid et al, (2021) found both men and women viewed carbon footprint as important. Conversely (Banovic et al, 2022) found male participants were more likely to purchase hybrid products – foods that combine animal and plant-based ingredients e.g., a mixed beef and mushroom burger- than female participants.

Some studies found that vegetarians were perceived to be more feminine (Patel and Buckland, 2021; Eckl et al, 2021). The results indicate that female gender, information on health and the environment, and lower price of non-meat protein sources may act as drivers, whereas male gender, food neophobia, attachment to meat, and the lower situational appropriateness of consuming non-meat protein sources act as inhibitors. Women are typically more involved with food purchasing and preparation which could lead them to being more aware of food related issues. Ethical consumption habits are generally considered more feminine which could lead to males disregarding these behaviours. Overcoming gender stereotypes is necessary to influence male citizens to adopt sustainable diet recommendations.

## 9.2. Life-stage

An experimental intervention study (Trewern, Chenoweth and Christie, 2022) found differences in behaviour according to the life-stage of the participants with all sustainable practices apart from food waste. Pre-family participants reported consuming meat more frequently, while family participants reported cooking less frequently from scratch compared to other segments. Differences in meat replacement strategies were noted such that retired participants were more likely to opt for vegetables than plant-based meat alternatives. This is consistent with research on healthy eating which shows that

older individuals associate healthy eating with largely unprocessed whole foods, whereas younger individuals are more likely to be open to trying plant-based meat alternatives.

### 9.3. Age

The food groups that emerge as more sensitive to socio-demographic trends are confectionery, other meats, and potatoes, all characterised by a positive effect on purchased quantities (hence emissions). Purchases for all three groups appear to be strongly increasing with age, and these significant increases are mainly an outcome of an ageing population. For potatoes, the effect is reinforced by the increase in retirement rates and unemployment rates (Biondi, Castiglione and Mazzocchi, 2021).

There were contradictory results regarding the age of the citizens and their behaviour towards sustainable practices. Culliford and Bradbury, (2020) found younger participants more likely to be in pre-contemplation/contemplation stages of change for 'choose organic produce' and 'choose sustainable fish'. However, they did also find that older participants were more concerned about the impact of food waste. De Boer and Aiking, (2021) found younger participants in more urban areas and with a higher social status were more likely to eat sustainably. One study found 18–24-year-olds are more likely to consume processed plant-based foods which are more convenience based and with less dramatic change to "normal" diets (Macdiarmid, 2021). People over the age of 55 and from upper- middle class are more likely to purchase sustainable fish and aquaculture products than those between the ages of 15 and 54 (Cantillo, Martín and Román, 2021). Ares, Ha and Jaeger, (2021) found no significant difference for age group distributions in attitudes to vertical farming.

### 9.4. Education

Most of the studies found that education was an important driver for sustainable lifestyles, food choice, and vegetarianism (Eker et al, 2021). Culliford and Bradbury, (2020) found that those with a higher education level perceived the recommendations to "limit red and processed meat consumption" and "prioritise plant-based proteins" to have a higher environmental benefit. Broeckhoven et al, (2021) found that "Poultry lovers" and Eco-friendly" citizens tend to have a higher education than "Meat Lovers". Ares, Ha and

Jaeger, (2021) found that those with a higher income and educational attainment had a more positive attitude towards vertical farming.

## 9.5. Socioeconomics

Socioeconomics is another important driver for sustainability with those from higher socioeconomic backgrounds often being more likely to practice sustainable behaviours. One study (Topić, Diers Lawson and Kelsey, 2021) showed that socioeconomic status has a significant influence in how women evaluate yellow-sticker food shopping. Women from lower socioeconomic backgrounds demonstrate a resentment towards price-reduced shopping and evaluate it negatively. We argue that these different attitudes reflect relative perceptions of agency and control, which the data suggest are connected to the propensity for food waste and a worsening of the squander cycle.

## 9.6. Nationality

There were differences between different countries and their sustainability practices too. One study (Cubero Dudinskaya et al, 2021) looked at the different European countries (including the UK) citizens' willingness to pay for red meat labelling. The results indicate that the EU origin was also valued positively and preferred over New Zealand imports, except for the UK. There was no significant difference in their willingness to pay for meat coming from the EU and New Zealand for British citizens. (It should be borne in mind that the UK has a long, close relationship with New Zealand through longstanding ties through the Commonwealth, and the Empire historically, which resulted in the longstanding import of lamb from New Zealand. As such, this could be said to be a cultural norm in the UK). The UK had lower willingness to pay for organic and low carbon footprint food despite it being positively valued.

Another study (Murphy et al, 2022) that looked at citizen trust in organic food and organic food certifications in four European countries (UK, Poland, Germany and Italy) found differences in perceptions of the citizens in the four different nations, with the UK scoring highly on general trust in the organic system of provision, and scoring highest on level of food chain trust in organic vegetables. The UK recorded the lowest scores regarding all EU certification values, sharing this position with Germany in respect of traceability certification. Germany and the UK also preferred their national schemes of certification

rather than the EU scheme, and were classified as low trust countries in respect of this study. Conversely, Kowalska et al, (2021) found perception of organic food more strongly influenced the purchase of organic food among Polish than British young citizens. This may be due to stronger rural-urban connections in Poland than in some parts of the UK.

For the consumption of insects, most people in Western Countries prefer eating processed foods incorporating insects or insect protein compared to edible insects because food neophobia was a barrier (Anusha Siddiqui et al, 2022). Interest in 'vegetarianism' and 'sustainable living' is not necessarily correlated at country level (Eker et al, 2021). However, the cultural importance of meat in UK diets, across all demographics, is highlighted (Macdiarmid et al, 2021).

## 10. The behavioural implications for different socio-demographic groups

Evidence for the implications of citizen understanding of sustainability to different socio-economic groups was identified in 8 studies of mixed design and quality; 1 quantitative study of experimental design (Patel and Buckland, 2021), 2 quantitative study of observational design (Eker et al, 2021; Culliford and Bradbury, 2020), 1 qualitative study involving interviews (Morley, 2020) and 5 systematic/literature reviews (Ravikumar et al, 2022; Eckl et al, 2021; Anusha Siddiqui et al, 2022; Macdiarmid, 2021). These studies were reported having adequate minimization of bias (Morley, 2020; Eker et al, 2021; Culliford and Bradbury, 2020; Ravikumar et al, 2022), and excellent minimization of bias (Patel and Buckland, 2021; Eckl et al, 2021). It is worth noting that two papers were reported as having poor minimization of bias (Macdiarmid, 2021; Anusha Siddiqui et al, 2022).

The socio-demographics studied in the papers were habitual meat eaters (Eckl et al, 2021; Patel and Buckland, 2021), meat reducers- also referred to as flexitarians (Eckl et al, 2021; Patel and Buckland, 2021), public procurement professionals (Morley, 2020), vegetarians (Macdiarmid, 2021; Patel and Buckland, 2021), younger citizen (Macdiarmid, 2021; Culliford and Bradbury, 2020), parents from lower socio-economic households

(Ravikumar et al, 2022), women (Eker et al, 2021; Culliford and Bradbury, 2020), and environmentally conscious citizens also referred to as eco-consumers/citizens or green consumers/citizens (Anusha Siddiqui et al, 2022; Morley, 2020).

Half of the papers indicated that younger women are more likely to adopt reduced meat diets (Macdiarmid, 2021; Anusha Siddiqui et al, 2022; Eckl et al, 2021; Culliford and Bradbury, 2020) as a result of environmental considerations related to climate change. This is bolstered by the perception of reduced meat diets being healthier (Macdiarmid, 2021; Eckl et al, 2021; Anusha Siddiqui et al, 2022). Younger vegetarians, however, are more likely to substitute meat for ultra-processed plant-based food (Macdiarmid, 2021) without understanding the environmental and health implications of their production methods. This is in contrast to "eco-conscious" citizens who have reduced their meat consumption seeking to replace meat with "minimally processed" plant-focused foodstuffs (Anusha Siddiqui et al, 2022). Another paper studying younger citizens (Culliford and Bradbury, 2020) found that younger citizens associate reduced transport, reduced food waste, and local provenance with more sustainable foodstuffs, however younger citizens are more likely to be considering procuring sustainable diets rather than acting on these beliefs (Culliford and Bradbury, 2020).

One paper studied the motivations for adopting more sustainable diets (Patel and Buckland, 2021) and found that meat-reducers associated their diet with "healthy" (63%), "eco-friendly" (48%), and "conscious" (14%) and similarly vegetarians associated their diet with "healthy" (57%), "eco-friendly" (30%), and "animal lovers" (29%). This paper also studied the perceptions of these demographics by their peers finding that they were more positively socially regarded than habitual meat eaters (Patel and Buckland, 2021).

The majority of the papers concentrated on the health and environmental aspects of sustainable diets with the exception of a paper studying parents in low-income households (Ravikumar et al, 2022) in which citizens associated sustainability with healthiness, accessibility, and availability of foodstuffs. This paper identified social determinants (such as marketing, finance, and time constraints) as having impacts on the food-choices of this socio-demographic. Another social determinant in the form of stigma was found to be a determinant of food choice in two papers (Patel and Buckland, 2021; Eker et al, 2021) with meat-reducers or vegetarians considered more favorably by their peers due to their dietary choice. Marketing can form a powerful tool in shaping social perceptions of dietary choices, and specific information and education can deal with

consumer distrust and skepticism, particularly at a time of change in production methods, products and processes (Spartano and Grasso, 2021), that embracing sustainability is likely to entail for all businesses, be they small or multinational in dimension. These impacts span all socio-demographic groups and require information provision and educational approaches tailored to different audiences.

Professionals working in the food industry, and public procurement professionals identified the need for a framework with which to understand sustainable diets and procurement in order to guide decision-making (Morley, 2020). This idea of frameworks for dietary consideration was also explored in Anusha Siddiqui et al, (2022) where a tension was established between citizen's understanding of the environmental implications of a "cultured meat burger" versus a "plant-based burger" with women more likely to choose the "plant-based burger" than men.

## 11. Where the FSA can contribute

The FSA's vision of the food system over the next five years is one in which (1) Food is safe, (2) Food is what it says it is, and (3) Food is healthier and more sustainable. This REA supports the FSA's acknowledgement that sustainability is a growing citizen concern, and that the FSA can play a critical role in protecting public health alongside - and as a result of - a drive towards a more sustainable food system? in the UK.

This REA highlights key evidence gaps around citizen and industry understanding of UK food sustainability. In line with the organisational roles identified in the 2022-2027 Strategy, the FSA could play a leading role in advancing UK food sustainability, particularly through evidence generation and as a convenor and collaborator across sectors.

### 11.1. The FSA as an evidence generator

*Evidence synthesis:* There is a clear need for continued systematic syntheses of the diverse and growing evidence base on sustainability of UK food, and citizen and industry understanding, perceptions and engagement with the multifaceted concept of sustainability. This REA synthesises over 100 publications in only a two-year period

(2020-22). This is a body of literature that will continue to expand rapidly over the next five years under the current FSA Strategy.

*FSA research and funding of primary research:* The FSA is well-placed to conduct and commission primary research on the cross-cutting priorities for UK food including safety, transparency, health, and sustainability. This REA highlights a number of data deficits which could be addressed through ongoing FSA laboratory analyses of new food products and FSA work on assessing alternative proteins, in addition to primary research providing insight into citizen behaviour and experience relating to sustainability.

Priority ranked goals for future primary research based on the findings of this REA are:

1. A working definition of sustainability in food and food systems for the UK, including standardised indicators that can be used as a basis for policy development, industry regulation and certification and to increase transparency for citizens;
2. Improved data quality and availability within sustainability metrics, and guidelines for standardized methodological reporting that will improve the quality and transparency of sustainability claims. Metrics should encompass or be applicable to the full life cycle of food products, from production, transportation, citizen use (including cooking, cooling, storage and disposal), and waste treatment. Though not the leading UK government department, the FSA can contribute much to this area.
3. Further engagement with UK citizens, amongst broad and representative demographic groups based on factors such as socio-economic status, age - in particular older citizens, education including different levels of cooking skills, urban/rural populations, health status, race and ethnicity, dietary requirements and different food environments. This research would identify trends in the importance of different aspects of sustainability and their influence on citizen food choices, and how these factors interact with sustainability. Research should encompass a broader range of food products and include considerations of ultra-processed foods, and food loss and waste where appropriate;
4. Evidence of behavioural intervention effectiveness, in broader population groups and in real-world settings, to identify how various strategies such as



education and nudge techniques lead to behaviour change and any barriers or facilitators to intervention effectiveness;

5. Qualitative evidence giving insight into citizen perceptions of how industry and government can better support citizens in making sustainable choices; and
6. Cost-benefit analyses on operationalising different aspects of sustainability in the UK food system.

## 11.2. The FSA as a policy maker

The FSA does not hold direct policy responsibility for health and sustainability of food, apart from nutritional standards and labelling in Northern Ireland. However, the FSA could play a critical role in informing and advising on the development of these policies by providing expertise and evidence to ensure food safety and transparency are adequately considered and any co-benefits or trade-offs of increasing sustainability of food are understood.

## 11.3. The FSA as a regulator

*Food system regulation:* FSA's direct regulation of meat, dairy and wine production could expand or adapt to include sustainability concerns and the safety of new sustainability-oriented practices within these industries. Similarly, FSA's work with local authorities and port health authorities could evolve to encompass sustainability as best practice and/or work to establish clear recommendations, with the links to the work of the Codex Alimentarius commission on this topic consolidated. This REA shows no standardised industry definition of sustainability and some evidence for consumer mistrust in new products, both in terms of their health effects and genuine contribution to reducing environmental burdens.

The FSA has a clear role in regulating meat, dairy and wine products and communicating findings of this regulation to citizens. However, if the FSA were to begin regulating meat, dairy and wine production using a sustainability lens, it would require regulatory reform and possibly legislative change. Instead, we highlight that the FSA can support the development of assessing the sustainability of the meat, dairy and wine production, and



incorporating this assessment into labelling, standards, and wider citizen communication (through collaborations with other government departments).

The FSA could also play a role in setting and regulating sustainability commitments with industry, perhaps through its work with the Food and Drink Sector Council, supporting businesses in making SMART sustainability goals in line with existing schemes once these have been reviewed and approved by FSA. Examples of existing schemes include the Ellen MacArthur and United Nations Environment Programme Global Plastic Commitment, WRI's Cool Food Pledge and WRAP's Courtauld Commitment 2030.

*Sustainability claims, labelling and certification regulation:* This role falls under the FSA goal to ensure that food is what it says it is. The FSA could act as an arbitrator for standards around sustainability labels, once agreed by wider government and industry working groups. Ensuring clear, trusted certification and labelling would increase citizen trust and may better support behavioural change. Sustainability guidance for procurement professionals could be developed and a sustainability scheme that complements and integrates the existing FSA Food Hygiene Rating Scheme could be redesigned for hospitality and procurement sectors, driving the implementation of better sustainability to the local level, consistent with changes in food regulation sustainability best practices.

## 11.4. The FSA as a watchdog

FSA's horizon scanning in the 2022-27 Strategy will be critical to monitor the development of new production practices and new novel food products directed towards increased sustainability and to investigate any associated safety and wellbeing risks. Publishing advice and information for citizens will increase awareness and understanding of sustainable food. The FSA could also report on these findings in the Westminster Annual Report to Parliament, providing an overview on the state of play of UK food system sustainability from a citizen perspective.

Once labelling norms have been established, there would be a role for enforcement and creating monitoring mechanisms for sustainability claims, linked to the FSA's ongoing work on food fraud through the National Food Crime Unit.

## 11.5. The FSA as a convenor and collaborator

In bringing together parties across government, academia, civil society and businesses to address issues in the food system, the FSA has the potential to generate a more holistic approach to ensuring that the UK food system provides citizens with food that is safe, is what it says it is, and is healthier and more sustainable. Convening and collaboration will be crucial across all FSA roles to gather robust evidence and understanding from different expertise perspectives, including actors within the UK food system and internationally, in line with the FSA strategy.

Research collaborations will ensure that evidence generation across food safety, citizen experience, and health and sustainability concerns can be maximized and complementary. Broad stakeholder engagement will be critical in defining sustainability within the UK food system and to developing any agreed standards and approvals for certification.

Citizen engagement and education is needed and important. A fifth of studies in this REA recommended developing campaigns or strategies to increase citizen awareness of the environmental impacts of animal and plant-based food items in particular. Increasing knowledge of different elements of sustainability, addressing outdated preconceptions and empowering citizens to understand the impact that personal choices can have will require collaboration. This could lead to developing a communicable guide to sustainable food, such as building on the Eatwell Guide, which was developed primarily to educate citizens on healthy food choices, by Public Health England (now the National Institute for Health Protection) in association with the Welsh Government, Food Standards Scotland and the Food Standards Agency in Northern Ireland, in collaboration with the Office of Health Improvement and Disparities, and the wider Department of Health.

Convening multi-stakeholder partnerships around industry commitments and sustainability claims and labelling will be critical to driving change in the UK food system and creating a more transparent food environment for citizens. Collaborating with government departments and partners outside of government, the FSA can bring evidence, experience of food policy regulation, and consumer insights to help shape the development of plans to make food healthier and more sustainable.

## 12. References

All references used in the appendix have been included in the list below.

- Aguirre Sánchez, L., Roa-Díaz, Z.M., Gamba, M., Grisotto, G., Moreno Londoño, A.M., Mantilla-Urbe, B.P., Rincón Méndez, A.Y., Ballesteros, M., Kopp-Heim, D., Minder, B., Suggs, L.S. and Franco, O.H. (2021). What Influences the Sustainable Food Consumption Behaviours of University Students? A Systematic Review. *International Journal of Public Health*, 66. doi:10.3389/ijph.2021.1604149. <https://doi.org/10.3389/ijph.2021.1604149>
- Ahmed, S., Downs, S. and Fanzo, J. (2019). Advancing an Integrative Framework to Evaluate Sustainability in National Dietary Guidelines. *Frontiers in Sustainable Food Systems*, 3. doi:10.3389/fsufs.2019.00076 <https://doi.org/10.3389/fsufs.2019.00076>
- Alae-Carew, C., Green, R., Stewart, C., Cook, B., Dangour, A.D. and Scheelbeek, P.F.D. (2021). The role of plant-based alternative foods in sustainable and healthy food systems: Consumption trends in the UK. *Science of The Total Environment*, 807(3), p.151041. doi:10.1016/j.scitotenv.2021.151041. <https://doi.org/10.1016/j.scitotenv.2021.151041>
- Alonso, M.E., González-Montaña, J.R. and Lomillos, J.M. (2020). Consumers' Concerns and Perceptions of Farm Animal Welfare. *Animals*, 10(3), p.385. doi:10.3390/ani10030385. <https://doi.org/10.3390/ani10030385>
- Altintzoglou, T., Honkanen, P. and Whitaker, R.D., 2021. Influence of the involvement in food waste reduction on attitudes towards sustainable products containing seafood by-products. *Journal of cleaner production*, 285, p.125487. doi:10.1016/j.jclepro.2020.125487. <https://doi.org/10.1016/j.jclepro.2020.125487>
- Anusha Siddiqui, S., Bahmid, N.A., Mahmud, C.M.M., Boukid, F., Lamri, M. and Gagaoua, M. (2022). Consumer acceptability of plant-, seaweed-, and insect-based foods as alternatives to meat: a critical compilation of a decade of research. *Critical Reviews in Food Science and Nutrition*, pp.1-22.

doi:10.1080/10408398.2022.2036096.<https://doi.org/10.1080/10408398.2022.2036096>

- Ares, G., Ha, B. and Jaeger, S.R. (2021). Consumer attitudes to vertical farming (indoor plant factory with artificial lighting) in China, Singapore, UK, and USA: A multi-method study. *Food Research International*, 150, p.110811.  
doi:10.1016/j.foodres.2021.110811.<https://doi.org/10.1016/j.foodres.2021.110811>
- Armstrong, B., Reynolds, C., Bridge, G., Oakden, L., Wang, C., Panzone, L., Schmidt Rivera, X., Kause, A., Ffoulkes, C., Krawczyk, C., Miller, G. and Serjeant, S. (2021). How Does Citizen Science Compare to Online Survey Panels? A Comparison of Food Knowledge and Perceptions Between the Zooniverse, Prolific and Qualtrics UK Panels. *Frontiers in Sustainable Food Systems*, 4.  
doi:10.3389/fsufs.2020.575021.<https://doi.org/10.3389/fsufs.2020.575021>
- Aschemann-Witzel, J., Gantriis, R.F., Fraga, P. and Perez-Cueto, F.J.A. (2020). Plant-based food and protein trend from a business perspective: Markets, consumers, and the challenges and opportunities in the future. *Critical Reviews in Food Science and Nutrition*, 61(18), pp.1-10.  
doi:10.1080/10408398.2020.1793730.<https://doi.org/10.1080/10408398.2020.1793730>
- Attwood, S., Chesworth, S.J. and Parkin, B.L. (2020). Menu engineering to encourage sustainable food choices when dining out: An online trial of priced-based decoys. *Appetite*, 149, p.104601.  
doi:10.1016/j.appet.2020.104601.<https://doi.org/10.1016/j.appet.2020.104601>
- Banovic, M. and Barone, A.M. (2021). The hybrid enigma: The importance of self-construal for the effectiveness of communication messages promoting sustainable behaviour. *Food Quality and Preference*, 94, p.104334.  
doi:10.1016/j.foodqual.2021.104334.  
<https://doi.org/10.1016/j.foodqual.2021.104334>
- Banovic, M., Barone, A.M., Asioli, D. and Grasso, S. (2022). Enabling sustainable plant-forward transition: European consumer attitudes and intention to buy hybrid products. *Food Quality and Preference*, 96, p.104440.  
doi:10.1016/j.foodqual.2021.104440.  
<https://doi.org/10.1016/j.foodqual.2021.104440>

- Béné, C., 2020. Resilience of local food systems and links to food security-A review of some important concepts in the context of COVID-19 and other shocks. *Food security*, 12(4), pp.805-822. <https://doi.org/10.1007/s12571-020-01076-1>
- Berry, E.M., Dernini, S., Burlingame, B., Meybeck, A. and Conforti, P., 2015. Food security and sustainability: can one exist without the other?. *Public health nutrition*, 18(13), pp.2293-2302. DOI: <https://doi.org/10.1017/S136898001500021X>
- Biasini, B., Rosi, A., Giopp, F., Turgut, R., Scazzina, F. and Menozzi, D. (2021). Understanding, promoting and predicting sustainable diets: A systematic review. *Trends in Food Science & Technology*. doi:10.1016/j.tifs.2021.02.062. <https://doi.org/10.1016/j.tifs.2021.02.062>
- Biondi, B., Castiglione, C. and Mazzocchi, M. (2021). Demand drivers and changes in food-related emissions in the UK: A decomposition approach. *Ecological Economics*, 188, p.107114. doi:10.1016/j.ecolecon.2021.107114. <https://doi.org/10.1016/j.ecolecon.2021.107114>
- Boulet, M., Hoek, A.C. and Raven, R. (2021). Towards a multi-level framework of household food waste and consumer behaviour: Untangling spaghetti soup. *Appetite*, 156, p.104856. doi:10.1016/j.appet.2020.104856. <https://doi.org/10.1016/j.appet.2020.104856>
- Brennan, S.F., Lavelle, F., Moore, S.E., Dean, M., McKinley, M.C., McCole, P., Hunter, R.F., Dunne, L., O'Connell, N.E., Cardwell, C.R., Elliott, C.T., McCarthy, D. and Woodside, J.V. (2021). Food environment intervention improves food knowledge, wellbeing and dietary habits in primary school children: Project Daire, a randomised-controlled, factorial design cluster trial. *International Journal of Behavioral Nutrition and Physical Activity*, 18(1). doi:10.1186/s12966-021-01086-y. <https://doi.org/10.1186/s12966-021-01086-y>
- Broeckhoven, I., Verbeke, W., Tur-Cardona, J., Speelman, S. and Hung, Y. (2021). Consumer valuation of carbon labeled protein-enriched burgers in European older adults. *Food Quality and Preference*, 89, p.104114. doi:10.1016/j.foodqual.2020.104114. <https://doi.org/10.1016/j.foodqual.2020.104114>

- Brzustewicz, P. and Singh, A. (2021). Sustainable Consumption in Consumer Behavior in the Time of COVID-19: Topic Modeling on Twitter Data Using LDA. *Energies*, [online] 14(18), p.5787. doi:10.3390/en14185787.  
<https://doi.org/10.3390/en14185787>
- Buttriss, J.L. (2020). Why food reformulation and innovation are key to a healthier and more sustainable diet. *Nutrition Bulletin*, 45(3), pp.244-252.  
doi:10.1111/nbu.12455. <https://doi.org/10.1111/nbu.12455>
- Byerlee, D., and J. Fanzo. (2019). The SDG of zero hunger 75 years on: Turning full circle on agriculture and nutrition. *Global Food Security* 21: 52-59.  
<https://doi.org/10.1016/j.gfs.2019.06.002> <https://doi.org/10.1016/j.gfs.2019.06.002>
- Cantillo, J., Martín, J.C. and Román, C. (2021). Determinants of fishery and aquaculture products consumption at home in the EU28. *Food Quality and Preference*, 88, p.104085. doi:10.1016/j.foodqual.2020.104085.  
<https://doi.org/10.1016/j.foodqual.2020.104085>
- Chalmers, N., Stetkiewicz, S., Sudhakar, P., Osei-Kwasi, H. and Reynolds, C.J., (2019) 'Impacts of Reducing UK Beef Consumption Using a Revised Sustainable Diets Framework', *Sustainability*, Vol. 11, DOI: 10.3390/su11236863  
<https://doi.org/10.3390/su11236863>
- Chaudhary, A., Gustafson, D. and Mathys, A. (2018). Multi-indicator sustainability assessment of global food systems. *Nature Communications*, [online] 9(1).  
doi:10.1038/s41467-018-03308-7. <https://doi.org/10.1038/s41467-018-03308-7>
- Clapp, J., Moseley, W.G., Burlingame, B. and Termine, P. (2021). The case for a six-dimensional food security framework. *Food Policy*, p.102164.  
doi:10.1016/j.foodpol.2021.102164. <https://doi.org/10.1016/j.foodpol.2021.102164>
- Collins, A.M., Coughlin, D., Miller, J., Kirk, S. (2015). *The Production of Quick Scoping Reviews and Rapid Evidence Assessments: A How to Guide*. Dept. for Environment Food and Rural Affairs, NERC. Joint water evidence group.  
[https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/560521/Production\\_of\\_quick\\_scoping\\_reviews\\_and\\_rapid\\_evidence\\_assessments.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/560521/Production_of_quick_scoping_reviews_and_rapid_evidence_assessments.pdf)
- Cubero Dudinskaya, E., Naspetti, S., Arsenos, G., Caramelle-Holtz, E., Latvala, T., Martin-Collado, D., Orsini, S., Ozturk, E. and Zanolli, R. (2021). *European*

- Consumers' Willingness to Pay for Red Meat Labelling Attributes. *Animals*, 11(2), p.556. doi:10.3390/ani11020556. <https://doi.org/10.3390/ani11020556>
- Culliford, A. and Bradbury, J. (2020). A cross-sectional survey of the readiness of consumers to adopt an environmentally sustainable diet. *Nutrition Journal*, 19(1). doi:10.1186/s12937-020-00644-7. <https://doi.org/10.1186/s12937-020-00644-7>
  - Dangi, N., Gupta, S.K. and Narula, S.A. (2020). Consumer buying behaviour and purchase intention of organic food: a conceptual framework. *Management of Environmental Quality: An International Journal*, ahead-of-print(ahead-of-print). doi:10.1108/meq-01-2020-0014. <https://doi.org/10.1108/MEQ-01-2020-0014>
  - de Boer, J. and Aiking, H. (2021). Climate change and species decline: Distinct sources of European consumer concern supporting more sustainable diets. *Ecological Economics*, 188, p.107141. doi:10.1016/j.ecolecon.2021.107141. <https://doi.org/10.1016/j.ecolecon.2021.107141>
  - Deroover, K., Siegrist, M., Brain, K., McIntyre, J. and Bucher, T. (2021). A scoping review on consumer behaviour related to wine and health. *Trends in Food Science & Technology*, 112, pp.559-580. doi:10.1016/j.tifs.2021.03.057. <https://doi.org/10.1016/j.tifs.2021.03.057>
  - Do, K.T., Wang, C. and Guchait, P. (2021). When normative framing saves Mr. Nature: Role of consumer efficacy in proenvironmental adoption. *Psychology & Marketing*. doi:10.1002/mar.21486. <https://doi.org/10.1002/mar.21486>
  - Drewnowski, A., 2017. Sustainable, healthy diets: models and measures. In *Sustainable nutrition in a changing world* (pp. 25-34). Springer, Cham. [https://doi.org/10.1007/978-3-319-55942-1\\_2](https://doi.org/10.1007/978-3-319-55942-1_2) [https://doi.org/10.1007/978-3-319-55942-1\\_2](https://doi.org/10.1007/978-3-319-55942-1_2)
  - DU PISANI, J.A. (2006). Sustainable development - historical roots of the concept. *Environmental Sciences*, [online] 3(2), pp.83-96. doi:10.1080/15693430600688831. <https://doi.org/10.1080/15693430600688831>
  - Eckl, M.R., Biesbroek, S., van't Veer, P. and Geleijnse, J.M. (2021). Replacement of Meat with Non-Meat Protein Sources: A Review of the Drivers and Inhibitors in Developed Countries. *Nutrients*, 13(10), p.3602. doi:10.3390/nu13103602. <https://doi.org/10.3390/nu13103602>



- Eker, S., Garcia, D., Valin, H. and van Ruijven, B. (2021). Using social media audience data to analyse the drivers of low-carbon diets. *Environmental Research Letters*, 16(7), p.074001. doi:10.1088/1748-9326/abf770.  
<https://doi.org/10.1088/1748-9326/abf770>
- Eme, P., Douwes, J., Kim, N., Foliaki, S. and Burlingame, B. (2019). Review of Methodologies for Assessing Sustainable Diets and Potential for Development of Harmonised Indicators. *International Journal of Environmental Research and Public Health*, 16(7), p.1184. doi:10.3390/ijerph16071184.  
<https://doi.org/10.3390/ijerph16071184>
- Ericksen, P.J., 2008. Conceptualizing food systems for global environmental change research. *Global environmental change*, 18(1), pp.234-245.  
<https://doi.org/10.1016/j.gloenvcha.2007.09.002>  
<https://doi.org/10.1016/j.gloenvcha.2007.09.002>
- Fanzo, J (2019). 'Healthy and Sustainable Diets and Food Systems: the Key to Achieving Sustainable Development Goal 2?', *Food Ethics*, Vol. 4, DOI: 10.1007/s41055-019-00052-6. <https://doi.org/10.1007/s41055-019-00052-6>
- FAO, (2012). Sustainable diets and biodiversity: directions and solutions for policy, research and action. International Scientific Symposium, Biodiversity and Sustainable Diets United against Hunger. FAO, Rome, Italy.  
<https://www.fao.org/policy-support/tools-and-publications/resources-details/en/c/522860/>
- FAO-WHO ICN2 Secretariat 2014. Second International Conference on Nutrition. Information Note on the Framework for Action. FAO. (2016). State of food insecurity. Rome, Italy.
- Farmers Weekly (2016). UK's biggest farming co-ops ranked by turnover - Farmers Weekly. Available at: <https://www.fwi.co.uk/business/25-biggest-farming-co-ops-ranked-by-turnover>
- Filimonau, V., Vi, L.H., Beer, S. and Ermolaev, V.A. (2021). The Covid-19 pandemic and food consumption at home and away: An exploratory study of English households. *Socio-Economic Planning Sciences*, p.101125. doi:10.1016/j.seps.2021.101125. <https://doi.org/10.1016/j.seps.2021.101125>



- Gibson, R.B. 2006, "Beyond the pillars: sustainability assessment as a framework for effective integration of social, economic and ecological considerations in significant decision-making", *Journal of Environmental Assessment Policy and Management*, vol. 8, no. 3, pp. 259-280.  
[https://doi.org/10.1142/9789814289696\\_0018](https://doi.org/10.1142/9789814289696_0018)  
[https://doi.org/10.1142/9789814289696\\_0018](https://doi.org/10.1142/9789814289696_0018)
- Graham, F., Barker, M., Menon, M. and Holdsworth, M. (2020). Acceptability and feasibility of a café-based sustainable food intervention in the UK. *Health Promotion International*. doi:10.1093/heapro/daaa027.  
<https://doi.org/10.1093/heapro/daaa027>
- Grasso, S. and Asioli, D. (2020). Consumer preferences for upcycled ingredients: a case study with biscuits. *Food Quality and Preference*, p.103951.  
doi:10.1016/j.foodqual.2020.103951.  
<https://doi.org/10.1016/j.foodqual.2020.103951>
- Gulbrandsen, L.H., Vormedal, I. and Larsen, M.L. (2022). No logo? The failure of ASC salmon labeling in Norway and the UK. *Marine Policy*, 138, p.104987.  
doi:10.1016/j.marpol.2022.104987. <https://doi.org/10.1016/j.marpol.2022.104987>
- Gussow, J.D. & Clancy, K. 1986, "Dietary guidelines for sustainability", *Journal of Nutrition Education*, vol. 18, pp. 1-5. [https://doi.org/10.1016/S0022-3182\(86\)80255-2](https://doi.org/10.1016/S0022-3182(86)80255-2) [https://doi.org/10.1016/S0022-3182\(86\)80255-2](https://doi.org/10.1016/S0022-3182(86)80255-2)
- Gustafson, D., Gutman, A., Leet, W., Drewnowski, A., Fanzo, J. and Ingram, J. (2016). Seven Food System Metrics of Sustainable Nutrition Security. *Sustainability*, [online] 8(3), p.196. doi:10.3390/su8030196.  
<https://doi.org/10.3390/su8030196>
- Hartmann, T., Jahnke, B. and Hamm, U. (2021). Making ugly food beautiful: Consumer barriers to purchase and marketing options for Suboptimal Food at retail level - A systematic review. *Food Quality and Preference*, 90, p.104179.  
doi:10.1016/j.foodqual.2021.104179.  
<https://doi.org/10.1016/j.foodqual.2021.104179>
- Haydon, P., Tobi, R., Bridge, G., Gurung, I. and Scott, C. (2020). Peas Please: Making a pledge for more veg. *Nutrition Bulletin*, 45(4), pp.483-494.  
doi:10.1111/nbu.12463. <https://doi.org/10.1111/nbu.12463>

- HLPE (2020). HLPE, 2020. Food Security and Nutrition: Building a Global Narrative Towards 2030. <http://www.fao.org/3/ca9731en/ca9731en.pdf> .
- Hopkins Van Mil (2021). National Food Strategy Independent Review THE PUBLIC DIALOGUE FINDINGS REPORT. Hopkins Van Mil.
- Howlett, N., Roberts, K.P.J., Swanston, D., Edmunds, L.D. and Willis, T.A. (2021). Testing the feasibility of a sustainable preschool obesity prevention approach: a mixed-methods service evaluation of a volunteer-led HENRY programme. BMC Public Health, 21(1). doi:10.1186/s12889-020-10031-w. <https://doi.org/10.1186/s12889-020-10031-w>
- Ingram, J., 2011. A food systems approach to researching food security and its interactions with global environmental change. Food security, 3(4), pp.417-431. <https://doi.org/10.1007/s12571-011-0149-9> <https://doi.org/10.1007/s12571-011-0149-9>
- International Union for Conservation of Nature and World Wildlife Fund, 1980. World conservation strategy: Living resource conservation for sustainable development (Vol. 1). Gland, Switzerland: IUCN.
- Jia, L. and Linden, S. (2020). Green but not altruistic warm-glow predicts conservation behavior. Conservation Science and Practice, 2(7). doi:10.1111/csp2.211. <https://doi.org/10.1111/csp2.211>
- Johnston, J.L., Fanzo, J.C. and Cogill, B., 2014. Understanding sustainable diets: a descriptive analysis of the determinants and processes that influence diets and their impact on health, food security, and environmental sustainability. Advances in nutrition, 5(4), pp.418-429. <https://doi.org/10.3945/an.113.005553>
- Jones, A.D., Hoey, L., Blesh, J., Miller, L., Green, A. and Shapiro, L.F. (2016) A Systematic Review of the Measurement of Sustainable Diets. American Society for Nutrition. Adv Nutr 2016;7:641-64; doi:10.3945/an.115.011015 <https://doi.org/10.3945/an.115.011015>
- Kantarworldpanel.com. (2022). Grocery Market Share - Kantar Worldpanel. [online] Available at: <https://www.kantarworldpanel.com/en/grocery-market-share/great-britain>
- Kowalska, A., Ratajczyk, M., Manning, L., Bieniek, M. and Maćik, R. (2021). 'Young and Green' a Study of Consumers' Perceptions and Reported Purchasing

Behaviour towards Organic Food in Poland and the United Kingdom.

Sustainability, 13(23), p.13022. doi:10.3390/su132313022.

<https://doi.org/10.3390/su132313022>

- Lonkila, A. and Kaljonen, M. (2021). Promises of meat and milk alternatives: an integrative literature review on emergent research themes. *Agriculture and Human Values*. doi:10.1007/s10460-020-10184-9. <https://doi.org/10.1007/s10460-020-10184-9>
- Lonnie, M. and Johnstone, A.M. (2020). The public health rationale for promoting plant protein as an important part of a sustainable and healthy diet. *Nutrition Bulletin*, 45(3), pp.281-293. doi:10.1111/nbu.12453. <https://doi.org/10.1111/nbu.12453>
- Macdiarmid, J.I. (2021). The food system and climate change: are plant-based diets becoming unhealthy and less environmentally sustainable? *Proceedings of the Nutrition Society*, pp.1-13. doi:10.1017/s0029665121003712. <https://doi.org/10.1017/S0029665121003712>
- Macdiarmid, J.I., Cerroni, S., Kalentakis, D. and Reynolds, C. (2021). How important is healthiness, carbon footprint and meat content when purchasing a ready meal? Evidence from a non-hypothetical discrete choice experiment. *Journal of Cleaner Production*, 282, p.124510. doi:10.1016/j.jclepro.2020.124510. <https://doi.org/10.1016/j.jclepro.2020.124510>
- McGinnis, R., Meadows, D.H., Meadows, D.L., Randers, J. and Behren, W.W. (1973). *The Limits to Growth: A Report for the Club of Rome's Project on the Predicament of Mankind*. *Demography*, 10(2), p.295. doi:10.2307/2060820. <https://doi.org/10.2307/2060820>
- Menozzi, D., Nguyen, T.T., Sogari, G., Taskov, D., Lucas, S., Castro-Rial, J.L.S. and Mora, C. (2020). Consumers' Preferences and Willingness to Pay for Fish Products with Health and Environmental Labels: Evidence from Five European Countries. *Nutrients*, 12(9), p.2650. doi:10.3390/nu12092650. <https://doi.org/10.3390/nu12092650>
- Miller, K., et al (2021). 'Role of Food Industry in Promoting Healthy and Sustainable Diets', *Nutrients*, Vol. 13, DOI: 10.3390/nu13082740 <https://doi.org/10.3390/nu13082740>

- Mintel (2022) Market Shares 2020 Available at: <https://clients.mintel.com>
- Modica, P.D., Altinay, L., Farmaki, A., Gursoy, D. and Zenga, M. (2018). Consumer perceptions towards sustainable supply chain practices in the hospitality industry. *Current Issues in Tourism*, pp.1-18.  
doi:10.1080/13683500.2018.1526258.  
<https://doi.org/10.1080/13683500.2018.1526258>
- Morley, A. (2020). Procuring for Change: An exploration of the innovation potential of sustainable food procurement. *Journal of Cleaner Production*, p.123410.  
doi:10.1016/j.jclepro.2020.123410. <https://doi.org/10.1016/j.jclepro.2020.123410>
- Morley, A. and Morgan, K. (2021). Municipal foodscapes: Urban food policy and the new municipalism. *Food Policy*, p.102069. doi:10.1016/j.foodpol.2021.102069.  
<https://doi.org/10.1016/j.foodpol.2021.102069>
- Murphy, B., Martini, M., Fedi, A., Loera, B.L., Elliott, C.T. and Dean, M. (2022). Consumer trust in organic food and organic certifications in four European countries. *Food Control*, 133, p.108484. doi:10.1016/j.foodcont.2021.108484.  
<https://doi.org/10.1016/j.foodcont.2021.108484>
- Oke, A., Ladas, J. and Bailey, M. (2020). Ethical consumers: an exploratory investigation of the ethical food consumption behaviour of young adults in the North East of Scotland. *British Food Journal*, 122(11), pp.3623-3638.  
doi:10.1108/bfj-10-2019-0801. <https://doi.org/10.1108/BFJ-10-2019-0801>
- Oloyede, O.O. and Lignou, S. (2021). Sustainable Paper-Based Packaging: A Consumer's Perspective. *Foods*, 10(5), p.1035. doi:10.3390/foods10051035.  
<https://doi.org/10.3390/foods10051035>
- Otto, S., Strenger, M., Maier-Nöth, A. and Schmid, M. (2021). Food packaging and sustainability - Consumer perception vs. correlated scientific facts: A review. *Journal of Cleaner Production*, 298, p.126733. doi:10.1016/j.jclepro.2021.126733.  
<https://doi.org/10.1016/j.jclepro.2021.126733>
- Pakseresht, A., Kaliji, S.A. and Canavari, M. (2021). Review of factors affecting consumer acceptance of cultured meat. *Appetite*, p.105829.  
doi:10.1016/j.appet.2021.105829. <https://doi.org/10.1016/j.appet.2021.105829>
- Panzone, L.A., Sniehotta, F.F., Comber, R. and Lemke, F. (2020). The effect of traffic-light labels and time pressure on estimating kilocalories and carbon footprint

of food. *Appetite*, [online] 155, p.104794. doi:10.1016/j.appet.2020.104794.

<https://doi.org/10.1016/j.appet.2020.104794>

- Panzone, L.A., Ulph, A., Zizzo, D.J., Hilton, D. and Clear, A. (2021). The impact of environmental recall and carbon taxation on the carbon footprint of supermarket shopping. *Journal of Environmental Economics and Management*, [online] 109, p.102137. doi:10.1016/j.jeem.2018.06.002.  
<https://doi.org/10.1016/j.jeem.2018.06.002>
- Papiés, E.K., Johannes, N., Daneva, T., Semyte, G. and Kauhanen, L.L., 2020. Using consumption and reward simulations to increase the appeal of plant-based foods. *Appetite*, 155, p.104812. doi:10.1016/j.appet.2020.104812.  
<https://doi.org/10.1016/j.appet.2020.104812>
- Parkin, B. and Attwood, S. (2021). Menu design approaches to promote sustainable vegetarian food choices when dining out. *Journal of Environmental Psychology*, p.101721. doi:10.1016/j.jenvp.2021.101721.  
<https://doi.org/10.1016/j.jenvp.2021.101721>
- Patel, V. and Buckland, N.J. (2021). Perceptions about meat reducers: Results from two UK studies exploring personality impressions and perceived group membership. *Food Quality and Preference*, 93, p.104289. doi:10.1016/j.foodqual.2021.104289.  
<https://doi.org/10.1016/j.foodqual.2021.104289>
- Pechey, R., Bateman, P., Cook, B. and Jebb, S.A. (2022). Impact of increasing the relative availability of meat-free options on food selection: two natural field experiments and an online randomised trial. *International Journal of Behavioral Nutrition and Physical Activity*, 19(1). doi:10.1186/s12966-021-01239-z.  
<https://doi.org/10.1186/s12966-021-01239-z>
- Pechey, R., Hollands, G.J. and Marteau, T.M. (2021). Are meat options preferred to comparable vegetarian options? An experimental study. *BMC Research Notes*, 14(1). doi:10.1186/s13104-021-05451-9. <https://doi.org/10.1186/s13104-021-05451-9>
- Pinto, V.R.A., Campos, R.F. de A., Rocha, F., Emmendoerfer, M.L., Vidigal, M.C.T.R., da Rocha, S.J.S.S., Lucia, S.M.D., Cabral, L.F.M., de Carvalho, A.F. and Perrone, Í.T. (2021). Perceived healthiness of foods: A systematic review of

- qualitative studies. *Future Foods*, [online] 4, p.100056.  
doi:10.1016/j.fufo.2021.100056. <https://doi.org/10.1016/j.fufo.2021.100056>
- POST 2012, Seeking sustainability, Parliamentary Office of Science and Technology, London. <https://post.parliament.uk/research-briefings/post-pn-408/>
  - Ravikumar, D., Spyreli, E., Woodside, J., McKinley, M. and Kelly, C. (2022). Parental perceptions of the food environment and their influence on food decisions among low-income families: a rapid review of qualitative evidence. *BMC Public Health*, 22(1). doi:10.1186/s12889-021-12414-z. <https://doi.org/10.1186/s12889-021-12414-z>
  - Rockström, J., Steffen, W., Noone, K., Persson, Å., Chapin, F.S., Lambin, E.F., Lenton, T.M., Scheffer, M., Folke, C., Schellnhuber, H.J. and Nykvist, B., 2009. A safe operating space for humanity. *nature*, 461(7263), pp.472-475.  
<https://doi.org/10.1038/461472a> <https://doi.org/10.1038/461472a>
  - Rondoni, A. and Grasso, S. (2021). Consumers behaviour towards carbon footprint labels on food: A review of the literature and discussion of industry implications. *Journal of Cleaner Production*, [online] 301, p.127031.  
doi:10.1016/j.jclepro.2021.127031. <https://doi.org/10.1016/j.jclepro.2021.127031>
  - Rondoni, A., Asioli, D. and Millan, E. (2020). Consumer behaviour, perceptions, and preferences towards eggs: A review of the literature and discussion of industry implications. *Trends in Food Science & Technology*.  
doi:10.1016/j.tifs.2020.10.038. <https://doi.org/10.1016/j.tifs.2020.10.038>
  - Schipanski, M.E., MacDonald, G.K., Rosenzweig, S., Chappell, M.J., Bennett, E.M., Kerr, R.B., Blesh, J., Crews, T., Drinkwater, L., Lundgren, J.G. and Schnarr, C., 2016. Realizing resilient food systems. *BioScience*, 66(7), pp.600-610.  
<https://doi.org/10.1093/biosci/biw052> <https://doi.org/10.1093/biosci/biw052>
  - Schubert, I., de Groot, J.I.M. and Newton, A.C. (2021). Challenging the Status Quo through Social Influence: Changes in Sustainable Consumption through the Influence of Social Networks. *Sustainability*, 13(10), p.5513.  
doi:10.3390/su13105513. <https://doi.org/10.3390/su13105513>
  - Sharpe, R. (2016). A piecemeal way to save the world: Investigating social sustainability in the UK's conventional food supply. [Thesis] Available at:

<https://openaccess.city.ac.uk/id/eprint/17353/1/Sharpe,%20Rosalind%20Complete.pdf> [Accessed 12 May 2022].

- Shreedhar, G. and Galizzi, M.M. (2021). Personal or planetary health? Direct, spillover and carryover effects of non-monetary benefits of vegetarian behaviour. *Journal of Environmental Psychology*, 78, p.101710. doi:10.1016/j.jenvp.2021.101710. <https://doi.org/10.1016/j.jenvp.2021.101710>
- Skelhorn, E.P.G., Garcia-Ara, A., Nova, R.J., Kinston, H. and Wapenaar, W. (2020). Public opinion and perception of rosé veal in the UK. *Meat Science*, 167, p.108032. doi:10.1016/j.meatsci.2019.108032. <https://doi.org/10.1016/j.meatsci.2019.108032>
- Spartano, S. and Grasso, S. (2021). Consumers' Perspectives on Eggs from Insect-Fed Hens: A UK Focus Group Study. *Foods*, 10(2), p.420. doi:10.3390/foods10020420. <https://doi.org/10.3390/foods10020420>
- Steenson, S. and Buttriss, J.L. (2020). The challenges of defining a healthy and 'sustainable' diet. *Nutrition Bulletin*, 45(2), pp.206-222. doi:10.1111/nbu.12439. <https://doi.org/10.1111/nbu.12439>
- Stuart, T., 2007. *The bloodless revolution: A cultural history of vegetarianism from 1600 to modern times*. WW Norton & Company.
- Sullivan, V.S., Smeltzer, M.E., Cox, G.R. and MacKenzie-Shalders, K.L. (2021). Consumer expectation and responses to environmental sustainability initiatives and their impact in foodservice operations: A systematic review. *Journal of Human Nutrition and Dietetics*, 34(6), pp.994-1013. doi:10.1111/jhn.12897. <https://doi.org/10.1111/jhn.12897>
- Theis, D.R. and White, M., (2021). Is obesity policy in England fit for purpose? Analysis of government strategies and policies, 1992-2020. *The Milbank Quarterly*, 99(1), pp.126-170. <https://doi.org/10.1111/1468-0009.12498>
- Topić, M., Diers Lawson, A. and Kelsey, S. (2021). Women and the squander cycle in food waste in the United Kingdom: An ecofeminist and feminist economic analysis. *Socijalna ekologija*, 30(2), pp.219-253. doi:10.17234/socekol.30.2.3. <https://doi.org/10.17234/SocEkol.30.2.3>



- Trewern, J., Chenoweth, J. and Christie, I. (2022). 'Does it change the nature of food and capitalism?' Exploring expert perspectives on public policies for a transition to 'less and better' meat and dairy. *Environmental Science & Policy*, 128, pp.110-120. doi:10.1016/j.envsci.2021.11.018.  
<https://doi.org/10.1016/j.envsci.2021.11.018>
- Trewern, J., Chenoweth, J. and Christie, I. (2022). Sparking Change: Evaluating the effectiveness of a multi-component intervention at encouraging more sustainable food behaviors. *Appetite*, 171, p.105933.  
doi:10.1016/j.appet.2022.105933. <https://doi.org/10.1016/j.appet.2022.105933>
- Tu, V.H., Kopp, S.W., Trang, N.T., Kontoleon, A. and Yabe, M. (2021). UK Consumers' Preferences for Ethical Attributes of Floating Rice: Implications for Environmentally Friendly Agriculture in Vietnam. *Sustainability*, [online] 13(15), p.8354. doi:10.3390/su13158354. <https://doi.org/10.3390/su13158354>
- Un.org. (2014). WSSD ∴ Sustainable Development Knowledge Platform. [online] Available at: <https://sustainabledevelopment.un.org/milestones/wssd>.
- United Nations (2018). United Nations sustainable development agenda. [online] United Nations Sustainable Development. Available at: <https://www.un.org/sustainabledevelopment/development-agenda-retired/> [Accessed 12 May 2022].
- van Bussel, L.M., Kuijsten, A., Mars, M. and van 't Veer, P. (2022). Consumers' perceptions on food-related sustainability: A systematic review. *Journal of Cleaner Production*, 341, p.130904. doi:10.1016/j.jclepro.2022.130904.  
<https://doi.org/10.1016/j.jclepro.2022.130904>
- Verfuherth, C., Gregory-Smith, D., Oates, C.J., Jones, C.R. and Alevizou, P. (2021). Reducing meat consumption at work and at home: facilitators and barriers that influence contextual spillover. *Journal of Marketing Management*, pp.1-32. doi:10.1080/0267257x.2021.1888773.  
<https://doi.org/10.1080/0267257X.2021.1888773>
- Wakefield, A. and Axon, S. (2020). 'I'm a bit of a waster': Identifying the enablers of, and barriers to, sustainable food waste practices. *Journal of Cleaner Production*, 275, p.122803. doi:10.1016/j.jclepro.2020.122803.  
<https://doi.org/10.1016/j.jclepro.2020.122803>



- WECD, (1987) Report of the World Commission on Environment and Development: Our Common Future. pp. XV, 35, 347. [online] Available at:<http://www.ask-force.org/web/Sustainability/Brundtland-Our-Common-Future-1987-2008.pdf>. [Accessed 12 May 2022]
- Willett, W., Rockström, J., Loken, B., Springmann, M., Lang, T., Vermeulen, S., Garnett, T., Tilman, D., DeClerck, F., Wood, A. and Jonell, M., (2019) 'Our Food in the Anthropocene: The EAT LANCET Commission on Healthy Diets from Sustainable Food Systems' LANCET, Vol. 393, DOI: 10.1016/S0140-6736(18)31788-4 [https://doi.org/10.1016/S0140-6736\(18\)31788-4](https://doi.org/10.1016/S0140-6736(18)31788-4)
- Yang, Q., Shen, Y., Foster, T. and Hort, J. (2020). Measuring consumer emotional response and acceptance to sustainable food products. Food Research International, 131, p.108992. doi:10.1016/j.foodres.2020.108992. <https://doi.org/10.1016/j.foodres.2020.108992>
- YouGov (2022). The most popular dining brands in the UK | Food | YouGov Ratings. Available at: <https://yougov.co.uk/ratings/food/popularity/dining-brands/all>

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