

Appendices

Sustainable Food:

Public Attitudes and Engagement in the UK, Brazil and India

November 2021



Download the [main findings report here](#)

Appendices for research conducted to a brief from the Science Museum Group supported by Lloyd's Register Foundation. These are shared by the research partners, Flow Associates, Flow India and People's Palace Projects, to provide full resources about our methodology and detailed accounts of our conversations.



Table of contents

Table of contents	2
Appendix for the Research Methodology	5
1.1 Solutions we shared in conversations	5
1.2 The stages of research: March to July 2021	6
1.3 A note on demographics and recruitment in Brazil	6
1.4 Conversations with professionals	8
Appendix to background research: contexts of Brazil, India and the UK	9
2.1 Brazil context	9
2.1.1 Food system issues and solutions	9
2.1.1.1 The key issues	9
2.1.1.2 Solutions arising	15
2.1.2 Demographics in Brazil	22
2.1.2.1 Demographics in relation to food sustainability	22
2.1.2.2 Demographics in relation to museums	23
2.1.3 Public attitudes to food sustainability in Brazil	24
2.1.4 Specific issues due to COVID-19	25
2.1.5 Audience engagement	26
2.2 India context	27
2.2.1 Food system issues and innovations	27
2.2.1.1 Key issues	27
2.2.1.2 Solutions arising	35
2.2.2 Demographics in India, in relation to museums	37
2.2.3 Public attitudes to food sustainability in India	39
2.2.4 Specific issues due to COVID-19	43
2.3 UK context	44
2.3.1 Food system issues and solutions	44
2.3.3.1 Key issues	44
2.3.3.2 Solutions arising	46
2.3.4 Demographics in the UK	46
2.3.4.1 Demographics and food	46
2.3.4.2 Demographics and museums	47
2.3.5 Specific issues in relation to COVID-19 in the UK	47
2.4 Note on the global impact of COVID-19 on culture	47
Appendix: Detailed Analysis of Survey	48
3.1 Methodology of online survey	48
3.2 Who responded to the survey?	49
3.3 Relationship to museums	50
3.4 Interest in issues about food	52
3.5 Concern about the environment	56

3.6 Thinking about food and the environment	60
3.7 Actions	61
4. Conversations in Brazil	64
4.1 What motivates and interests people?	64
4.1.1 Mobilising, positive relationships	64
4.1.2 Ethical dilemmas and everyday challenges	67
4.1.3 Subjects which mobilise adults and families	70
4.1.4 Changing habits: the pandemic's consequences	70
4.2 What do people understand about food sustainability?	72
4.2.1 Equality and sustainability	72
4.2.2 Hunger and reducing inequalities	72
4.2.3 Inappropriate use of soil	73
4.3 What do audiences think are the effective and relevant solutions?	92
4.4 How do audiences like to explore and learn about these issues?	85
4.4.1 Sources of Learning and Information	85
4.4.2 Sources of Information	86
4.4.3 Museum of food: What would be effective to involve target audiences?	89
5. Conversations in India	99
5.1 What motivates and interests audiences about food and the planet?	99
5.1.1 Independent adults	99
5.1.2 Teachers	100
5.1.3 Secondary students	100
5.1.4 Families	101
5.2 What do audiences understand about food sustainability?	102
5.2.1 Independent adults	102
5.2.2 Teachers	103
5.2.3 Students	104
5.2.4 Families	105
5.3 What do people think are the effective and relevant solutions?	106
5.3.1 Independent adults	106
5.3.2 Teachers	107
5.3.3 Secondary students	108
5.3.4 Families	109
5.4 What engages audiences?	111
5.4.1 Independent adults	111
5.4.2 Teachers	111
5.4.3 Secondary students	112
5.4.4 Families	112
5.5 Talking to public engagement professionals	113
5.5.1 Motivations and interests	113
5.5.2 What people need to understand about food sustainability	113
5.5.3 What are effective and relevant solutions people need to know about	115

5.5.4 What engages people?	116
5.5.5 What museums and informal science education can achieve	118
6. Conversations in the UK	119
6.1 What motivates and interests people about food and the planet?	119
6.1.1 Independent adults	119
6.1.2 Teachers	121
6.1.3 Secondary students	123
6.1.3.1 Younger students	123
6.1.3.2 Older students	124
6.1.4 Families	124
6.2 What do audiences understand about food sustainability?	125
6.2.1 Independent adults	125
6.2.2 Teachers	129
6.2.3 Secondary students	130
6.2.3.1 Younger students	130
6.2.3.2 Older students	130
6.2.4 Families	131
6.3 What do audiences think are the effective and relevant solutions?	131
6.3.1 Independent adults	131
6.3.2 Teachers	139
6.3.3 Secondary students	141
6.3.3.1 Younger students	141
6.3.3.2 Older students	141
6.3.4 Families	143
6.4 What engages audiences?	144
6.4.1 Independent adults	144
6.4.1.1 Sources of information	144
6.4.1.2 How do audiences like to learn about these issues in a museum?	148
6.4.2 Teachers	151
6.4.3 Secondary students	154
6.4.3.1 Younger students	154
6.4.3.2 Older students	154
6.4.4 Families	155
6.5 Talking to professionals	156
6.5.1 Context of UK food systems and culture	156
6.5.2 Key findings	157
7. Resources to engage public in food sustainability	161
Resources gathered in preparation for this research	161
Shared by UK professionals consulted	161
Shared by Brazil professionals consulted	162
Shared by India professionals consulted	163

1. Appendix for the Research Methodology

1.1 Solutions we shared in conversations

This collage is of solutions shared in focus groups and interviews with UK audiences. Slight adjustments and translations were made for audiences in Brazil and India.



1 High tech greenhouses
Sensors keep watch to control water and light. Lights allow for 24 hour growing. They use less space for more food.



2 GMO food
Modify genes to breed plants that resist pests or drought, or use less space, water and soil.





3 Greener aquaculture
Growing aquatic plants, animals & other organisms to produce food, with other benefits such as capturing CO2 and cleaning water.

Integrating several species of plants & fish in one system; learning from indigenous methods

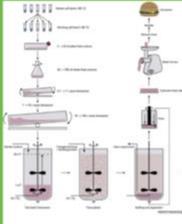




4 Eating insects
They're nutritious and healthy, high protein and low fat. They use less space & energy than livestock so are more climate-friendly.



Home insect breeder gadget



5 Lab grown meat
Produced in bioreactors using animal cells and plant-based material. Cleaner, drug-free & animals aren't harmed.





6 Regenerative farming
A range of methods, such as not ploughing fields. It helps restore biodiversity, improve soil health and save water. Farms are resilient to climate change while helping to reduce its impacts.

Water 1L	Emissions 1.8 kgCO ₂	Water 250L	Emissions 25 kgCO ₂
3g Pesticide Toxicity LOW	Low Impact on Biodiversity HIGH	25g Pesticide Toxicity LOW	Medium Impact on Biodiversity HIGH
Environmental Impact per 100g		Environmental Impact per 100g	

7 Eco labels
Labels on products showing their impacts on environment. Also, badges to certify greener foods.



Good for forests, climate & people



8 Ending food waste
Schemes that reduce, use up, give away or recycle food waste. Less waste reduces the harm created by the food system.



No-waste restaurants
Selling imperfect produce



Getting unsold food to people in need



9 Community supported farming
Movements to support small farmers & landless workers where big companies are grabbing land. Schemes ensure fair food prices and the protection of nature.

Navdanya in India, e.g. seed banks




Landless Workers Movement, Brazil

1.2 The stages of research: March to July 2021

Collaborative research design: March - April

- Meetings with stakeholders across the Science Museum Group, Lloyd's Register Foundation, National Council of Science Museums and Museum of Tomorrow
- Meetings between UK, India and Brazil research teams
- Detailed development of the thesis, questions and definitions of audiences
- Applying [Flow's Three Lenses](#) framework to model responses in three realms of interest: self & family; community & society; global & more-than-human world.
- Planning methods of recruitment and communication about the research. Producing research ethics statements and consent forms.
- Revising our plan in light of worsening pandemic in Brazil and India.

Contextual research: April - May

- Familiarisation with Science Museum Group's Equity and Science Capital frameworks
- Familiarisation with projects at the partner museums on food and environment
- Background research into public attitudes and issues in Brazil, India and the UK, writing contextual summaries about each country
- Collecting and reading [hundreds of articles and case studies](#) of communication on food and sustainability
- Writing an overview of the causes, impacts and solutions of harms that arise from the food system, at a global level.

Consultation: May - July

- May - June: An initial light-touch survey replicated for each country to recruit participants while eliciting enough data to code people in relation to knowledge and attitudes. This was shared with existing museum visitors via the museum partners' databases, to almost 350k people.
- June - July: conversations with teachers, independent adult visitors and food/culture professionals
- June - July: Interviews and focus groups with schools, families, independent adults and food/culture professionals.

Analysis and reporting: July - August

- Coding of the survey results
- Revision of the background research to adjust to new knowledge
- Analysis of transcripts for each country's consultation
- Sharing and synthesising findings between the research team, writing an executive summary
- Discussing findings with the research stakeholders
- Design and revisions.

1.3 A note on demographics and recruitment in Brazil

The recruitment for independent adults and some of the families for the in-depth study phase was carried out based on the responses received from the brief survey sent electronically. First, we surveyed demographic and socioeconomic data for the city of Rio de Janeiro in order to qualitatively contextualise the responses given by the people consulted in our sample. We must highlight here that the sample for the qualitative interview stage, as well as the profile of survey respondents, represents a limited cross-section of society.

While most of the 190 respondents willing to participate in the in-depth interviews have completed their higher education, data from the Brazilian National Household Sample Survey (PNAD Contínua, 2021)¹² shows that in the municipality of Rio de Janeiro in 2019, 32.2% of the population aged 25+ had only completed secondary education, while 24.2% of this same age group had not completed their primary education, meaning a total of 56.4% of the population aged 25+ didn't go on to higher education. We also highlight that only 21.3% of people in this same age group completed their higher education.

Another important statistic worth mentioning is the country's unemployment rate which has increased exponentially in recent years. In the state of Rio de Janeiro, the number of unemployed reached 1.6 million in the last quarter, or 19.4% of the population, the fifth highest unemployment rate among Brazil's states. According to a survey by the Brazilian Institute of Geography and Statistics (IBGE, 2021)²³, Rio de Janeiro state broke a historic record in the first quarter of 2021, ending the period with 316,000 more unemployed people than in the previous year.

In contrast, in our sample a large proportion said they were employed or not looking for a job, a pattern similar to that identified by the survey responses, especially among respondents who were willing to participate in the qualitative phase.

With this in mind, we sought to include greater plurality among those interviewed by selecting people who live in different locations in the city of Rio de Janeiro, as well as the city's metropolitan area. We also took care to ensure a minimum of social representation by selecting families and young people who live in different socioeconomic contexts, such as a group of students living in favelas in the east of the metropolitan area and families living in marginalised areas of the city.

1.5 Revisions of methodology due to COVID-19

In response to the COVID-19 situation, we revised our proposed methodology to alter the timeline of the research, to shift almost entirely to online conversations and to acknowledge the experience of the worsening pandemic:

- As Brazil's COVID-19 crisis got worse in March, another crisis has been unfolding: hunger and food insecurity. A survey in April³ showed that hunger hit 19 million Brazilians in the pandemic in 2020. 116.8 million people (55.2% of all households) lived with some degree of food insecurity in Brazil. The pandemic has thrown many of Brazil's 38 million informal workers into unemployment, and basic food prices have rocketed, which has had a disproportionate effect on poorer citizens. In one year, the price of rice shot up by 70% and soybean oil by 87%.
- In India, the numbers of people infected sharply rose in April, so that healthcare and other services were on the brink of collapse. Food prices rose over 5% in one month of May 2021, affecting. Delhi was particularly badly affected by the pandemic, having also been troubled by farmers' protests

¹ Data from the last National Household Sample Survey (PNAD Contínua, 2021), published by the Brazilian Institute of Geography and Statistics (IBGE), show that 489,000 new unemployed people were added to the country's statistics, totalling 14.761 million unemployed workers.

Source: <https://biblioteca.ibge.gov.br/index.php/biblioteca-catalogo?view=detalhes&id=72421>

² *ibid.*

³ By the Brazilian Network for Research in Sovereignty and Food & Nutritional Security

earlier in the year. The ‘Delta variant’ that arose in India spread to affect other countries, including younger unvaccinated people.

- In the UK, a three month lockdown ended at the end of March, but restrictive measures continued in place. Infection rates dropped from a spike in the winter, but has since been affected by the spread of the Delta variant. Background inequality and food insecurity is among the worst in Europe, and this has been exacerbated by the pandemic as well as problems with customs and transport due to Brexit.

Internationally, food prices rose 47% in the first half of 2021, with climate change being a rising factor alongside the pandemic. We assumed that this context would affect people’s ability to participate in the research and their perceptions of food sustainability issues. It could affect the abilities of some to consider longer term or wider issues, while, on the other hand, it may increase their desire and need for local, resilient solutions and sharpen their awareness of the fragility of food supplies.

1.4 Conversations with professionals

The names and roles of those we spoke to are in the appendix of the report. We assumed that the cultural methods for engaging publics on food sustainability include:

- Museums, galleries and cultural heritage sites
- Botanic gardens, parks and wildlife reserves
- Tourist farms, city farms and community gardens/orchards
- Broadcast and media, such as films, events, online resources and games
- Digital platforms, collections and communities e.g. [Atlas of the Future](#)
- Public-facing academic research - books, articles, talks
- Campaigns by community charities and NGOs
- Curriculum and special projects in schools and colleges
- Advertising and other commercial activities (e.g. low waste restaurants)
- Individual influencers: cooks, family members and celebrities.

Our conversations focused on the role of museums and science centres, considering how they might need to be reimagined, and how effective they are alongside other kinds of information campaigns. They also gave views on the problems and solutions that public audiences need to know about.

2. Appendix to background research: contexts of Brazil, India and the UK

2.1 Brazil context

2.1.1 Food system issues and solutions

2.1.1.1 The key issues

Overview

Brazil is the fourth largest food producer in the world and ranks as the number one crop producer⁴. Farming accounts for 22 per cent of the country's economy⁵. The forecast for 2021 is that the country will harvest 264.5 million tons of grains, cereal and pulses, a record which surpasses the 2020 figure by 4.1% a de 2020, which had already been the largest harvest in history. Meat production occupies 63 million hectares of land, and the country is currently the world's second-largest commercial beef and poultry producer. The significant figures in the country's agricultural economy, linked to commodities for export, contrast with the reality of hunger and inequality, which have intensified even more because of the crisis caused by the COVID-19 pandemic. In addition, activities related to soya crops and livestock pose great threats to natural resources, due to the high use of pesticides, deforestation rates and greenhouse gas emissions. Overall, Brazil ranks 40th out of the 67 countries included in the Food Sustainability Index (managed by the FEC)⁶.

Water: Supplies and water insecurity

Home to 13% of the planet's surface freshwater, Brazil is considered to be the world's largest water power. However, the country suffers from problems of scarcity, lack of supply in several regions, water pollution and contamination, in addition to recording significant data on losses (the national average reaches 39.2%) and waste. Even today, there are almost 35 million people who live without access to treated water, with some regions being more severely affected: in 2020, around 40% of households in the North and Northeast regions suffered from water insecurity. With the lack of basic sanitation, in 2017, 34.7% of Brazilian municipalities registered epidemics or endemics related to the absence of or deficiencies in the service. The country is committed to guaranteeing access to basic sanitation for the whole population by 2033, but it is still a very distant reality.

Highly dangerous pesticides on tables and in the country's water

Brazil's large water resources suffer from the impacts of intensive agriculture, both through water consumption and contamination by pesticides and fertilizers. Each year, around 1 billion litres of pesticides are used in the country, mainly to grow soya, corn, sugarcane and cotton.

⁴ WeForest. 2021. Brazil as an agricultural powerhouse. Available at <https://www.weforest.org/newsroom/brazil-agricultural-powerhouse#:~:text=Agriculture%20is%20one%20of%20the,soy%2C%20sugarcane%20and%20maize>

⁵ Ft.com. 2021. *Cattle muddy Brazil's path to sustainable farming*. Available at <https://www.ft.com/content/35fe3d81-3c45-444f-a069-7f7e9854dcdd>

⁶ BCFN Foundation: Food and Nutrition Sustainability Index. 2021. *Country Profile*. Available at <https://foodsustainability.eiu.com/country-profile/br>

The country is the largest buyer of pesticides classified as "highly hazardous" (HHPs) by the UN amounting to around 44% of the chemical products used in the country's agriculture⁷. Brazilian laws are highly lax compared to other countries and allow 5,000 times more glyphosate in water than the European Union. Since 2019, as part of the Bolsonaro government's agenda, the country has experienced an intense loosening of environmental and agricultural regulations, especially with regard to GM foods and pesticides, and the amount of approved chemicals has been increasing every year. With the Covid-19 pandemic, regulatory acts were modified and instruments were renewed that increasingly adapt the rules to the reality of the commodities market.

Source: Agrotóxicos e GMOs: Socio ambiental setbacks and conservative advances in the Bolsonaro government.

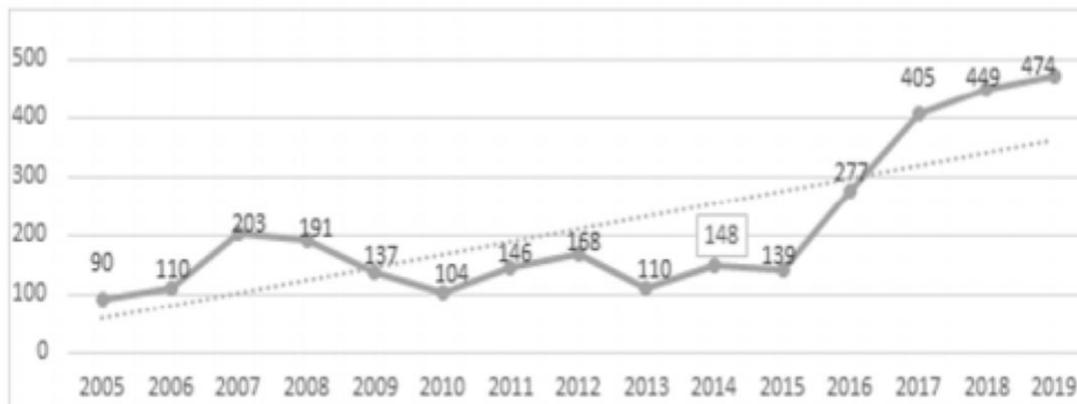


Figura 1: Total de agrotóxicos e afins registrados por ano no período de 2005 a 2020.
 Fonte: Ministério da Agricultura, Pecuária e Abastecimento (MAPA), 2020.

Figure 1: Total pesticides and related registered each year between 2005 and 2020
 Source: Ministry of Agriculture, Livestock and Food Supply (MAPA), 2020

The Pantanal region, where the sources of Brazil's main drainage basins are located, has been transformed into a dump for pesticide residues and all the rivers that constitute the biome are contaminated due to soya crops, the region that uses the most pesticides in Brazil. Among the chemicals found in the water is Atrazine, a herbicide banned in the European Union since 2004. The effects of pesticides on water used for consumption in the country are still scarcely known due to a lack of studies and access to data.

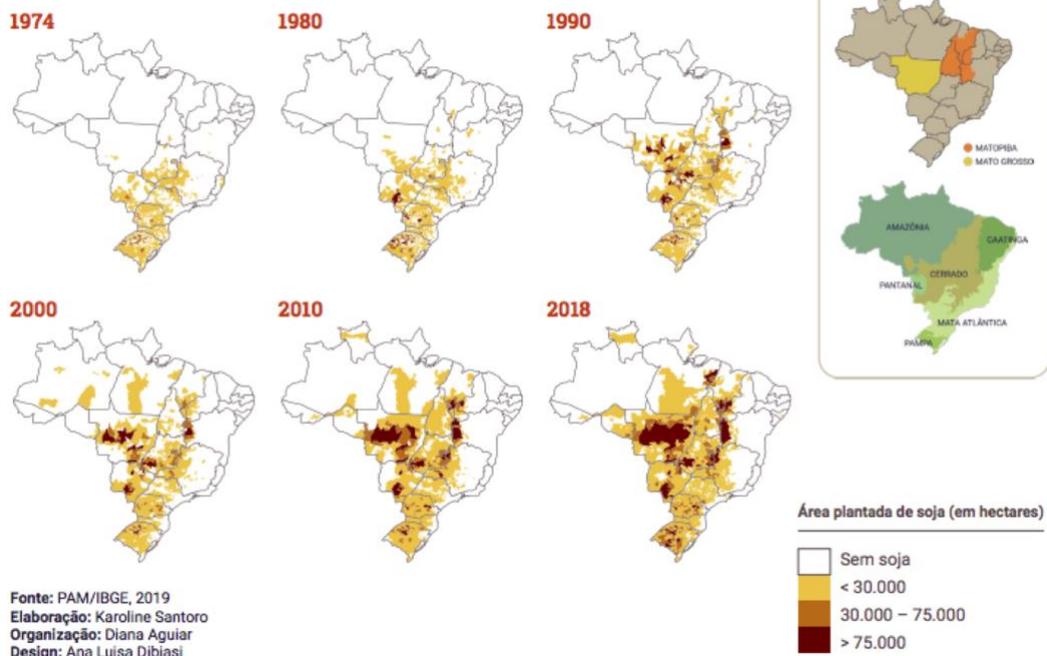
The expansion of soya

Brazil is one of the world's largest producers of commodities. Corn and soya crops represent more than 90% of all the grain crops harvested in Brazil in 2020. In 43 years, national production of soya has increased tenfold and the country is currently the world's largest producer of soya, with the 2019/20 harvest producing 124.845 million tons. In addition to most of this production being destined for animal feed, a significant amount is for the foreign market, and it currently constitutes Brazil's main export product: in 2019, more than 90 million tons were exported as grain, bran or oil, from a harvest of approximately 125 million tons.

The invasion of Central Brazil by soya monocultures

⁷ Scherer, G., 2021. *Brazil sets record for highly hazardous pesticide consumption: Report*. Mongabay Environmental News. Available at <https://news.mongabay.com/2020/03/brazil-sets-record-for-highly-hazardous-pesticide-consumption-report>

A invasão do Brasil Central por monocultivos de soja



Source: *CRITICAL DOSSIER ON THE LOGISTIC OF SOYA - FASE*
 Area planted with soya (in hectares)

In addition to the high use of pesticides (more than 60% of the total amount used in the country), which, among other serious consequences, contaminates water, the expansion of soya in the country, under a monoculture regime on very large farms (a total area of 36.950 million hectares in the country) is also strongly linked to deforestation and land conflicts.

Brazil's agribusiness companies are viewed with suspicion by the international community because of the sector's historical links to deforestation in fragile biomes, such as the Amazon and the Cerrado savannah, which adjoins the south and east of the rainforest.

Agribusiness and deforestation

Brazil has an estimated 210 million head of cattle and the country is currently the world's second largest commercial beef and poultry producer⁸. Almost half of Brazilian cattle are produced in *Amazônia Legal*, the name given by the government to an area of 5 million km² formed by nine of the country's states where the Superintendency for the Development of Amazonia operates. In the country there is a direct correlation between this area, deforestation and the agricultural sector, which uses large pasture areas to raise cattle: about 90% of deforestation is associated with agribusiness, 80% of which is for creating pasture.

In 2020, the country hit a 12-year high with a total of 1.1 million hectares.⁹ Much of the country's deforestation in the country has been done illegally. Since taking office in 2019, Bolsonaro has drained environmental agencies of funding and appointed officials who promote softer tactics against illegal logging and other crimes. Deforestation is also one of the main causes of fires in the Amazon rainforest. In 2020, the numbers were the highest in the last decade: 222,798 outbreaks. In 2020 the Pantanal also suffered from historic fires which affected 30% of the area.

⁸ Commodity.com. 2021. *Brazil's Economy: Foreign Trade Figures Reveal Why They're a Major Global Player* - Commodity.com. Available at: <https://commodity.com/data/brazil>

⁹ Spring, J., 2021. *Brazil proposes cuts to 2021 budget for environmental protection as deforestation spikes*, Reuters. Available at <https://www.reuters.com/article/us-brazil-environment-idUSKBN29U26S>

Greenhouse Gases (GHGs)

In 2019, 72% of Brazilian GHG emissions were related to rural activities in the country, the main factors being changes in land use (44%) and agriculture (28%). Almost 968 million tons of greenhouse gases (MtCO₂e) were released into the atmosphere by changes in land use, especially deforestation (94%). Other important factors behind the emissions were the use of synthetic fertilizers and the application of limestone.

Deforestation and agricultural activities combined made up for 44% of Brazil's carbon emissions in 2018, which are currently so high that the country is ranking as the 7th largest carbon emitter in the world. Emissions from Brazil contribute 2.19% to global emissions, and almost half of it comes from agriculture: 1.06% to global emissions¹⁰.

Livestock activity contributes to the countries' increase in emissions numbers, and international attention is focused on Brazil's big meat producers, which are regularly accused of failing to keep their supply chains free from cattle raised on deforested lands.

Agribusiness vs. food production: the reality of family farming

The production of agricultural commodities for export occupies large areas of the country and gives for impressive numbers, but does not directly feed the Brazilian population and makes products for the domestic market more expensive, limiting the population's access to quality basic items produced in the country. In this context, the main sector responsible for producing food that reaches the Brazilian table is family farming. The model, which differs in many ways from the reality of large monocultures, takes place on small areas of land owned and managed families, employing family members themselves as labour, guaranteeing their subsistence, and with a production value of just over R\$400 per month, that is, living in poverty or below the poverty line.

Their production is notable since they cultivate various foodstuffs, such as manioc, beans, corn and rice. They are not, in general, pesticide-free food producers, but they are the protagonists of this type of farming in the country

Although their activities feed the domestic market and are responsible for generating income for 70% of Brazilians living in the countryside, family farmers do not receive the same attention from public policies as the large monoculture exporters and have difficulties in selling produce (around 2 million rural establishments do not commercialise their production), both because of the lack of access to production technologies and digital media, and because of the lack of incentives for small producers. Although there are some government incentive programs, these producers have access to only 14% of all available financing for agriculture and are currently suffering from the suspension of loans in some programs.

Food waste

Brazil is among the countries that most wastes food in the world. More than 12.5 million tons of food is wasted every year. Losses in the fruit sector reach an average of 30% and vegetables 35%. Much of this is lost due to long distance travel between producers and consumers and inadequate packing for transportation by road in a continental country.

The numbers become even more alarming in a country where half the population suffers from some degree of food insecurity. Recently, due to the increase in national hunger rates during the pandemic, the government began to authorize restaurants (responsible for 15% of food waste in the country) and bars to donate unsold meals, as long as they are within the use-by date and suitable for human consumption.

A portrait of hunger and inequality

Brazil is one of the countries with the greatest income inequality and lowest distribution in the world. While 2.7% of the Brazilian population has a per capita monthly income more than 25 times higher than the minimum wage,

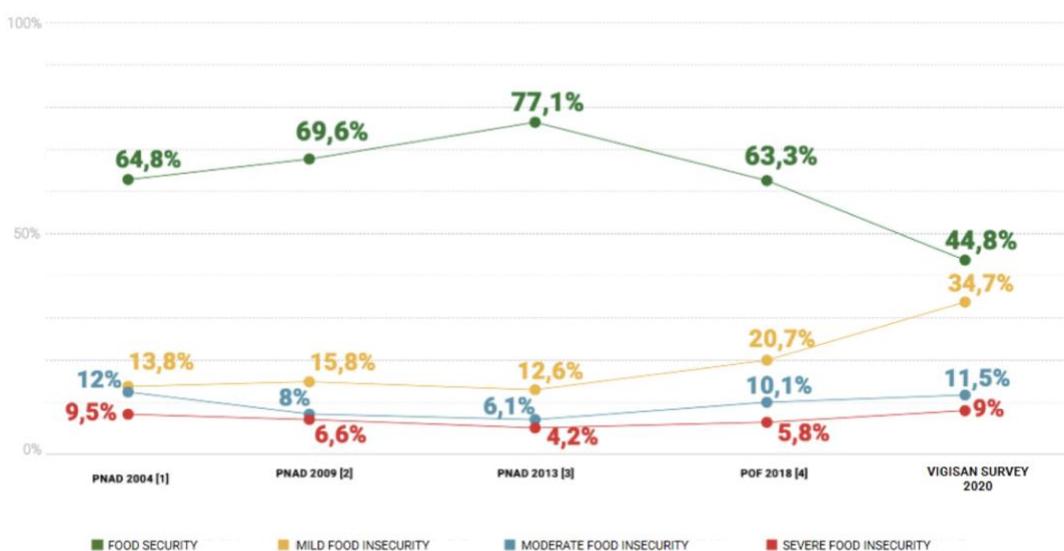
¹⁰ World Resources Institute. 2021. *This Interactive Chart Shows Changes in the World's Top 10 Emitters*. Available at <https://www.wri.org/blog/2020/12/interactive-chart-top-emitters>

24%, that is, 16.5 million families, have a monthly income of up to 2 minimum wages. This inequality directly affects the conditions of access to and quality of food for the population.

This situation has become even worse since the beginning of the pandemic in the country, in March 2020. According to a recent survey on the food security of Brazilians, in the last months of 2020, 19 million Brazilians went hungry and 55.2% of Brazilian households (corresponding to 116.8 million people) faced some degree of food insecurity.

The proportion of households whose access to food was jeopardised, or were in a situation of mild food insecurity, rose from 20.7% in 2018 to 34.7%.

Figure 1 - Comparison of Food Security/Insecurity estimates from the VigiSAN survey and national surveys reanalyzed according to the eight-item scale. VigiSAN National Survey of Food Insecurity in the Context of the Covid-19 Pandemic in Brazil, 2020.



Source: Data from the following surveys, reanalyzed for the eight-item scale: [1] National Household Survey (Pesquisa Nacional por Amostra de Domicílios – PNAD) 2003-2004 (IBGE); [2] National Household Survey (PNAD) 2008-2009 (IBGE); [3] National Household Survey (PNAD) 2013-2014 (IBGE); [4] Family Budget Survey (Pesquisa de Orçamentos Familiares – POF) 2017-2018 (IBGE).

The statistics around hunger in the country also show the inequality between rural and urban areas and between regions of the country. Food security was felt in 44.3% of households in urban areas and 24.8% among households in areas considered exclusively rural. With regard to regional differences, levels of hunger in the North were 29.2%, and 22.1% in the Northeast, both being above the national average, while in the Southeast, South and Midwest regions they were 15%.

Gender and race inequalities also significantly influence the country's map of hunger (PENSSAN, 2021) :

- 11.1% of households headed by women are in a situation of hunger, and another 15.9% face moderate food insecurity.
- 23.4% of households whose heads are black people suffer from severe food insecurity and 18.9% of households whose heads are mixed race.
- Where the head of the household is a black or mixed race woman with little schooling the levels of insecurity are even higher.
- Households where at least one of the heads is white have a higher level of food security (50.9%) than households where none are white (black, mixed race, Asian and indigenous) (37.1 %)

The issue of nutrition: consumption of ultra-processed foods and poor dietary variety

Despite regional differences, the food consumption habits of Brazilians are similar, whether in urban or rural areas. In the different regions, spending on food is focused on a few products, which account for more than 45% of food consumption: rice, beans, bread rolls, beef, chicken, bananas, milk, soft drinks, beer and refined sugar.

In addition to less varied meals, which affects food quality, ultra-processed products are being increasingly eaten. In 16 years, while fresh food consumption has dropped 7%, ultra-processed food has risen by 46%. The purchase of ready meals, such as frozen pizzas, rose 250%, and inequality is also reflected here: individuals living in households with food insecurity eat processed foods more frequently than any others (63%) .

Before the pandemic, many households already ate healthy foods on an irregular basis (less than 5 times a week), and the commitment to eating healthy foods is currently getting worse: meat (72.6%), vegetables and legumes (67.2%) and fruits (66.5%).

Meat consumption

80% of Brazilians eat around 88g of red meat a day, being the third largest consumers of beef, at 25.2 kg per year, and meat accounts for Brazilian families' largest expenditure on food, regardless of income (The Good Food Brasil):

- Chicken consumption (40.3 Kg per year)
- Pork consumption (12.8 Kg a year)

In the current scenario of health and economic crises, much of this data has been changing, since a large part of the Brazilian population has seen their food circumstances affected by financial issues. Although Brazil is one of the largest beef cattle producers in the world, this product's increasingly high cost means it has been replaced by ultra-processed items or low-quality meats in many of the country's homes.

Obesity, childhood and food in schools

Worldwide, approximately 20–25% of adolescents (individuals aged 10–19 years) are overweight. In Brazil, 23.7% of adolescents are overweight, which is associated with poor eating habits such as high consumption of ultra-processed foods and low consumption of minimally processed and/or fresh foods.¹¹

It is projected that there could be a doubling of the obesity-related healthcare costs in Brazil from USD 5.8 billion in 2010 to USD 10.1 billion in 2050.¹²

Contribution of school meals to healthy food consumption among public school students in Brazil: Brazil implemented a national policy requiring public schools to offer meals to students. Food consumption between students who eat or do not eat meals at school was compared. School meal consumption positively affects the overall quality of diet, increasing indicators of healthy diets and decreasing indicators of unhealthy ones. The effect of school feeding programmes that offer free meals in school can positively affect food habits.¹³

The National School Feeding Programme increased the quantity of fruits and vegetables in its menus and reduced the presence of highly processed foods containing high amounts of sugar and/or salt. It also successfully encouraged local purchases from smallholders through public procurement mechanisms, which added to the success of the integrated programmes. A nutrition-sensitive approach is key to fighting malnutrition through school feeding programmes.

¹¹ Ultra-processed food consumption by Brazilian adolescents in cafeterias and school meals.2019. Available at: <https://www.nature.com/articles/s41598-019-43611-x#ref-CR5>

¹² The State of Food Security and Nutrition in the World, 2020: <http://www.fao.org/publications/sofi/2020/en>

¹³ Positive influence of school meals on food consumption in Brazil. 2018. Available at: <https://www.sciencedirect.com/science/article/abs/pii/S0899900718300893>

Researchers have found that, over six years (2009-2015), three types of change in Brazilian adolescents from the capitals' diet were observed: decreasing regular consumption of beans, sweets and soft drinks, increasing regular consumption of vegetables, and stable consumption of fruit and fried salty snacks.¹⁴

2.1.1.2 Solutions arising

Within Brazil's reality there are several initiatives and solutions in different areas with practices involving food production, sustainability and food security for the population. Some solutions are directly related to changes in rural production models, while others seek to bring farming closer to the city and make nutritious food viable for vulnerable populations in large cities. Many solutions are still expensive to carry out and have a limited reach and audience, yet another reflection of the country's inequality. Below is a brief overview of actions and solutions that have been proposed in Brazil.

Agroforestry Systems

Agroforestry systems (AFSs) are where agricultural crops are grown in combination with tree and plant species of different vegetation strata (high, medium and low) and life cycles (short, medium and long). This planting method aims to increase biodiversity and reduce soil erosion and has economic benefits — as it allows farmers to diversify their products — and social benefits, as it helps to keep workers in the field, with demand for labor all year round. In addition, it is environmentally favorable for the farmer's day-to-day work: in about five years, an agroforestry system implemented in a tropical region can already show characteristics of the first stage of forest succession in terms of microclimate, biodiversity, shade and humidity. They exist in several places in Brazil, but policy incentives are lacking for this model which requires a high initial investment.

In Brazil there are different proposals for its use, in some cases the use and management of the land combines tree species with agricultural crops and/or raising livestock, simultaneously or sequentially. Its use in programs to regenerate degraded areas and restore ecosystems has also grown.

The project 'Renovando Paisagem' (Renewing the Landscape) has been implementing AFSs in municipalities in the Doce River basin affected by the collapse of the Fundão dam in 2015.

Currently made up of 75 families, [Cooperafloresta](#) is an association of agroforestry farmers created by farmers from quilombos - settlements originally founded by AfroBrazilians who escaped slavery - in Vale do Ribeira, a region in the south of São Paulo state and in the east of Paraná. In addition to producing food, it runs the Projeto Agroflorestar (Agroforestry Project), which promotes environmental recovery and conservation, and sustainable development for quilombo communities, traditional farming families and indigenous villages in the region, offering training activities and capacity building for public school students.

[Fazenda da Toca](#) is the largest producer of organic eggs in Brazil and a large-scale organic production hub, with around 50 hectares of agroforestry systems. As well as producing food, it regenerates the soil, captures carbon, diversifies production, conserves water and promotes biodiversity.

With partner communities from the Amazon and the Atlantic Forest region of southern Bahia, [AMMA](#) produces chocolates with organic and biodynamic cocoa in areas of agroforestry cultivation. Packaging is compostable.

Pasto Vivo (Live Pasture) is a large-scale regenerative livestock project in Mato Grosso using a silvopasture system, agroforestry and holistic pasture management. It seeks to transform degraded pastures into productive,

¹⁴ Ventura Barbosa Gonçalves H, Canella DS, Bandoni DH (2020) Temporal variation in food consumption of Brazilian adolescents (2009-2015). PLoS ONE 15(9): e0239217, <https://doi.org/10.1371/journal.pone.0239217>

regenerative pasture systems that include the forestry component for commercialisation and bioeconomic elements, such as the sale of carbon credit.

Waste reduction and food donation

Given the concomitant reality of high levels of hunger and food waste in the country, many initiatives from different institutions, non-governmental organisations and numerous startups have used technology to optimise donations to people in vulnerable situations and/or provide reduced-priced food that would otherwise be wasted.

The NGO [Banco de Alimentos](#) (Food Bank) helps people in situations of food insecurity by combating food waste, and donate nutritious meals to more than 23 thousand people every day.

The national network of food banks [Bancos de Alimento Mesa Brasil Sesc](#) serves people who are socially and nutritionally vulnerable through social entities. More than 3000 partners donate their production surpluses and food that is not up to commercial standards but suitable for consumption.

To facilitate the donation of food that would otherwise be discarded, the app [Comida Invisível](#) (Invisible Food) connects restaurants, hotels, buffet services, bars and retail outlets with NGOs. The app [Desperdício Zero](#) (Zero Waste) offers food and products that are close to the expiry date at prices up to 75% lower. Supermarkets and other establishments register the offers and consumers can search by location. [Ndays](#) operates along the same lines.

[Food Finder](#) allows restaurants and other food establishments to buy good quality products at lower prices which are close to their expiry date and would otherwise be thrown away. The startup also connects those interested in donating food for free. With the same focus, [XPRAJA](#) aims to reduce the disposal of products from the industry by putting remanufactured or discontinued items and food close to its expiry date, back in the market.

Aware of the high rate of fruit and vegetable waste due to its appearance, [Fruta Imperfeita](#) (Imperfect Fruit) delivers products from small rural producers that would be considered “ugly” by retail standards. In 3 years, they have sold more than 600 tons of food that would be thrown away.

Urban community gardens

There are several public and collective initiatives that have occupied unused spaces in cities to create and maintain community gardens as a sustainable solution for the country's food insecurity. Often revitalising rubble disposal sites which become hotspots for disease, as well as acting to conserve biodiversity and reduce the greenhouse effect and pollution, the gardens serve the purpose of making products available to vulnerable communities, improving food quality for nearby families and generating income.

Inaugurated by the Municipal Department for the Environment in 2006, the [Hortas Cariocas](#) (Gardens of Rio) Program, present in 49 communities in Rio de Janeiro, serves as a model for promoting socio-economic development and creating jobs in low-income regions. With the aim of combating hunger and environmental degradation, the project has 216 grantees, including gardeners and garden supervisors, and was included by the UN as a key action for achieving its Sustainable Development Goals by 2030.

The community garden in Manguinhos which is part of the programme is currently the largest in Latin America, harvesting 2 tons of pesticide-free food per month. The land was once a space where crack users would gather, and now residents work to produce vegetables in an area the size of four football fields. The workers receive a grant from the city council and the food is shared among them, donated to other residents and also sold. All money received from sales is also split. In addition to generating income, 800 families receive free food every month.

Since 2015 the project [Horta Inteligente](#) (Smart Garden) in Morro da Providência, also in Rio, has been developing environmental education activities, reaching more than 400 children. The group also carries out group activities for planting and agro-ecological management, and in 2019 revitalised a public area on top of the João Ricardo tunnel, one of the main access routes to the community. The area, known as Javas, was a dumping ground for waste and a

focus of disease. Now it has a community agroforestry system with several varieties of food, a social and leisure area for the population and a phytoremediation system for local water, technology that uses plants to reduce water pollutants.

Also in Providência, there is the project “[Lave as mãos](#)” (Wash your hands), thought up by a couple of local activists concerned about health conditions in the community and the severe water supply crisis they were experiencing in the midst of the COVID-19 pandemic. In partnership with artists and other local collectives, 37 sinks were installed throughout the community and 1200 litres of soap were produced from recycled cooking oil.

[Projeto Jovem Eco Social](#) (Eco-Social Youth Project) is the result of a partnership between Niterói City Council in Rio de Janeiro, and Firjan SENAI SESI. It carries out environmental education and agroforestry planting with 400 young residents from 11 communities, seeking to develop the renewal of ecosystems and build participants’ technical and personal skills.

The Serra da Misericórdia Integration Centre is a non-profit association dedicated to promoting nutritional food sovereignty in urban areas and is based on the precepts of agroecology. Located in Penha in Rio, large degraded areas are being reforested. The initiative offers technical assistance for agricultural production in the favela, in addition to providing food through markets and food parcels.

In order to alleviate hunger in São Paulo, the project São Paulo Composta, Cultiva by the Pólis Institute, is currently working together with [proposals that encourage urban gardens to be created](#) on public and private idle land.

Thanks to the work of the organisation [Cities without hunger](#), public and private land in the East Zone of São Paulo has been turned into organic community gardens, and gardens have also been implemented and developed in São Paulo’s public schools. With the grave situation around food insecurity during the pandemic, all the produce started to be distributed to communities. The NGO also trains people in organic food production techniques in urban areas and in how to market their products.

After an outbreak of ortho hantavirus in a waste dump in the Federal District more than 15 years ago, a garden was created that today is the Instituto Horta Girassol. It is located on five thousand square metres of public land and is now the largest urban garden in the Federal District.

Also in the Federal District, the Guaré Community Garden was created in 2017 in an abandoned public space thanks to the initiative of a small group of volunteers. There are currently about 200 volunteers, many of them replicating the garden model in other neighbourhoods.

CSA - Community-supported Agriculture

Community-supported Agriculture (CSA) is a system that has been in existence for over 40 years around the world in countries like France, the United States or Japan, and which is also beginning to be established in Brazil.

CSA is based on:

- A direct relationship between consumers and farmers without intermediaries;
- Mutual and long-term commitment. Consumers pay in advance for produce for a specified period (usually 1 year) and farmers provide a pre-established amount of their produce;
- Sharing risks and benefits. Participants are willing to share the burden arising from climatic (or other) factors with the farmer that may compromise part or all of the production, without demanding compensation for the fact that less produce is available or it is of poorer quality. Likewise, in times of abundance, the farmer can offer more copious amounts.
- The system provides greater reliability for the consumer, as they know: ‘how; ‘by whom’; ‘where’ and ‘when’ their food is produced.

In the city of Rio de Janeiro, [Organicamente](#) has been in operation since 2015.

In order to value, encourage and make family farming viable, the non-profit organisation [CSA BRASIL](#) began operating in 2011. Today there are 400 participating families that support farmers in the transition to ecological production models, maintaining crop diversity and guaranteeing an income for producers.

Landless Workers' Movement (MST)

The struggle for land is often the only possibility for families to obtain a plot, survive and make a living in Brazil. With the establishment of settlements through the expropriation of land that is unproductive, was obtained illegally, or where environmental and/or labour crimes occurred, [MST](#) has benefited around 400,000 families who produce food and aim to ensure their produce is healthy and accessible. There are 160 cooperatives and 190 associations, and established production chains for rice, milk, meat, coffee, cocoa, seeds, manioc, sugarcane and grains. The products are sold at low cost at markets, MST shops, and as food baskets. MST is Latin America's largest producer of organic rice and is projected to harvest more than 12,400 tons in the 2020/2021 harvest.

During the pandemic in 2020, MST donated more than 4,000 tons of food, in addition to 20,000 face masks and more than 700 meals. In 2021, they have donated more than 300 tons of food across all the country's regions.

Small Farmers Movement (MPA)

The [Small Farmers Movement \(MPA\)](#) is a national initiative, made up of local networks of rural families. Its objective is to produce healthy food for rural and urban people, thus guaranteeing food sovereignty as a right for people and countries. With this, it seeks to revive rural identity and culture, respecting regional diversities and organising systems of production, marketing and rural education.

Along with the MST and other social movements, the MPA is part of [Via Campesina](#), an international network of rural movements, peoples and traditional communities.

[Raízes do Brasil](#) (Roots of Brazil) is an MPA initiative based in Rio de Janeiro. It is a space that offers cultural activities, accommodation and healthy food through meals served on site and the sale of (fresh and processed) agro-ecological produce. Cesta Camponesa is an online tool for buying food with a home delivery service. This initiative was in high demand during the COVID-19 pandemic.

Participatory Certificates

Due to the high costs involved in obtaining certain seals from the Ministry of Agriculture, Brazil's Participatory Guarantee System (SPG) seeks to democratise access to organic food for both consumers and farmers. To get certification, farmers organise themselves into groups and respond together, if necessary, for any irregularities, and credibility comes from the community of those involved in the production, consumption and distribution of the products.

Training and social transformation through gastronomy

Since 2010, the [Maré de Sabores](#) (Maré of Flavours) project has held gastronomy training workshops for residents of the Maré community in Rio de Janeiro. The professional qualification courses revitalise Maré's food culture and promote healthy eating habits based on organic and sustainable food. It has trained more than 500 women and, more recently, created a catering service to generate income for women trained in the workshops.

Using gastronomy as a tool for social transformation and combating waste, [Gastromotiva](#) is an organisation that offers professional training for its students to become entrepreneurs, kitchen assistants and chefs. Many students mobilise their communities, generating local opportunities and activities to combat hunger in their territories. It opened a restaurant school in 2016, where students and guest chefs cook meals to serve socially vulnerable people. Volunteers work as waiters. During the pandemic, it started to produce 1,300 meals a week distributed in the city centre with the help of partner projects.

Urban Composting

Bucket Revolution is a community project for managing organic waste and urban agriculture in Florianópolis, coordinated by the NGO CEPAGRO in partnership with local youth. Families and institutions separate their organic waste into buckets, left at voluntary delivery points (PEVs), distributed throughout the community and, in exchange, they receive the compost produced for fertilising gardens. The initiative has already treated 1,200 tons of organic waste, benefiting more than 1,600 people. In 2019 it won an award from the Outstanding Practices in Agroecology, organised by the World Future Council (WFC), for being one of the best transition initiatives for agroecology in the Global South.

Private Natural Heritage Reserves (RPPNs)

Brazil's Federal Law 9985/00 institutes the National System of Conservation Units (SNUC) which aims to ensure the preservation of biological diversity and genetic resources. Private Natural Heritage Reserves (RPPNs) are conservation units created voluntarily by rural landowners. In doing so, they undertake a commitment to conserve nature and receive legal benefits, such as guaranteed property rights and exemption from the Rural Land Tax for the RPPN area. In Brazil there are more than 1,664 reserves conserving more than 800 thousand hectares. RPPNs have often taken on goals such as protecting water resources, managing natural resources, developing scientific research, maintaining ecological climate balances, among several other environmental services.

Vale das Palmeiras was once a degraded farm with several areas of deforestation. Today it's an RPPN that has undergone a recovery project and has become one of the largest producers of 100% organic milk and sells its derivatives throughout the country. It is also a space that trains technical, rural and livestock professionals in agricultural, zootechnical, managerial and environmental techniques, practices and processes.

In the River Doce Valley, an old degraded cattle farm has become the Instituto Terra (The Earth Institute), an RPPN focused on environmental restoration and sustainable rural development. It was founded by photographer Sebastião Salgado and develops projects around forest restoration, protection of water springs, applied scientific research and environmental education. Thousands of hectares of degraded Atlantic Forest in the mid valley and close to 2,000 springs are being regenerated.

Innovations in aquaculture

Several case studies are currently being developed in Brazil as part of the international project AquaVitae, funded by the European Union, in which researchers and producers develop sustainable solutions for aquaculture in countries bordering the Atlantic Ocean. In addition to their economic feasibility and their ability to satisfy the needs, demands and safety of consumers, industry prototypes are evaluated for their environmental sustainability.

Among the studies, São Paulo State University (Unesp) is developing a model of integrated organic farming involving macroalgae, marine shrimp and native oysters. And case studies are also being conducted in Brazil of farming systems (IMTA) integrated into hatcheries and biofloc systems, species of freshwater fish (pirarucu and tambaqui) and marine ones (flounders).

The collaboration is supported by Embrapa, several universities and the organic aquaculture company Primar Aquacultura, the first certified organic aquaculture farm in Brazil, which has about 40 hectares of hatcheries along the coast of Rio Grande do Norte.

Vertical farms in cities

Given the reality of transport in the country, some vertical farms are starting to appear in the country, a way to reduce distances and waste, bringing the production of vegetables in particular closer to consumers in large cities. The cost, however, still makes these products limited.

- Fazenda Urbana in Rio de Janeiro conducts indoor farming without pesticides, making use of containers or warehouses, transforming unproductive spaces and buildings into productive areas within the city.
- A 750 m² warehouse in São Paulo is the largest vertical urban farm in Latin America, inaugurated in 2019 by Pink Farms. Several species - lettuce, arugula, basil, spinach and chard - are planted using a controlled environment farming system with the help of LED lights and hydroponics, The farm reduces the distance between food and consumer and reduces water consumption by 95% compared to open-air plantations, but it is still a high-cost venture.
- Also in São Paulo crops of vegetables have been grown since the beginning of 2021 using indoor farming production systems without the use of pesticides as a result of studies made possible through a public-private partnership (PPP) signed between Embrapa Hortaliças and the company 100% Livre.
- Fazenda Cubo in São Paulo also has its own shop at the production site.

Embrapa

Embrapa, the Brazilian Agricultural Research Corporation is a public research company linked to the Ministry of Agriculture, Livestock and Food Supply that seeks to develop technologies, knowledge, and technical and scientific information regarding Brazilian agriculture and livestock. It has almost 10,000 employees, including approximately 2500 researchers, with branches in almost every state in the country.

Among recent products developed by Embrapa are a bio product capable of increasing the resistance of some plant species to drought, the result of more than a decade of research on mandacaru, a cactus found in Brazil's semi-arid region, and a wax that uses nanotechnology to increase the shelf life of fruits and vegetables, produced from carnauba, a natural and abundant species in the Northeast.

Agro techs

Many start-ups have been developing technologies to improve agricultural processes in the country, create digital access, and also use technological resources to connect rural regions with the city.

- ConnectFarm has developed a cost-effective tool that gathers information from multiple applications to help family farmers with more complex decision-making, resulting in increased productivity, optimisation of resources, and has maximised profitability for farmers. With a national presence and less than two years in operation, it already serves more than 70 producers in the country. As part of the 5k project, it is currently seeking to help at least 5,000 family producers who face difficulties in accessing family farming technologies.
- Technologies such as big data, geolocation, automation and robotics are proliferating in the country and are used by producers to follow conditions in their planted areas with precision.
- Digifarmz is a precision farming tool with recommendations such as which product to use or how to adapt to a specific climate variation, guiding producers from planting to harvest in a customised way. There are more than 200,000 hectares under Digifarmz's management, from small to large producers.
- Supply chain tracking: the startup Agrottools has created satellite monitoring technology capable of tracking the entire chain of agro companies, from the field to the shelf.
- Raizis: this company sells food from small organic producers directly to restaurants and to the end consumer. Currently, produce comes from 824 farming families.
- With a focus on the large-scale production of organic grains, Rizoma Agro produces grains in organic regenerative systems and citrus farming in agroforestry systems at Fazenda da Toca.

Edible Insects

Raising insects for human consumption is still taking its first steps in Brazil. There are few producers, costs are still very high and much of what is produced domestically is still intended for animal feed. And there are also regulatory obstacles: Anvisa, Brazil's Health Regulatory Agency does not have specific guidance for these products and does not recognise them as food, including insects among "foreign matter" that is allowed in food up to a

certain amount. As there is still no legislation for the creation, use and consumption of insects in human food, the practice remains limited.

In 2015, Abrasci (Brazilian Association of Insect Breeders) was founded, which currently has a working group with the Ministry of Agriculture, Livestock and Food Supply and Anvisa with the aim of making the sector professional.

Despite being controversial and great resistance by people to eating them, insects are already entering the Brazilian diet to a certain degree. Içá flour is a delicacy made from manioc flour and Atta ants, deriving from indigenous cuisine and is a traditional food in the Northeast.

National Policy for Comprehensive Health in Rural and Forest Populations (PNSIPCF)⁴²

PNSIPCF's aim is to improve the level of health of rural and forest populations, through actions and initiatives that recognise the specificities of gender, generation, race, ethnicity and sexual orientation, looking to provide access to health services; reduce health risks arising from work processes and agricultural technological innovations; and improve health and quality of life indicators. It is considered a historic landmark in the context of public health policies in Brazil, including in its principles and guidelines the "support for sustainable and solidarity production, with the recognition of rural family farming and extractivism" and the "appreciation of traditional practices and knowledge". Although it came into force in 2011, there are still difficulties in promoting and applying it.

National Policy on Agroecology and Organic Production (PNAPO)

One of the world's most pioneering structural policies, developed with the close involvement of civil society and the National Network of Agroecology (ANA), PNAPO aims to bring together programs and actions that enable the transition to organic and agro-ecological production systems. It aims to improve the population's quality of life through the supply and consumption of healthy foods and the sustainable use of natural resources. In 2018 it won the Future Policy Award from the FAO which recognised it as one of the best policies for strengthening sustainable agrifood systems, essential for sustainable development and climate resilience.

Low carbon agriculture

Since 2010, the Ministry of Agriculture's Harvest Plan has encouraged investments in low GHG emission technologies, supporting low-carbon agriculture with incentives for good environmental practices in the field. On its 10th anniversary in 2020, an evaluation of the plan showed that the demand for low-carbon production grows every year and that the technology has been put to use in 59 million hectares around the country, around 25% of the area used for agriculture. The goals involve the renewal of degraded pastures, the implementation of agroforestry systems, regenerative agriculture practices, the planting of native species, and animal waste treatment, among others. According to Embrapa's president, Celso Moretti, low carbon agricultural technologies have helped the country develop carbon neutral meat and protocols are already underway to produce carbon neutral calves, carbon neutral leather and low carbon milk

Selo Verde cross-checking data platform

In Pará, the state where the Amazon's deforestation is at its highest and one of the states in Brazil which most emits greenhouse gases due to the amount of cattle, the government has launched the [Selo Verde](#) (Green Seal), which seeks to identify producers who violate the law. A free, public platform allows for an automatic diagnosis of the socio-environmental situation of agricultural properties by cross-checking data to avoid information asymmetry. It shows the situation of farms in relation to deforestation and the protection of preservation areas, as well as slave labour and respect for indigenous lands. It is the first cross-checking data platform in the country with a focus on the socio-environmental control of rural properties

Saúde na Escola (Health at School) and Crescer Saudável (Healthy Growing) programs

Launched in 2007, the Health at School program, run by the Ministries of Health and Education, carries out actions to promote health and prevent diseases in public schools. In 2019/2020 more than 90% of Brazilian municipalities joined the program, which means that they agree with its undertakings. The actions involved more than 20 million students and more than 36,000 primary healthcare teams from the Brazilian public health system, SUS. As part of the scope of the School Health Program (PSE), Healthy Growing is a set of actions to be implemented in schools to help in the fight against childhood obesity in the country. They include monitoring nutrition, promoting adequate and healthy eating, encouraging physical exercise and practices, and care for obese children.

2.1.2 Demographics in Brazil

2.1.2.1 Demographics in relation to food sustainability

- Rural Population (2018): 28,321.49
- Urban Population (2018): 182,546.46

Hunger and food insecurity:

- Number of people undernourished (3-year average: 2006-2008): 5.4 million
- Prevalence of undernourishment (3-year average: 2006-2008): 2.8 %
- Number of severely food insecure people (3-year average: 2017-2019): 3.4 million
- Prevalence of severe food insecurity in the total population (3-year average: 2017-2019): 1.6 %

Food Availability:

- Average protein supply (3-year average: 2015-2017): 90 grams/capita/day
- Average supply of protein of animal origin (2015-2017): 51.7 g/capita/day
- Average dietary energy supply adequacy (3-year average: 2016-2018): 132 %
- Average value of food production (3-year average: 2004-2016): 689 (constant I\$ per person)

Food Utilization:

- Percentage of population using at least basic drinking water services (2016): 97.8 %
- Percentage of population using at least basic sanitation services (2016): 88.3 %
- Percentage of child under 5 years affected by wasting (2007): 1.8 %
- Percentage of child under 5 years of age who are overweight (2007): 6.4 %
- Percentage of child under 5 years of age who are stunted (2007): 7 %
- Prevalence of anaemia among women of reproductive age (15-49 years) (2016): 27.2 %
- Prevalence of obesity in the adult population (18 years and older) (2016): 22.1 %

Land:

- Agricultural land (2018): 236,878.8 k/ha
- Other land (2018): 99,833.8 k/ha
- Agricultural Area: Arable land: 55,762 k/ha
- Agricultural Area: Land under permanent crops: 7,756 k/ha
- Agricultural Area: Land under permanent meadows and pastures: 173,360.8

(Source: Food and Agriculture Organization of the United Nations)¹⁵

¹⁵ <http://www.fao.org/faostat/en/#country/21>

2.1.2.2 Demographics in relation to museums

- There are 3,793 museums in Brazil (Cadastro Nacional de Museus, 2019), most of them are public museums.
- The vast majority is concentrated in the states of Rio de Janeiro and São Paulo, followed by Minas Gerais and Rio Grande do Sul.
- Counting the number of visitors has not yet become a widespread practice, especially in smaller museums. Qualitative and behavioural research is done by a small number of museums, but this is slowly changing.
- A report published by IPEA* in November 2010 stated that approximately 70% of the population in Brazil have never been to a museum or cultural centre.¹⁶
- Another report states that 34% of the cariocas (those born in the city of Rio de Janeiro) go to museums. It showed that family has great influence on the carioca's cultural taste, and that the greatest difficulties in visiting museums are distance and accessibility challenges.¹⁷

In 2011, the University of Brasilia conducted research in the capital of Brazil about non-audiences. Answers for "Why don't you visit museums?":

- Lack of time (over 37%)
- Don't like museums, not interested (20%)
- Access difficulty / don't know any (15% each)

Going to museums abroad: In 2011, Brazilians accounted for the second highest number (410,000) of Louvre museum visitors.¹⁸

Public perceptions of museums

Narratives that the Brazilian public have about museums.¹⁹

- Museums are seen as places of history and serve to keep what is old;
- They are historic buildings;
- They are places to acquire historical knowledge;
- They are elitist and have nothing new;
- They are places to see ancient artefacts, skeletons and paintings.
- For 81%, museums are old buildings with classical architecture
- For 65% of the public, the role of museum's is education. Museums must maintain a collection and present the history of that collection of a city or country.
- 58% say museums are elitists and rarely visited
- 52% say they are monotonous spaces
- 52% like to see ancient artefacts, bones and skeletons in museums
- For 51%, museums are tourist attractions for holidays - many people only go when they are in other cities or outside the country.

¹⁶ Brazilian Museums & Visitors: Statistics, research, examples – an overview, Ministry of Culture, 2015. https://uk.icom.museum/wp-content/uploads/2015/06/Brazilian-Museums_compressed.pdf

¹⁷ Hábitos Culturais dos Cariocas – 2013

¹⁸ BBC News Brasil. 2021. Aumento recorde em gastos dá visibilidade a poder de compra de brasileiros na Europa - BBC News Brasil. https://www.bbc.com/portuguese/noticias/2011/11/1111110_brasileiros_gastos_exterior_df

¹⁹ Museu: Narrativas para o Futuro, 2019, available at <https://oifuturo.org.br/wp-content/uploads/2019/05/Oi-Futuro-e-Consumoteca-Pesquisa-Museus-2019-DOWNLOAD.pdf>

2.1.3 Public attitudes to food sustainability in Brazil

Sugar and derivatives

- Brazil is the country that consumes the most sugar in the world.
- Mexico and Brazil were the countries that were more willing to reduce their consumption if it helps food chain sustainability.
- Diabetes prevalence in Brazil and Mexico reached 11.4 and 15.2% respectively.
- In this sense, due to the high incidence of diabetes among the population of Mexico and Brazil caused by high sugar consumption, and the high rate of overweight reported, it is possible that reducing sugar consumption is the strategy to be followed by these countries to reduce diabetes and diseases derived from the consumption of sugar, along with the overweight and obesity of the population.

Fruits and vegetables

- Consumers in the USA, Brazil and China were not aware of issues of sustainability in seasonal fruit consumption.

Fats and oils

- China, Mexico and Brazil agreed with the fact that reducing the consumption of animal fats is a sustainable behaviour.

Coffee, tea and cocoa

- Brazil is the world's main coffee producer.
- Brazil and India considered that fair trade certification guarantees the origin of the product and, therefore, makes the consumer feel better.

Meat products

- Regarding the question that providing a low environmental impact certification would increase meat consumption country, age and education level showed significant differences in response. In general, Mexico and Brazil were the countries that indicated a more favourable, as well as consumers worldwide under the age of 52 and with high school and primary school education or less.
- Mexico, Brazil and India considered that beef cattle is not sustainable due to the high carbon footprint it generates.

Eggs

- People in Spain and Brazil think that eggs from free-range hens are more sustainable than those from caged-hens and, together with Mexico, they would prefer to be able to buy them directly from the farmer.

Milk and dairy products

- Regarding milk traceability as an important aspect in the decision to purchase dairy foods, country and income were the factors that presented significant differences. In Brazil and China, consumers considered milk traceability key when buying cheese. This aspect was also important for consumers with an income level above 100,000 US dollars. Milk production intensification in Brazil in the last decade has increased. This has provoked environmental and economic stress. In this sense, Brazilian consumers' concern about milk traceability could be a way of ensuring its local origin and, thereby, reducing environmental impact caused by increased production.

2.1.4 Specific issues due to COVID-19

In June 2021, Brazil hit the sad landmark of 500 thousand COVID-19 deaths, being the country with the second highest number of deaths in the world. With vaccination in progress since January 2021, 35% of the population has currently received the first dose, while the virus continues to spread. The scenario of high death rates by the virus is attributed to the federal government's delayed handling of the pandemic, struggling with the rollout of its vaccination program and the spread of highly contagious variants of the virus. As a result of the lockdown and restrictions in activities to contain the virus, Rio's three largest museums - the Museum of Modern Art, the Museum of Tomorrow (Museum of Tomorrow) and the Museum of Art of Rio - have closed their doors for months.

The Museum of Tomorrow recently opened an exhibition called [Coronaceno, Reflections in Times of Pandemic](#), to encourage reflection on the impacts of the disease on the world and the prospects for changes in lifestyle. The exhibition is divided into six parts - Essentials, From the virus to the pandemic, transformed societies, Memorial to those who left, Science is the protagonist, and Culture is the way.

It is estimated that the Coronavirus pandemic (Covid-19) will affect food production, distribution and supply in different ways and intensities. Research on the scope and depth of the crisis arising from Covid-19 on agriculture and agribusiness in Brazil points out that the pandemic could have beneficial effects and increase the production supply and the international insertion of Brazilian agribusiness. Demand for food is increasing and it is possible that the United States versus China trade dispute will increase Brazilian exports. The analysis also indicates potential problems in supplying the domestic market and possible price increases, as well as food price inflation, resulting from both increased demand and production costs due to exchange rate devaluation, which represents a stimulus for exports. The effects of the Covid-19 pandemic on family farming and on the supply of local markets were strongest at the beginning of the pandemic, when there were restrictions on trade and the circulation of products. Public policies and the role of the State were not effective along the crisis, especially with regard to problems of contamination in slaughterhouses.²¹

Unemployment, inflation, closed schools - food insecurity during the health and economic crisis

Due to the severe crisis caused by the pandemic, unemployment in Brazil hit 14.7% (14.8 million people) in the first quarter of 2021, its highest rate since IBGE's series began in 2012. The number of people who would like to work but have given up looking for a job also grew 25% compared to the same period in 2020.

Another aggravating factor for food security is inflation, and in 2020 it reached its highest rate since 2016, with essential items on the Brazilian table increasing significantly in price: rice (+76.01%), black beans (+40%), potatoes (67.27%), tomatoes (52.76%), fruit (25.40%), meat (17.97%) and soya oil (+103.79%).

With school activities affected, millions of children and young people were also left without access to school meals, posing yet another food challenge for the most vulnerable families.

²⁰ *Consumers' Attitude towards the Sustainability of Different Food Categories, 2020*, available at <https://www.mdpi.com/2304-8158/9/11/1608>

²¹ Schneider, S., Cassol, A., Leonardi, A., & Marinho, M. de M. (2020). Os efeitos da pandemia da Covid-19 sobre o agronegócio e a alimentação. *Estudos Avançados*, 34(100), 167-188. <https://doi.org/10.1590/s0103-4014.2020.34100.011>

The country's unemployment and despondency data strongly affects food quality and access. The most recent surveys on Brazilian food security show that in the last few months of 2020, 19 million Brazilians went hungry and 55.2% of households faced some degree of food insecurity.

Faced with the economic crisis, last year the Brazilian government offered five emergency aid payments of R\$600.00, with double the amount paid to single women supporting their households alone. According to the Ministry of Citizenship, 56.1% of the Brazilian population received the payments offered by the government. 63% of survey respondents reported having used the aid payments to purchase food. With the crisis continuing into 2021, the aid payments were only resumed in April and at significantly lower levels (R\$150 and R\$375).

Regarding the quality of food consumed, the crisis meant that the healthy food being eaten decreased significantly for financial reasons: in households that reported living with food insecurity, healthy food consumption dropped by more than 85%. The decrease also occurred in households with food security, but with significantly less variation, between 7 and 15%. The decrease was highest for meat (44%), followed by fruit (40.8%), cheese (40.4%) and vegetables (36.8%). As for proteins and the decrease in meat consumption, ham is now consumed in 8.4 million new homes, and families have replaced eating steaks with sausages and hamburgers.

In this scenario, there was an increase in the consumption of industrialized breads, and porridge (water or milk prepared with some flour or cereal commonly served to children) became one of the most consumed dishes in the lowest social classes, with its consumption for dinner increasing by 8 percent compared to the same period in 2020.

2.1.5 Audience engagement

What works in Brazil to engage audiences about food and sustainability?

Brazilians lead in concern about environmental issues, with over 90% perceiving air pollution, climate change, biodiversity loss or water availability as very serious problems – at least 30 percentage points more than the international average. High awareness translates into a majority that puts a premium upon environmental protection over economic growth and enthusiasm to engage in domestic recycling if given the chance. Awareness also drives a record level of interest in corporate sustainability, well over 70% since we began tracking it in 2002. Equally relevant, one in two adults admits being willing to pay more for an ethical product.

Yet, when it comes to consumers taking action on sustainability, the results are surprising. Ethical consumer action, for example boycotting or rewarding brands and products based on sustainable credentials, is accredited by less than one fifth. Seven in 10 adults mix up batteries and e-waste in the residence garbage. And an overwhelming majority still relies on free non-biodegradable plastic bags when shopping at the supermarket.

Sustainability issues have entered the daily language in Brazil, but attentiveness and positive attitudes towards sustainability issues are overshadowed by long-standing barriers.

Recycling is impaired by the fact that less than 1/3 of the 5,565 municipalities provide selective waste collection. Greenwashing has already forced the national council for advertisement self-regulation (CONAR) to set up a specific code that bans false claims by brands. An average annual per capita income slightly exceeding US\$10,000 makes it very difficult to afford the premium prices of most sustainable choices or lifestyles. And, on top of all that, the repressed consumption felt by almost 42 million Brazilians who have moved into the new middle class in the past few years cannot form a base for responsible consumerism.

When asked who is responsible for socio-environmental degradation, Brazilians blame the government; when asked who should lead, they point to the government once again.²²

²² See <https://www.theguardian.com/sustainable-business/sustainability-brazil-mixed-conundrum>

In order to mobilise consumers and citizens, you must go beyond highlighting the gravity of an issue. It shows that awareness of and attention to sustainability can be perfectly divorced from sustainable action and that while corporate and social leadership are extremely positive, they are not sufficient conditions to help society walk the talk of sustainability.

Museum of Tomorrow's recent exhibition FOOD FOR TOMORROW – Feeding 10 billion was an exhibition about the future of food and the dilemma of feeding billions of people nutritionally, sustainably and by diversifying production in the coming decades.

2.2 India context

2.2.1 Food system issues and innovations

2.2.1.1 Key issues

Overview

The 2016 Food Sustainability Index²³ scores India last out of 25 countries, largely because of challenges regarding nutrition and agricultural sustainability. The country's approach to food loss and waste is, however, more positive.

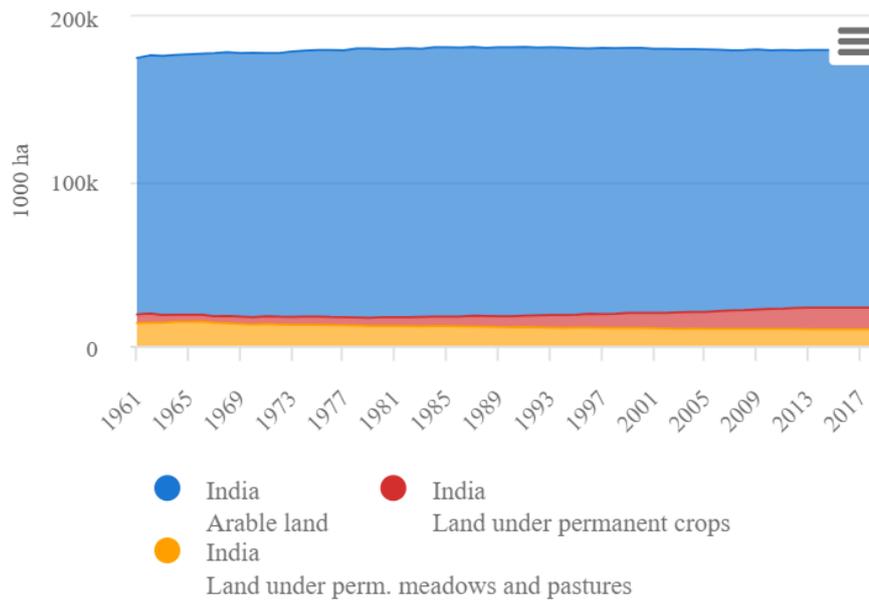
India's biggest agricultural challenge is water: its crops and livestock are taking a heavy toll on the water system relative to other countries in the index, and the country lacks initiatives to promote water recycling.

Land is a scarce resource in India, and agricultural holdings are small and fragmented. Marginal holdings (<1 hectares) and small holdings (<2ha) account for 86% of all holdings and 47% of the area devoted to agricultural production. Subsistence agriculture is widespread, and since 60% of India's total cropped area is rainfed, poverty and inability to take risks, lack of access to credit and inputs, and poor market access all combine to limit the sustainability of food and agriculture systems in most parts of India. ^[1]_[SEP]

Given the limited capacity of smallholder farmers, institutional environments to counter and manage complex and multi-layered climate risks need support from multiple departments and stakeholders at the central and state levels. Information systems related to land, soils, irrigation, inputs (including credit), prices, logistics, land tenurial systems, farming systems etc. are not available in formats that enable evidence-based decision making at appropriate levels. The issue of ecological footprint needs to be incorporated into decision making with reference to land use, water, biomass and production systems. ^[1]_[SEP]

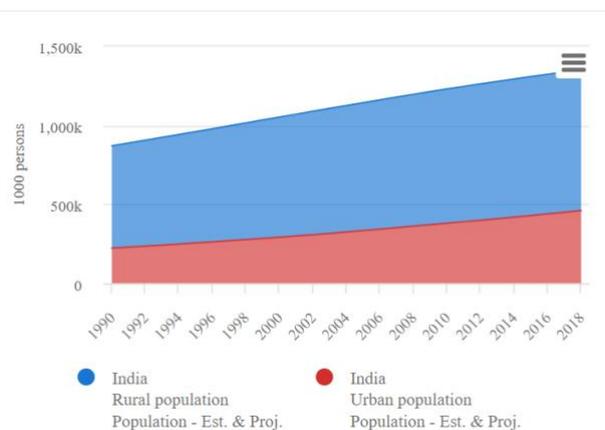
Land use and land degradation ^[1]_[SEP]

²³ Food Sustainability Index, <https://foodsustainability.eiu.com/india/>



Agricultural area, 1968 - 2017²⁴

Land degradation threatens agricultural productivity, in-situ biodiversity conservation, water quality and the socio-economic well-being of land dependent communities. To reclaim degraded land and combat degradation, a robust land-use policy is required that must be strictly implemented. This needs to be coupled with strengthening capacities at various levels to regulate and manage land resources effectively and sustainably, including through watershed approaches to land management. [SEP]



Rural and urban population, 1990 - 2018²⁵

Though agriculture contributes only 14% of India's GDP, over 50% of the population relies on it as their main source of income. Agriculture and forests are an economic lifeline for at least 700 million people, including smallholder farmers, tribals, and [SEP] other marginalized groups who live in rural India. Forests provide fuelwood, fodder, small timber and non-timber forest products to the people who live in and around them. In times of scarcity, forests also contribute to household food security. However, decision making on land use and natural

²⁴ Food and Agriculture Organization of the United Nations: India: Selected indicators, <http://www.fao.org/faostat/en/#country/100>

²⁵ Food and Agriculture Organization of the United Nations: India: Selected indicators, <http://www.fao.org/faostat/en/#country/100>

resource priorities is not always integrated. The interdependent and complex interrelationship between forests, agriculture and sustainable development calls for looking at the forestry and agriculture sector in a balanced and integrated manner, while recognizing that integrated farming systems that include livestock are key to sustainable development.

India's forested lands (about 22% of the country's land area) are under pressure. While India has managed to maintain its forest and tree cover, conflicts over the diversion of forest for non-forest purposes – particularly for mining, hydroelectric projects and infrastructure projects which are part of the country's growth and poverty reduction effort – are a major challenge. In some areas the use of forest lands by local communities to meet their fodder, fuelwood and biomass needs is unsustainable (particularly degraded forest land with less than 10% canopy density). Strengthening community institutions and building their capacities to manage these resources effectively is key, as is making them aware of forests' local and global relevance. ^[1]_[SEP]

Intensification of agricultural practices, including the increased use of fertilizers and pesticides, and the specialization and concentration of crop and livestock production, is damaging farmland and undermining future gains from land and water resources. Water logging and salinity resulting from intensive irrigation are also causing land degradation and affecting crop productivity. To minimize the harmful effects of the intensive use of chemical fertilizers and pesticides, a holistic view of soil fertility is required. ^[1]_[SEP] For this, a crop management system that promotes the use of organic manures, biofertilizers and biopesticides and the judicious use of agrochemicals needs to be balanced with the imperatives of food security.

Water

India receives an average of 4,000 billion cubic meters of precipitation every year. However, only 48% of it is captured in India's surface and groundwater bodies. A dearth of storage and exploitation infrastructure and inappropriate water management mean that only 18-20% of the water is actually used. ^[1]_[SEP] The gap between potential and actual water availability could partly be closed by completing tail-end distribution infrastructure in the command area and improving maintenance and regulation of supply, as well as reducing loss of arable land to waterlogging caused by poor surface water management. ^[1]_[SEP]

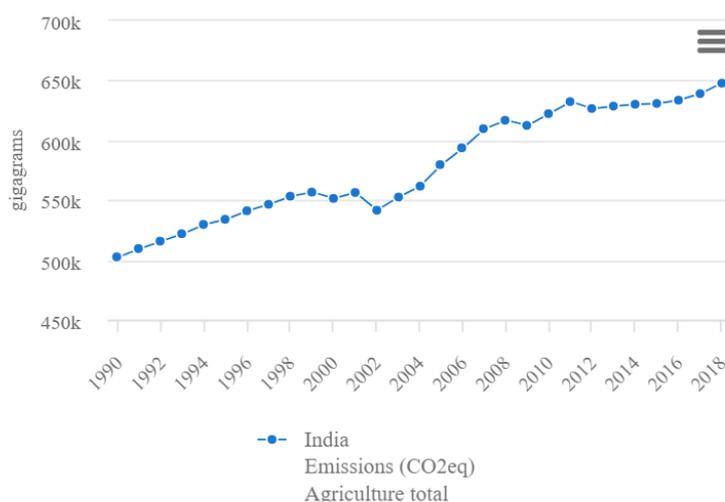
Large shifts from rainfed agriculture (and even canal irrigated agriculture) towards groundwater irrigation have occurred in many parts of the country. Today 64 mha are irrigated from groundwater. This has resulted in a fall in groundwater levels in several agricultural regions, where withdrawals exceed replenishment rates. The Central Groundwater Board categorizes 16.2% of the total assessment units (spread across 15 states and 2 union territories) as 'over-exploited', and an additional 14% as either 'critical' or 'semi-critical'. According to a survey, only 3% of India's some 8.5 million tube-well owners used drip or sprinkler irrigation and 88% delivered water to their crops by flooding through open channels. ^[1]_[SEP]

India's annual rainfall is around 1183 mm, 75% of which is received in a short span of four months during the monsoon (July to September). Watershed protection is important for soil moisture conservation, aquifer recharge and balanced land use. Forest ecosystems are essential for watershed management, as deforestation and forest degradation lead to significant soil erosion, with substantial economic and environmental costs. At a time when the lack of water in many regions threatens food security, livelihoods and human health, watershed management can reverse the water depletion process if forests are included as part of a 'ridge to valley' approach for watershed development. ^[1]_[SEP]

Farming systems

While the Green Revolution has enabled the country to move from a food-deficit to a food-secure nation and further to having a food surplus today, some of the practices that have led to this transformation are now threatening production sustainability, as well as ecological and economic viability, with diminishing marginal returns on inputs. Depleting ground water, land and soil degradation – including the spread of problem soils (acidic, saline and alkaline) – loss of soil organic carbon, etc. are symptomatic of the various dimensions of the problem.

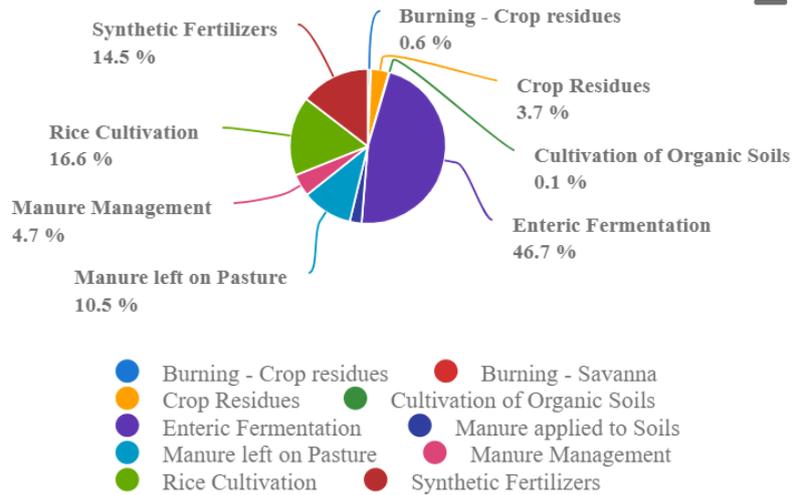
Crop diversification is important for sustainable food and land-use systems, but policy support for staple crops like wheat and rice make it challenging to implement. It will be very difficult to substitute the paddy-wheat cropping pattern in Punjab and Haryana in the short and medium term, as an entire ecosystem has developed to support it, including incentives in the form of free/highly subsidized electricity, minimum support price (MSP) and procurement support, and the presence of a strong network of input industry/dealers as well as processing units.



Emissions (CO2 equivalent), Agricultural total, 1990 - 2018²⁶

Shifting to farming practices such as conservation agriculture (CA) and zero budget natural farming (ZBNF) will be important for future productivity gains while sustaining natural resources. These farming practices can potentially increase climatic resilience, food security, soil nutrition and crop diversification; reduce farm energy consumption; and enhance farmers’ incomes.

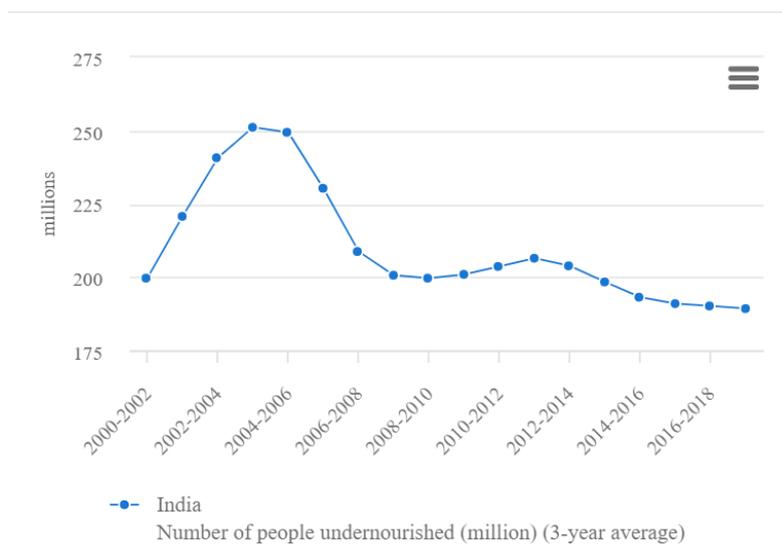
²⁶ Food and Agriculture Organization of the United Nations: India: Selected indicators, <http://www.fao.org/faostat/en/#country/100>



Emissions by sector (CO2 equivalent), average 1990 - 2018²⁷

Sustainable farming practices need to be mainstreamed across departments, schemes and policies. There is an urgent need to develop technologies suited for smallholders, boost awareness among farming communities about the benefits and create an effective policy framework and strategies for promoting sustainable farming practices.²⁸

Nutrition



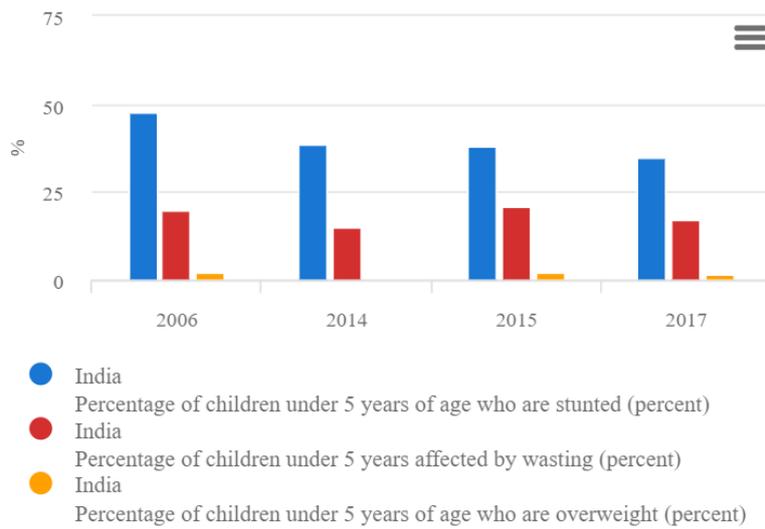
Number of people undernourished, 2000 - 2018²⁹

²⁷ <http://www.fao.org/faostat/en/#country/100>

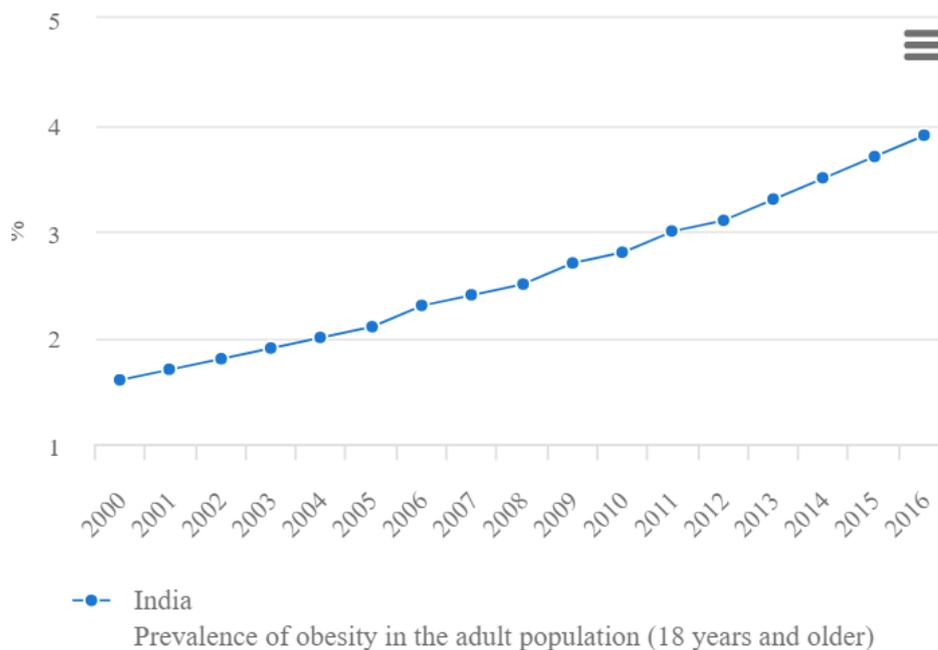
²⁸ Sustainable Food And Land Use Systems In India: National Roundtable 2019: Summary Report, available at https://www.foodandlandusecoalition.org/wp-content/uploads/2019/12/FOLU-India_Roundtable-Report_Final-Versvk.pdf

²⁹ Food and Agriculture Organization of the United Nations: India: Selected indicators, <http://www.fao.org/faostat/en/#country/100>

Research indicates that many consuming sufficient amounts of calories may still suffer from symptoms of malnutrition due to diets deficient in micronutrients.

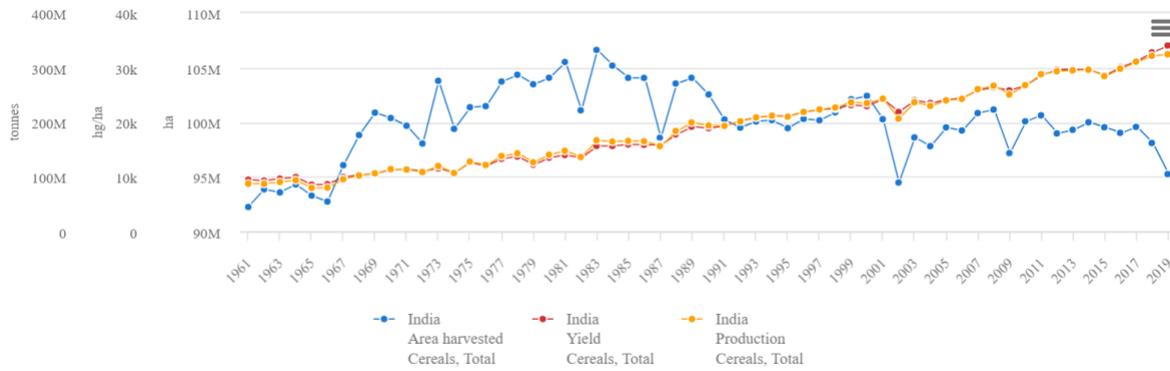


In 1992–93, 52 percent of Indian children were classified as stunted. In 2015–16, the prevalence of stunting was still high, at 38%.



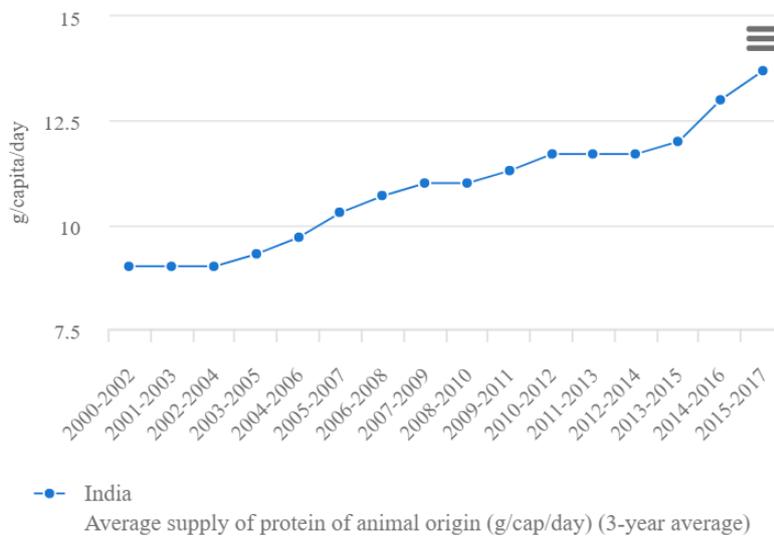
In addition, another form of malnutrition, obesity, has significantly increased, posing a new public health challenge. Obesity prevalence doubled among Indian men and increased by 62 percent among Indian women, between 2005-06 and 2015-16.

Access to nutritious foods is lagging, despite increasing demand.



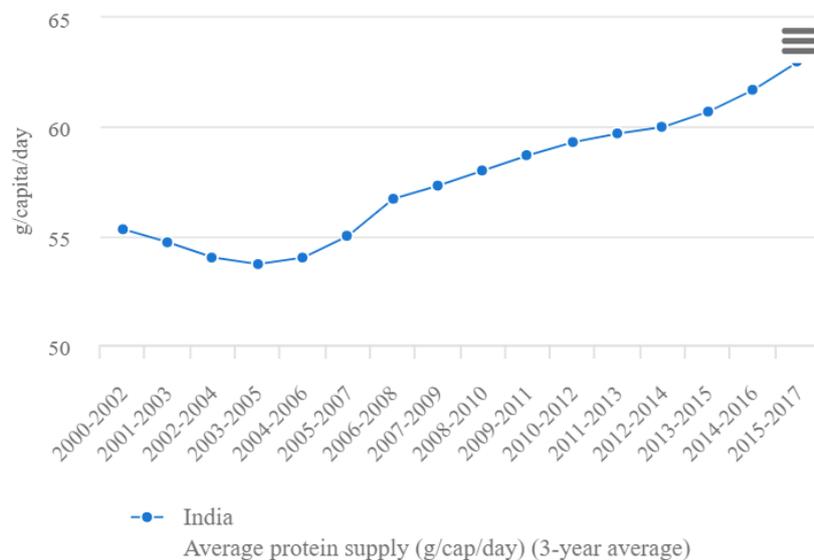
Cereals, total production, 1961 - 2019³⁰

While access to cereals in India has increased due to the persistent focus of Green Revolution-era food security policies on staple grains, access to more nutritious and diverse foods^[SEP] is limited.



The demand for more nutritious foods is certainly present, as evidenced by higher expenditures on fruits and vegetables, milk products, meat, eggs, and fish. However,^[SEP] this demand is not translating into increased caloric intake from these food groups. Instead, caloric intake from cereals, which decreased from 71 percent in 1993–94 to 61 percent in 2011–12,^[SEP] is being replaced by processed foods, beverages, oils, and fats.

³⁰ Food and Agriculture Organization of the United Nations: India: Selected indicators, <http://www.fao.org/faostat/en/#country/100>

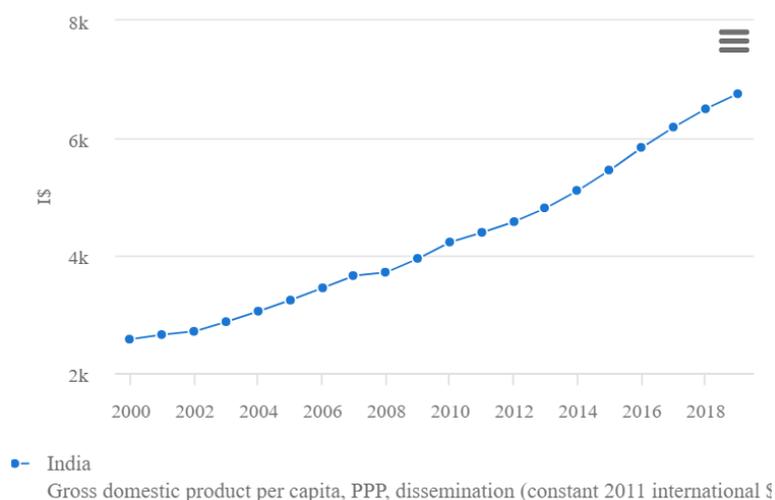


Part of the reason for limited consumption of more nutritious foods, like protein-rich pulses and micronutrient-rich fruits and vegetables, is the high and fluctuating prices for these foods. Changes in dietary patterns, together with a stasis in production policies, have therefore led to the consumption–production disconnect, adding to the nutritional challenge. Policies, as a result, must prioritize making these nutritious foods affordable by encouraging increased production of such foods.

Regional disparities in nutritional outcomes can be attributed to varying trajectories of subnational structural transformation. Symptoms of malnutrition, including child stunting and wasting, anaemia in women of childbearing age, and obesity in adults, vary significantly between and within states in India. Such variation in nutrition outcomes at the country level has been related to a country’s progress along the path of structural transformation— the process by which a region’s economy, stimulated by growth in the agriculture sector, experiences subsequent growth in the industrial and service sectors, thus prompting a shift of labour to those sectors and a reduction in agriculture’s share of total gross domestic product (GDP).

Investing in agriculture in the lagging states is fundamental to reducing malnutrition. While some states in India have certainly experienced growth via structural transformation, others, particularly in eastern India, are lagging behind. For these states, investment in agriculture is necessary to kick-start the process of structural transformation, and ultimately, to achieve higher incomes and better nutrition outcomes.

In regions where agriculture is underdeveloped and poverty is high, diets are mainly staple-based, and nutrition outcomes are poor. In eastern India, agricultural development has lagged behind the other states for many reasons, including unfavourable climatic conditions, lack of economic incentives, low adoption of high-yielding varieties, and lack of irrigation infrastructure and electrical connectivity.



As a result, the GDP per capita is still low, and diets are still composed mainly of staple grains. The effect of low incomes and lack of diet diversity is evident in nutrition outcomes: the prevalence of stunting is higher in these areas.

In more developed regions, diets and nutrition outcomes have improved, but over-nutrition is emerging as an important concern. In both agriculture-led growth states and urbanizing states, cereals have become less prominent in diets. While some of the foods replacing cereals are healthy, and stunting has certainly decreased in some parts of these regions, greater consumption of processed foods is contributing to a rise in obesity and non-communicable diseases, such as diabetes and heart disease. Consumption of fruits and vegetables, despite economic progress, continues to be chronically low, leading to continued micronutrient deficiency.³¹

2.2.1.2 Solutions arising

Agritech innovations

There are a number of agritech innovations in India addressing challenges and gaps in the current agriculture food systems.

Farming-as-a-Service

“Farming as a service (FaaS)” is a concept introduced to India by a company called [EM3 Agri Services](#), which offers farming services and machinery rentals to farmers on a pay-for-use basis. Impact investment fund [Aspada invested in EM3 in 2015](#). The concept has caught on and there are other agriculture equipment leasing and farm services startups in the space including [Goldfarm](#), [Ravgo](#), [Oxen Farm Solutions](#), and [FarMart](#). The average farm holding in India is 1.2 hectares, compared to several hundred or even thousand across Europe and the US, meaning the farmers have less income to invest in equipment like irrigation pumps, storage solutions, and so on. FaaS variabilizes the cost of farming and reduces the need for capex, making it relevant to small farm sizes and affordable to small and marginal farmers.

Big Data for improving farm productivity

Farm productivity in India is one third to one half less than the world average. This is in part due to poor soil health. Soil analyses show the NPK (Nitrogen, Phosphorus, Potassium) ratio of Indian soils is significantly skewed

³¹ Food, Agriculture and Nutrition in India; 2020 Report; Tata-Cornell Institute for Agriculture and Nutrition. <https://tci.cornell.edu/news/publications/food-agriculture-and-nutrition-in-india-2020-leveraging-agriculture-to-achieve-zero-hunger>

in favour of N due to high usage of Urea. Developing farm-specific, data-driven diagnostics to determine soil health is a big opportunity area as well as biotechnological solutions to help improve soil health like soil amendments. There are also a growing number of big data technologies aimed at improving the efficiency of farming and supply chain such as drones, sensors, and other IoT technology, and data analytics to provide decision support to farmers and other players in the supply chain. [CropIn](#), [AgRisk](#), [AgNext](#), [Skymet](#), [Stellaps](#), and [Airwood](#) are some of the examples that are working on this theme.

Market linkage models for farmers

Indian agriculture is supply driven and less market-driven compared to other markets. This is the primary reason for seasonal food inflation as well as significant food waste and value loss along the supply chain. Though demand is becoming more predictable in India given the homogenization of consumption trends, supply is less predictable.

A farmer's decision on which crop to plant each year is often driven by the price of that crop the previous year. Government policy in supporting the price for certain crops also plays a role in that decision. This presents an opportunity for developing market linkage models for farmers. This in turn could require innovations to help farmers with the timely and accurate estimation of sowing and harvesting in the context of patterns in consumer demand. The way forward will probably be hybrid models involving Big Data and Aggregation. [Sabziwala](#), [MeraKisan](#), and [Dehaat](#) are some of the start-ups who have demonstrated successful aggregation in horticulture.

Supply chain models for dairy and horticulture

The dairy and horticulture industries are growing faster than the grain industry in India. Milk production in India is approx. 150 million tonnes and horticulture production is approx. 270 million tonnes. For the first time in Indian history, horticulture production has outpaced food grain production. There is a need to optimize these supply chains for both milk and horticulture. Solutions that can preserve the quality, reduce waste, improve traceability, and improve shelf-life efficient aggregation, transportation and storage, are in need. Farm to consumer milk supply chain models, such as [LaVeda](#), [Farmery](#), [Puralite](#), and [4S Foods](#) have been able to innovate supply chains and scale up at a city to regional level.

Investment across the agricultural supply chain in India has averaged around \$250 million each year for the last five. We expect this to gain momentum with more focus on the above five trends in agritech innovation. Indian agriculture is set for a big leap forward in 2017, with an infusion of capital and high quality entrepreneurial talent focused on scaling up innovations.³²

Apps to minimise food waste

Smartphones are increasingly widespread, and apps are a simple and easy way to reach large portions of the global population. During the pandemic, the popularity of apps to solve food loss and waste has increased. Several countries also began to develop apps to facilitate the logistics, transport and e-commerce of perishable foods.

The Feeding India app, focuses on donations of food for those in need. Restaurants and individuals can sign up on the app to donate food, which is then collected and distributed by this non-profit's network of more than 4 500 volunteers. These regular feeding programmes run in more than 45 Indian cities and have served over 4.8 million meals so far.³³

Government of India and the Food and Agriculture Organization of the United Nations with support of the Global Environment Facility to develop and implement a strategic pilot project on climate change adaptation in seven

³² Trends in Agritech Innovation in India to Watch Out for in 2017, available at <https://agfundernews.com/five-trends-in-agritech-innovation-in-india-to-watch-out-for-in-2017.html>

³³ Three smart ways innovation is helping reduce food loss and waste, available at <http://www.fao.org/fao-stories/article/en/c/1309567>

drought-prone districts of Andhra Pradesh & Telangana. The project objective was to build local knowledge and expertise of farmers on climate change adaptation options - for sustainable land and water management.³⁴

2.2.2 Demographics in India, in relation to museums

Most museums in India are collection and exhibition-focused and have no monitoring or evaluation of audience reaction or response. There are few that even aim at being visitor-friendly and interactive. Most museums are not accessible to visitors with special needs.

While large numbers of students and families are often the audiences that museums get there is not enough done to engage with them. Data indicates that most museums lack basic amenities like clean functional toilets, eatery and free drinking water. Additionally, facilities that enhance interest in the collection like library or internet usage, photocopying facilities, research and documented material are minimal and found only in a few cases.³⁵

Evolution of the Science Museum Network In India

Non-formal science education through Science Museums took its root in India in the early 1950s when two Science Museums opened their doors to the public at Pilani, Rajasthan and New Delhi. The Central Museum inside the BITS (Birla Institute of Technology & Science) campus at Pilani and the museum inside National Physical Laboratory (NPL), New Delhi premises offered new opportunities to people for learning science at their own leisure time and more significantly, in a new way completely different from the formal mode.

The idea of extending science and technology education through the medium of Science Museums was boosted when the Government of India decided in 1956 to set up an organised Industrial & Technological Museum at Kolkata following the European model. Following its success, another similar museum was set up in Bangalore. Subsequently in the 1960s and 70s, science museums went beyond the boundaries of metropolitan cities and established themselves in rural areas, some of which were predominantly tribal and economically backward. The rural foray of Science Museums called for simple and activity intensive programmes that invited participation of various communities in villages and small towns. Thereafter the concept of 'Mobile Science Exhibition' (MSE)s took shape to carry the universal messages of science to those who could not access the established museums.

Visitor details

The Science Centres under the NCSM network are visited by about 6 million people each year. In addition, the Mobile Science Exhibition units are visited by about 2.5 million visitors. Out of this, approximately 30% to 32% on an average comprise organized student groups.

³⁴ Farmer Climate School – Cultivating climate resilience; FAO Youtube channel, available at <https://www.youtube.com/watch?v=hjdybT85Bwk>

³⁵ Re-Imagine: Museums and Galleries: UK-India Opportunities and Partnerships; British Council 2014, https://www.britishcouncil.in/sites/default/files/re-imagine_museums_india-uk.pdf

Institution	Visitor to centre (A)			Visitor to outreach programme (B)			Website visitors (C)
	Adults	Children	Students in groups	Adults	Children	Students in groups	
Birla Museum, Pilani, Rajasthan	90,000	30,000					
Tamilnadu S&T Centre + B.M. Birla Planetarium, Chennai	50,744	77,535		19,000			
Kerala State S&T Museum	92,675	52,863	79,295	2500	195		
Sukanta Academy, Agartala, Tripura	40,000	50,000	20,000	30,000			
B.M. Birla Science Centre, Hyderabad	11 million						

Visitor profile

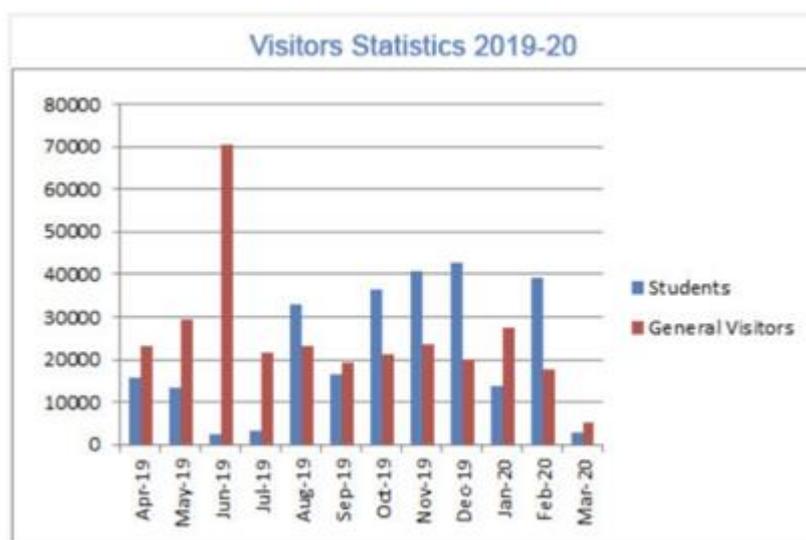
Genderwise profile		BITM, Kolkata	Science City	RSC, Nagpur	RSC, Bhopal	NSC, Delhi
	Male		65%	78%	70%	72%
Female		35%	22%	30%	28%	
Occupationwise profile	Students	35%		44%	47%	59%
	Businessmen/ Professionals/ salaried people	54%			37%	35%
	Housewife	7%			7%	6%
	Tourists			1%		
	Others	4%		1%	9%	
Repeat visitors profile		48%	33%			41%

Source: *The science centre movement in India: a conspectus; 4th Science Centre World Congress Dossier 2005*³⁶

Below is data related specifically to the National Science Centre, New Delhi

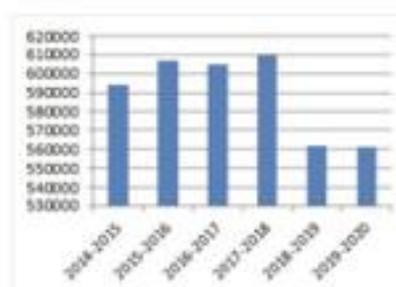
Months	Students	General Visitors
Apr-19	15726	23311
May-19	13362	29252
Jun-19	2313	70456
Jul-19	3026	21753
Aug-19	33012	23057
Sep-19	16481	19105
Oct-19	36524	21080
Nov-19	40586	23595
Dec-19	42532	19992
Jan-20	13777	27360
Feb-20	39349	17767
Mar-20	2647	5044

³⁶ More information and charts available at http://www.scielo.br/scielo.php?script=sci_arttext&pid=S0104-59702005000400014



Months	Visitors (Outreach Prog.)
Apr-19	0
May-19	0
Jun-19	0
Jul-19	5000
Aug-19	600
Sep-19	3748
Oct-19	43200
Nov-19	241205
Dec-19	52016
Jan-20	0
Feb-20	0
Mar-20	0

Year	Total Visitors
2014-2015	584214
2015-2016	606794
2016-2017	604840
2017-2018	609435
2018-2019	561910
2019-2020	561107



Source: National Science Centre; Ministry of Culture; Government of India.³⁷

2.2.3 Public attitudes to food sustainability in India

The first stage of India’s nutrition transition was completed with the achievement of food self-sufficiency via the Green Revolution policy of the 1970s. The challenge of food availability therefore has been addressed. The new challenge lies in the access and affordability of a nutritious diet. With an increase in the demand for high-value agricultural products such as fruits and vegetables, dairy and meat and processed foods, India has now entered the second stage of this nutrition transition. Indian diets are now becoming more *westernized*, influenced by a multitude of factors such as rising income, demographic transition, urbanization and the spread of retail chains or supermarkets. Urbanization, demographic changes, globalization and exposure to new types of food have not only

³⁷ Available at <http://nscd.gov.in/visitor-statistics>

brought about lifestyle changes but have considerably changed Indian food consumption patterns too. Consumption data from subsequent rounds of the National Sample Survey (NSS) appropriately reflects these dietary changes.

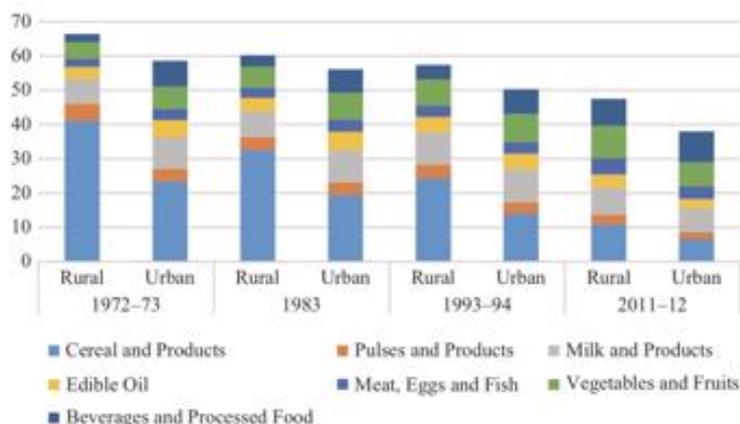


Fig. 4.1 Share of monthly expenditures on various food items. Source: NSS Surveys; based on authors calculations

There has been a secular decline in the household share of food expenditure, across both rural and urban areas. In 1972–73, 72.9% of monthly expenditure was allocated to food items in rural India which has come down to 52.9% in 2011–12. The share of food expenditure in urban areas is lower than rural shares and has come down significantly from 64.5% to 42.6% during the same time.

One can see that the decline in the share of food consumption has been accompanied by a proportionately higher decline in the share of expenditure on cereals, while expenditure on non-cereals like vegetables, fruit, dairy products, edible oils, meat products, beverages and other processed food has increased.

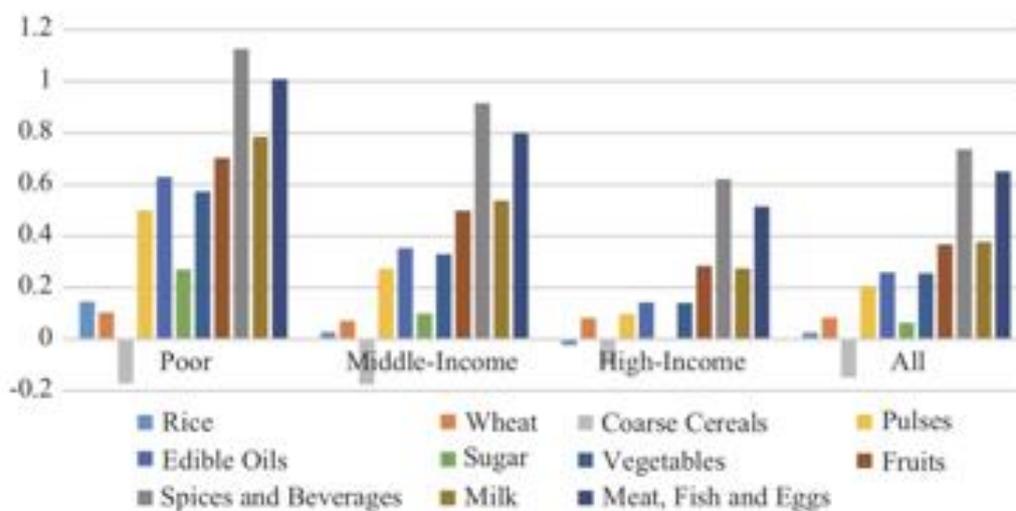


Fig. 4.2 Expenditure elasticity for food items by household class. Source: Joshi and Kumar (2016)

A compelling case for changing dietary preferences can be discerned through food expenditure elasticities. Data shows that consumers prefer an additional income on food and beverages, followed by animal protein items (meats, fish and eggs). Consumer food preference is the lowest for cereals followed by coarse cereals.

These statistics strongly reflect the notion that India is undergoing a nutrition transition where higher incomes facilitate greater consumption of non-cereal food products, processed food and eating out. With time, Indian consumers—urban and rural—are moving towards the calorie threshold at which greater income leads to substitution away from cereals.

Once households surpass a subsistence level of energy intake, their marginal utility from extra calories declines and they substitute food products with non-nutritional attributes such as taste. There is also a decline in the dietary practices with a change in poverty levels which leads to a decline in average calorie consumption while overall nutritional and other health outcomes continue to improve. Occupational changes which require less strenuous labour, improvements in health, hygiene and sanitary conditions across India have reduced the need for greater energy intake.

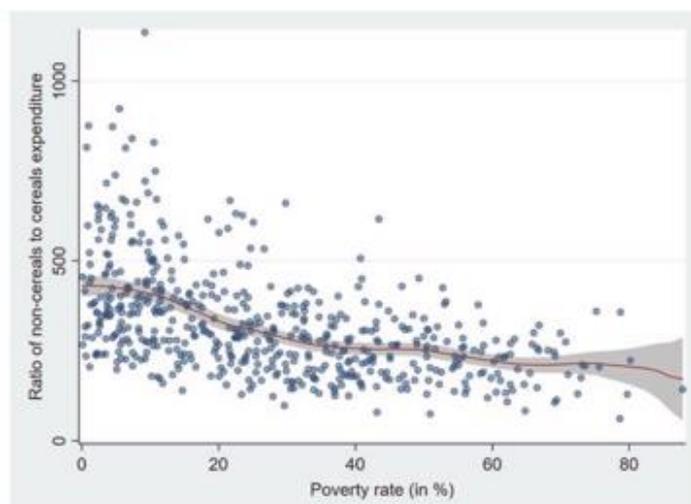


Fig. 4.3 District-level association between share of expenditure on non-cereals to cereals and poverty levels in rural India. Source: NSSO 2011–12; based on authors calculations.

Rising demand for high-value products, eating out and processed food has coincided with the growth of restaurants and fast-food chains and the emergence of modern food value chains. Newer forms of food value chains have affected how food travels from farm to fork. The expansion of modern value chains through large modern supermarkets or mega-markets have gradually started replacing small convenience stores, at least in the urban centres. The proliferation of retail chains—of varying quality, tastes and affordability catering to all sections of the society—and changing time use of women, too, have affected how India eats.

Market research reports suggest that the number of super-markets have increased from 500 in 2006 to 8,500 in 2016. With an annual growth of around 15%, India's food retail industry is ranked as the sixth largest in the world. It contributes to a substantial part of the overall economic output and has grown because of favourable changes in demographics along with increasing disposable incomes. Much of the retail sector continues to be unorganized, but there has been a significant growth when organized brands were almost non-existent.

Together with the expansion of food retail, there has also been a significant change in how India eats. Entry of foreign brands like McDonald's, Pizza Hut, Domino's and others during the 1990s and greater participation of women in the workforce, at least in the urban areas, eating out is increasingly becoming a common feature. More than 25% of the households report eating out every month. Quite understandably, people in the major metropolitan cities eat out the most, followed by the urban population in non-metro urban areas and then by the rural population. While consumption from local vendors and small eateries has always been a feature of Indian diets, the emergence and consolidation of indigenous brands like Haldiram's and Barbeque Nation, among others, have also affected Indian diets. Greater integration with the global economy, and the rise of an aspirational "middle

class” with it, has played its role in bringing this change in consumption patterns, providing an opportunity for the modern agri-food systems to evolve.

Rise in the consumption of convenience food

Since the 1990s, there has been a greater shift towards the consumption of “convenience food” as eating out has increased along with the greater consumption of processed food, beverages and other packaged items which have higher salt, fat or sugar content, often associated with the incidence of chronic non-communicable diseases. The cost of food from the local carts and other cheap processed food is often less than the cost of cooking food at home, especially when both parents work. Consumption of these unhealthy food items, in an increasingly dynamic economy, is often an economic choice for the poor. Even in rural India, the consumption of convenience foods like chips, chocolate, bakery products, soft drinks and other sugar-sweetened beverages is extremely common among school-going children.

Based upon a household survey of slums in Delhi, researchers find that on average households spend around 11% of their monthly food expenditure on snacks, while 15% of the working members reported eating lunch outside. While higher-income households may rely on more packaged convenience foods, for the households with poor socioeconomic, often the local vendors are the purchase point. Food hygiene and dietary safety, therefore, become very pertinent concerning diets of the poor.

Food prices and inflation

A major concern, which affects food security and dietary diversification, especially for the poor, is the rise in food prices. Food inflation is among one of the most pressing challenges for India’s food policy as higher levels of inflation have been a feature of the economy in the last decade. In India, the food price inflation episode between 2006 and 2009 led to an increase in the risk of child malnutrition. Protein-rich items such as pulses and animal-based protein items have seen an increase in the prices as well as its volatility. This was famously referred to as “protein inflation” by the former deputy governor of India’s central bank. Increase in the price of protein-rich items like eggs, meat, fish, milk has been primarily driven by greater demand for these products. Similarly, the highly seasonal supply of fruits and vegetables and the lack of a storage infrastructure have also impacted the price scale.

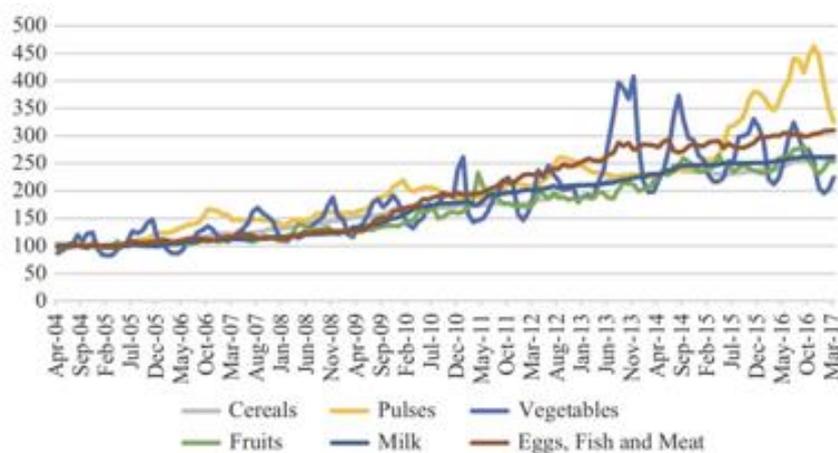


Fig. 4.5 Wholesale Price Index (WPI) for food items. Source: Office of the Economic Adviser, Govt. of India, Ministry of Commerce and Industry

2.2.4 Specific issues due to COVID-19

The ongoing health crisis around COVID-19 has raised global concerns on food and nutrition security. India has not seen immediate serious disruptions in the food system during the pandemic primarily because of good harvests in the previous crop seasons; sufficient buffer stock of grains, and a slew of welfare measures declared by the Government to protect vulnerable populations e.g. smallholder farmers, agricultural laborers, migrant workers, etc.

The impacts of climate change on the agriculture sector are profound. The challenge of malnutrition adds to that burden. These challenges are now exacerbated by the uncertainties due to the COVID-19 pandemic. The lockdown during the pandemic has raised serious concerns on reduced access to nutritious foods by the vulnerable sections of the society. This calls for affirmative actions on making safe and nutritious food available, accessible and affordable.

In this context, the following pathways are suggested to transform the food systems to tackle the twin challenges of climate change and the burden of malnutrition.

Refocusing public policies and investments

A food systems transformation in India requires repurposing of existing agricultural policies. Underlying policy regimes like the Minimum Support Price (MSP) and the Public Distribution Systems (PDS), coupled with subsidies on irrigation, power, and farm inputs, are skewed in favour of staple crops like rice and wheat. Although MSP mechanisms exist for climate-resilient and more nutritious cereals like sorghum and millets, they are largely ineffective because of the policy bias in favour of the “big two” staples.

Crop diversification is often suggested to correct such legacy incentives, but unless farmers’ income from alternative crops is stabilized, they may not be willing to switch to a new crop production system. The shift in farmers’ behaviour can only be possible with suitable financial incentives during the transition (making quality inputs, such as seeds affordable and available), value chain strengthening, and efforts to change consumer behaviour.

Similarly, investments in the animal husbandry sector should be pursued considering the rising demand for meat, dairy products and eggs. Diversification to small ruminants, backyard poultry and aquaculture provide additional income to smallholder farmers and the landless poor.

The reverse migration that has been reported from the Green Revolution belt during the current COVID pandemic has offered a peculiar, yet unique opportunity. The movement of agricultural laborers from cities to their villages has now forced some states to promote crops such as maize, soybean, cotton, etc. in the ongoing rainy season.

Strengthening sustainable value chains

Since Indian agriculture is dominated by smallholders, aggregating small farms (like small farm, large field concept in Vietnam) could help reduce transaction costs for accessing value chains. This will also offset scale disadvantages and benefit the farmers to access inputs, technology, and the market.

³⁸ Available at <https://library.open.org/bitstream/id/789d4d1e-252a-48e3-9a72-dddebd16c1c4/1007333.pdf>

Agricultural production should focus on high-value agricultural products like fruits, vegetables and dairy products. As far as practicable, primary processing facilities should be established closer to the farm gates. Digital agriculture tools could assist producers to gather market intelligence and provide for better management of the entire value chain.

Consumer Behaviour Change

Post-COVID, consumers across the spectrum will want to adopt diets that can boost their immune systems. To create consumer interest in a food system with low health risks, the government must create behaviour change campaigns in rural and underserved populations. However, such campaigns may not be sufficient to achieve behavioural changes. Several other factors, like taste, affordability, convenience and knowing how to prepare the desired food items in a palatable way would influence the change process. Government programmes can be great delivery channels to leverage nutritious food products in India.

Empowerment of women

Evidence suggests that women's asset ownership (agricultural lands, dwelling house, etc.) is critical for their participation in decision making within households. State land policies must address this sensitive dimension to achieve positive nutritional outcomes. Education and empowerment of women is also positively correlated with reduced prevalence of anaemia and malnutrition; therefore they must be included in policy-level strategies.³⁹

2.3 UK context

2.3.1 Food system issues and solutions

2.3.3.1 Key issues

Climate change policy

Campaign groups and the Public Accounts Committee argue that the UK government is failing to take enough action to meet its commitments to the Paris agreement.⁴⁰ In part this failure to reduce its GHG emissions is due to the lack of integration of climate policy into other sectors. Its agricultural policy does not specifically mention climate change. The UK is offshoring many of its negative impacts, by importing so much food and not accounting for these (agriculture contributes 10% of the UK's GHG emissions).⁴¹ However, some are hopeful about recent movements in the right direction, in part because the UK is hosting COP26. For example, the Government is ending investment in new overseas fossil fuel projects.

In terms of public opinion in the UK, there is increasing agreement that climate change is serious. Climate Outreach research, published in March 2021,⁴² breaks down the UK public into seven segments, finding that all segments are concerned to a greater or lesser extent, that the majority agree climate change is caused by human activities, and that impacts are being felt in the UK. At least 60% in each segment agrees that the situation demands a global response.

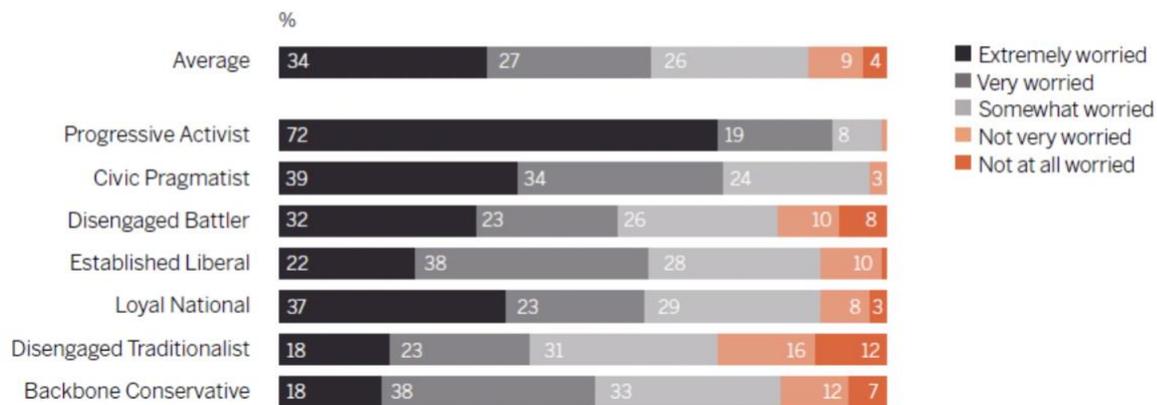
³⁹ Ideas To Transform Food Systems In A Post-Covid-19 India; The International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), <https://www.icrisat.org/6-ideas-to-transform-food-systems-in-a-post-covid-19-india>

⁴⁰ Available at <https://www.theguardian.com/environment/2021/mar/05/boris-johnson-failing-on-uk-plan-to-reach-net-zero-say-mps>

⁴¹ Available at <https://youtu.be/wL5ADg7Kldc>

⁴² Available at <https://climateoutreach.org/britain-talks-climate/seven-segments-big-picture/common-ground-differences>

How worried, if at all, are you about climate change?



Source: *Climate Outreach 2021*

Food policy

In terms of food sustainability, overall, the UK ranks 24th out of the 67 countries included in the Food Sustainability Index (managed by the FEC), and 16th out of 28 EU countries.

“The UK’s performance on food sustainability is disappointing. With the future of food, farming, the environment, animals and our health at stake, there is an urgent need for coherence, not complacency.” Food Ethics Council (FEC)⁴³

Its worst ranking (27th place) is for the number of people per fast food restaurant, with a lack of restriction on where they can be opened (e.g. near schools). It also performs poorly (26th) on GHG emissions from agriculture.⁴⁴

In terms of food insecurity and inequality, the UK ranks among the worst in Europe and is the 8th worst performing of 41 more economically developed nations.⁴⁵

There are several threats to the UK farming industry which might drive positive change, while also being extremely challenging. These threats include:

- Brexit labour shortage (95% of seasonal labour has been from the EU), and export costs with customs checks.
- New Environmental Land Management scheme replacing direct payments to farmers.
- Climate impacts such as drought and flooding.
- Low prices paid to farmers by supermarkets.

In addition, if Brexit (and an ongoing pandemic) reduce food imports, this may increase our GHG emissions because food is much more efficiently grown in warmer climates, even accounting for transport energy costs.

The positive change that might be driven by these threats include a possible transition to high efficiency, low harm farming inspired by countries such as the Netherlands.

⁴³ Available at <https://www.foodethicscouncil.org/programme/measuring-uk-food-sustainability>

⁴⁴ Available at https://www.foodethicscouncil.org/app/uploads/2019/02/Snapshot-FSI_analysis_2018.pdf

⁴⁵ <https://foodfoundation.org.uk/new-evidence-of-child-food-insecurity-in-the-uk/>

2.3.3.2 Solutions arising

In the UK, innovation is being forged out of relationships between universities, businesses and research initiatives. For example, the UKRI has released £5 million to train the next generation of food system leaders.⁴⁶ Food is the largest manufacturing sector in the UK, and there are 149,000 farm businesses in the country. Innovations in the UK focus on increasing self-sufficiency (currently at 55%⁴⁷), increasing resilience to pests & drought and increasing the efficiency of manufacturing chains (e.g. reducing energy and waste).

There is also a rise in small food businesses serving rising demand for more plant-based and ethical diets, for example, no-waste shops and veg box schemes.

Sustainable Food Places is a network to promote sustainable food in places across the UK.

<https://www.sustainablefoodplaces.org> A Sustainable Food Place meets standards in these six areas: food governance & strategy; Healthy food for all; catering and procurement; Good food movement; Sustainable food economy; Food for the planet.

The National Food Strategy, published July 2021 has also pointed to a number of good practice projects in agriculture and business, and has made recommendations to increase healthy and sustainable outcomes from the UK food system. <https://www.nationalfoodstrategy.org>

2.3.4 Demographics in the UK

2.3.4.1 Demographics and food

RAND research on 'Food Consumption in the UK' from 2020⁴⁸ finds that:

- There are socio-demographic differences in the consumption of a healthy diet. Low socio-economic status...is the single most consistent risk factor for an unhealthy diet.
- Despite these sociodemographic differences, diets remain on average unhealthy across all groups.
- There has been an increase in the sales of ethical and sustainable produce, such as Fairtrade and RSPCA Assured products. However, total sales are low, at only 11 per cent of all household food purchases.

Individuals with health and environmental concerns about food tend to be female and younger.⁴⁹

The Food Ethics Council aims to reframe the public as active citizens contributing to the food cycle, not just as consumers.⁵⁰

Rural communities in the UK are in most areas more concerned and active about climate change than urban communities. 50% of rural people compared to 39% of urban people buy local food and reduce food waste. Urban

⁴⁶ Available at <https://www.ukri.org/news/5-million-investment-to-transform-the-uks-food-systems>

⁴⁷ Available at <https://www.gov.uk/government/statistics/food-statistics-pocketbook/food-statistics-in-your-pocket-global-and-uk-supply>

⁴⁸ Dr Susan Guthrie et al, RAND Corp 2020, https://www.rand.org/content/dam/rand/pubs/research_reports/RR4300/RR4379/RAND_RR4379.pdf

⁴⁹ Guthrie, RAND 2020 references: Latvala et al., 2012; Su et al., 2019; WRAP, 2015; YouGov: Eating Better, 2019.

⁵⁰ <https://www.foodethicscouncil.org/programme/food-citizenship>

communities are a little less likely to take action in their own lifestyles but are more likely to vote based on climate policies or attend protests.⁵¹

2.3.4.2 Demographics and museums

In 2019/2020, museums sponsored by the DCMS in England attracted roughly 47.6 million visitors. In the last quarter of 2020, visit numbers declined 89% compared to the year before. The Science Museum Group recorded c. 5 million visitors. Tate Modern, British Museum and the National Gallery attracted the most visitors, particularly from international tourists. Tourism is the 5th largest industry in the UK, and 43% of visitors to the UK attended a museum or gallery.⁵²

In 2018-19, 50.2% of people aged 16 and over had visited a museum or gallery at least once in the past year. 51.1% of White people had visited a museum or gallery, compared with 33.5% of Black people and 43.7% of Asian people.⁵³

2.3.5 Specific issues in relation to COVID-19 in the UK

Food and health, in relation to environmental issues

In the UK, in 2020 although most consumers still buy food from supermarkets, there is increasing use of smaller shops and online food suppliers (apart from supermarkets online).⁵⁴

Before the pandemic, poor diet was responsible for one in seven deaths in the UK. Now, people living with obesity are more than 50% more likely to die from COVID-19. Only around 1% of the population currently eat a diet that reflects the Eatwell recommendations. (This is a mainly plant-based diet with 12% of energy coming from protein such as beans, pulses, fish, eggs and non-red meat.) Most consumers overestimate how healthy and sustainable their diets already are. Although many understand the principles of a balanced diet, what they consume doesn't reflect this. Health is more of a driver now than ever, especially personal health. Concern for the environment has taken a backseat, but still offers support to sustain change.

Access to culture

The UK has had comparatively high rates of infection, for example having the highest Covid-19 related death rate of any major country in December and January⁵⁵. The UK Government has imposed restrictions since March 2020 which have included two full lockdowns, or the closure of cultural venues, schools, office work, non-essential shops and food venues for several months. Throughout the year, cultural events and work meetings have pivoted online. This has exacerbated inequalities of access to culture and education especially in communities or families where there is lack of digital access and an increase in unemployment, sickness or food poverty.

2.4 Note on the global impact of COVID-19 on culture

⁵¹ Rural attitudes to climate change, Climate Outreach, March 2021, available at <https://climateoutreach.org/reports/rural-attitudes-climate-uk>

⁵² https://www.nationalmuseums.org.uk/what-we-do/encouraging_investment/tourism

⁵³ <https://www.ethnicity-facts-figures.service.gov.uk/culture-and-community/culture-and-heritage/adults-visiting-museums-and-galleries/latest>

⁵⁴ Guthrie et al, Rand, 2020, https://www.rand.org/content/dam/rand/pubs/research_reports/RR4300/RR4379/RAND_RR4379.pdf

⁵⁵ <https://www.newstatesman.com/science-tech/coronavirus/2021/01/uk-has-highest-current-covid-19-death-rate-any-major-country>

Museum audiences globally have risen in the past 30 years. The ICOM annual survey in 2019 recorded 230 million visitors to the 100 most visited museums. This is caused by the affordability of air transport and the construction of iconic museums, so that there are now 55,000 in the world (ICOM). However, funding for museums has declined over this period, particularly from the public purse (apart from e.g. China), so that museums often depend on corporate sponsorship.

Worldwide, during the COVID-19 pandemic, wherever social distancing and lockdown measures are in place, museums and other cultural venues are closed or, if open, receiving greatly reduced visitor numbers.

A NEMO survey gathered information from over 650 museums in 41 countries in an attempt to paint a picture of how these cultural institutions have been affected. The report reads: *The majority of museums in Europe and around the globe are closed. Closing doors to the public results in a drastic loss of income for many museums.*⁵⁶

An ICOM survey found that more than one tenth of museums globally will be forced to close, and that one third will reduce staff.⁵⁷ The UN World Tourism Organization⁵⁸ recorded a 74% decline in tourism in 2020. The Art Newspaper reported a 77% drop in visits to museums.⁵⁹

During this time, museums and cultural organisations have used digital and remote means to continue to engage with existing audiences and to reach new international audiences. This has been an opportunity for innovation and the formation of new habits and initiatives that are likely to be sustained in some form. The implication for this research is that museums, science centres and other communicators will need to plan for hybrid programmes, able to pivot to remote provision as pandemics and climate impacts are likely to continue as a destabilising factor.

3. Appendix: Detailed Analysis of Survey

3.1 Methodology of online survey

The online questionnaire, consisting of a total of 22 open and closed questions, was translated into Portuguese and Hindi, and circulated in the UK, Brazil and India via the partner museums' networks. The invitation to complete the survey was explicit about the subject matter, and in all three countries this generated a range of informed responses from people who were highly engaged with the subject. It is worth mentioning the quality of the open responses received, with many participants giving informed feedback through well-structured sentences and mostly wide-ranging content.

In Brazil, the survey was open between 21 April - 14 June 2021 and circulated to 142,139 people registered on the Museum of Tomorrow's mailing list. 553 unique clicks were registered redirecting them to the research link, and 328 responses were received from this mailing alone. On 7 June the survey was made available on PPP do Brasil's social media channels, generating further 139 responses. Among these respondents, 190 people qualified to participate in the second phase with more in-depth interviews.

⁵⁶ <https://www.ne-mo.org/news/article/nemo/nemo-publishes-results-of-survey-on-the-impact-of-the-corona-crisis-on-museums-in-europe.html>

⁵⁷ <https://icom.museum/en/covid-19/surveys-and-data/survey-museums-and-museum-professionals>

⁵⁸ <https://www.unwto.org/covid-19-and-tourism-2020>

⁵⁹ <https://www.theartnewspaper.com/analysis/visitor-figures-2020-top-100-art-museums>

In India the survey was shared by the National Science Centre, New Delhi, the North Indian zonal headquarter of the 25-centre network of the National Council of Science Museums, Ministry of Culture, Government of India. The survey was open between 21st April - 21st June 2021 and shared via email and WhatsApp groups with a 5000+ database comprising students, educators, adults, families, affiliate institutions and the museum's innovation hub members. It was made available on the museum's website and social media handles – FB & Twitter and further circulated within the Northern zones satellite units (Regional Science City, Lucknow and Kurukshetra Panorama and Science centre, Kurukshetra).

In the UK the survey was shared by the Science Museum in London, The Science and Media Museum in Bradford and The Science and Industry Museum in Manchester. Between them they sent 10 newsletters from the 9th April to 17th May to over 200,000 people. Additionally, messages were sent via Twitter and Facebook to the Manchester Science Festival's mailing lists, reaching 2,593 people.

3.2 Who responded to the survey?

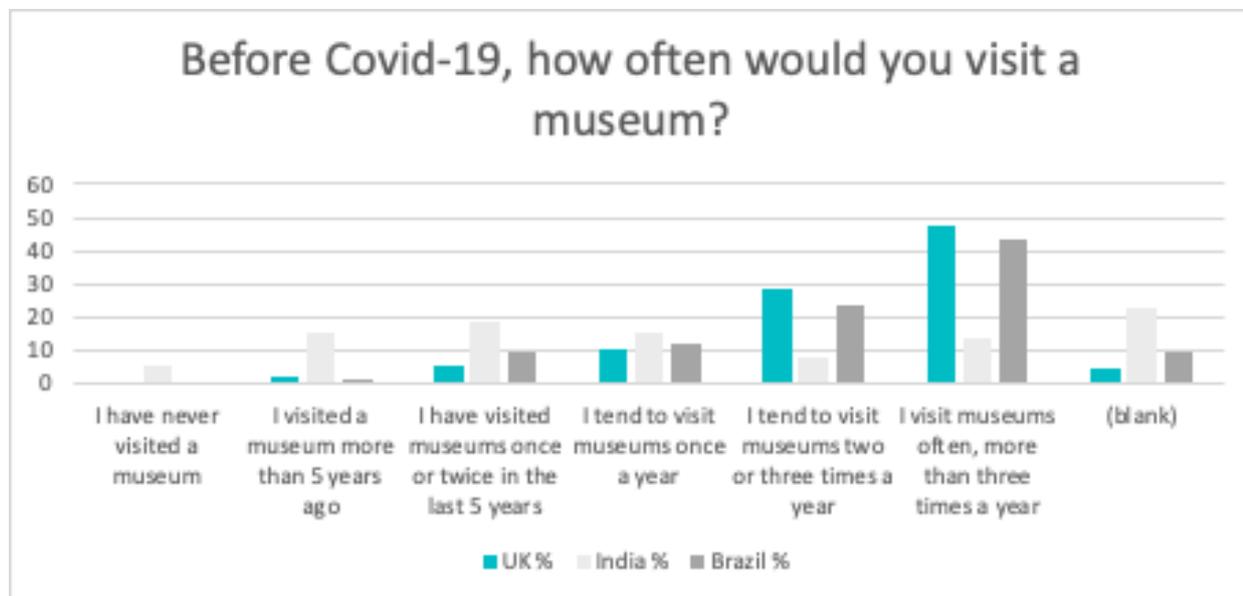
A total of 1304 people responded to the survey, 433 in the UK, 404 in India and 467 in Brazil. Around 150 respondents did not fully complete the survey across the three countries.

UK: 433 responses, 23 incomplete	India: 404 responses, 93 incomplete	Brazil: 467 responses, 44 incomplete
<p>Older and educated to a high level, majority either working or retired, and without children living at home. Located around Yorkshire and the North West of England. Less than 5% live in London.</p> <ul style="list-style-type: none"> ● Older age group, majority 50+, biggest age bracket 65+ ● Most in Yorkshire and the Humber (49%) ● 25% say they have children at home, mostly 13 years and under, with 32% 8-13 years. ● 77% Higher Education and above ● 34% in full time work, 15% part time work, 33% retired. 7% unemployed or unable to work. 	<p>Working aged, with a mixed education and work status. High number live with children at home, including those over 18. Located in North India including Delhi NCR.</p> <ul style="list-style-type: none"> ● Majority aged 35 to 54 ● Most in North India including Delhi, (67%) ● 58% say they have children at home. Of these a high percentage over the age of 18 (39%), 25% are 8 to 13 ● 56% Post Graduation and above ● 55% in full time work, 7% part time, 3% retired. 4% unemployed or unable to work. 	<p>Highly educated working aged public with professional stability* and without children or dependents. 49% located in Rio de Janeiro, others from other Brazilian states – such as Pará, Espírito Santo and Recife – as well as from other countries, such as Argentina, Portugal and Uruguay</p> <p><i>*This profile is striking and diverges from data on Brazil's educational context and current labour market.</i></p> <ul style="list-style-type: none"> ● Variety of ages, with slightly more in the 35-44 and 55-64 age brackets ● Focus on Rio de Janeiro, (49%) especially from the South and North zones of the city. Others are from across ● 20% say they have children at home, high percentage over the age of 18 (38%), 27% 8 to 13 ● 85% Higher Education and above ● 55% in full time work, 10% part time, 14% retired. 8% unemployed or unable to work.

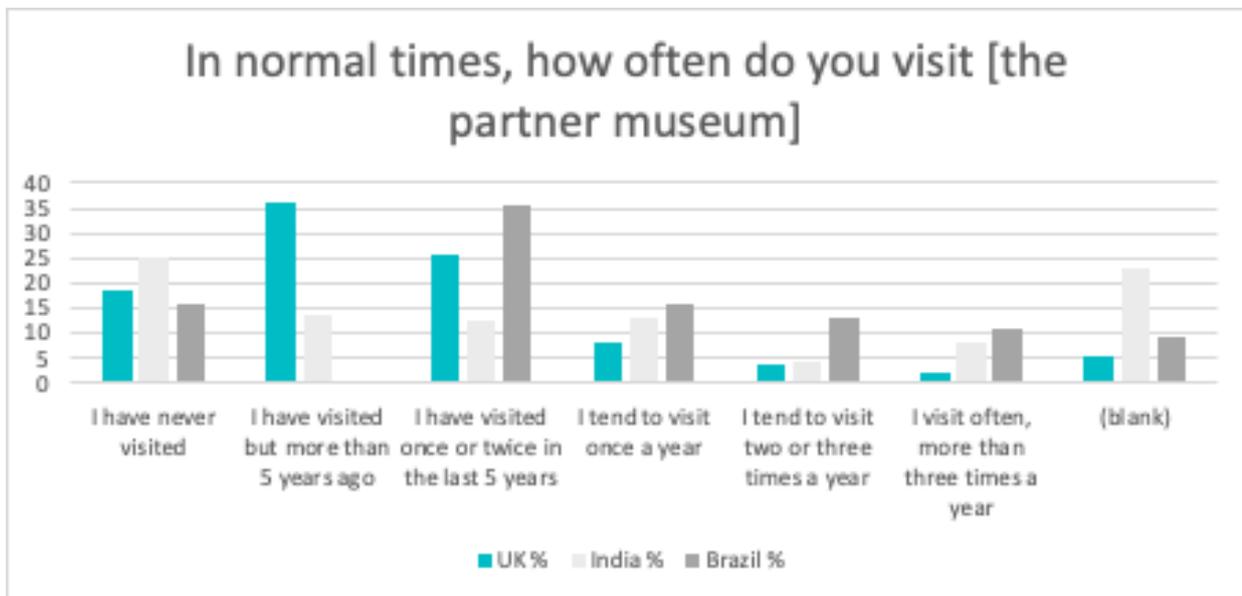
3.3 Relationship to museums

This was a series of questions to ask how often museums were visited, and for what purposes.

The UK respondents were the most likely to regularly visit museums closely followed by those in Brazil, with 87% and 74% respectively visiting more than three times a year. This fits with the highly educated and older demographic of respondents in both countries. However, our Brazilian research partners noted that this may differ from the Brazilian context of limited access to the country's cultural facilities. Respondents to the India branch of the survey were the least likely to regularly visit museums, with 40% visiting less than once a year, if at all.



The surveys were distributed widely through the partner museums' mailing lists, reaching both specialist interest groups such as cultural workers and teachers, as well as the general public. Information on the location of respondents shows a wide geographic spread, indicating that some may have signed up for information during a trip to the city in the past, and 'tourism' was mentioned by many in Brazil and the UK as a main reason for a previous visit. In the UK and India the survey was shared by affiliated museums in different parts of the country, where people may be less likely to travel to London or Delhi. This is reflected in the visitor patterns indicated below, where there is a relatively low number across all three countries who regularly visit the partner museum.



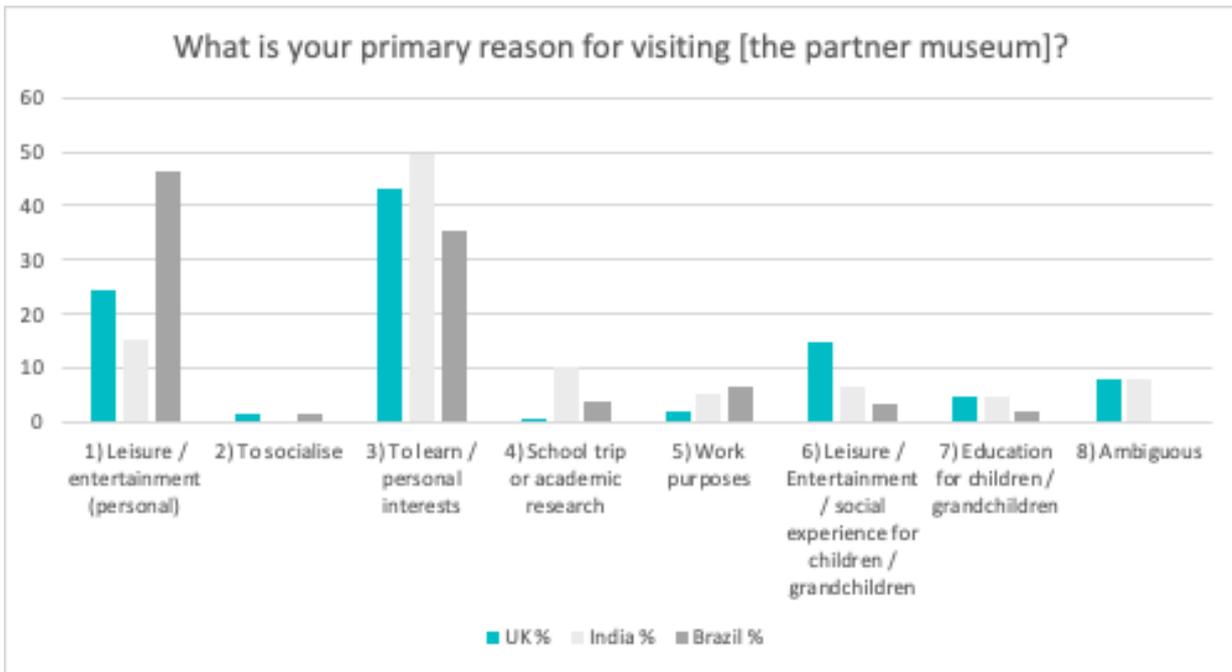
Those who have visited the museum in the past told us more about their reasons for visiting in an open response, which we categorised according to their primary focus. In all three countries the respondents were motivated more by their own interests than that of their families or children. For the UK and India the top reason was to learn or explore subjects that they have an interest in:

- *To learn, to get inspired, to explore.* (India)
- *To be updated & discover new & old ideas / innovations. I visit museums on all my travels.* (UK)

For Brazil the top reason was leisure or entertainment, with many visiting as a tourist to the city.

I went to Rio de Janeiro with my family, and we went to get to know the city's newest museum. We loved it!!! (Brazil)

A higher proportion of UK visitors were motivated by the interests of children or grandchildren than the other two countries. This was in part due to the reputation of London's Science Museum as a family friendly destination, while in India other cultural activities would be favoured over a museum visit, and in Brazil the sample demographic had fewer young children living at home.



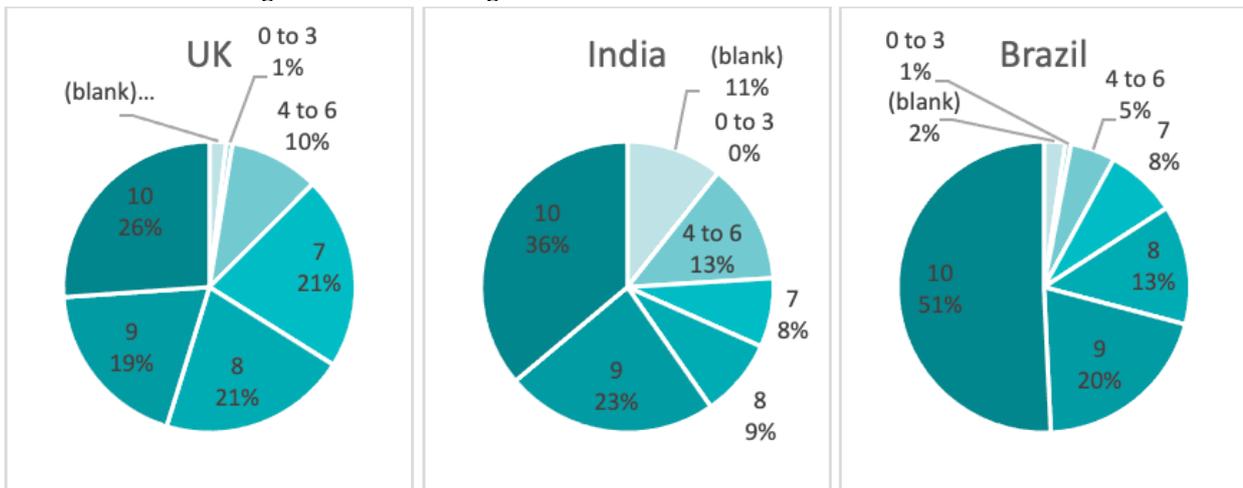
The following summarises responses to our core research questions, giving insights into motivations about and perceptions of food sustainability in each country.

3.4 Interest in issues about food

This question asked: thinking about your interest in issues about food, where on this scale are you?

Respondents were invited to score themselves from 0 to 10 depending on their level of interest, where 0 is low and 10 is high, and then give their reasons for their choice in an open response.

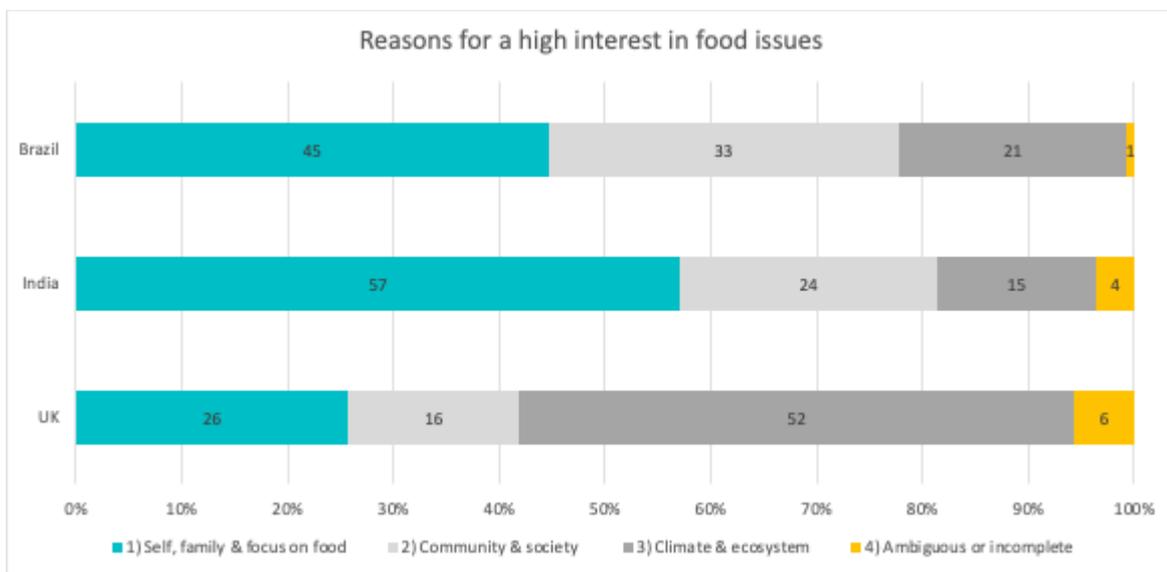
Responses from all three countries indicate a high level of engagement in the subject, with more than two thirds choosing a score of 7 and above. Respondents in Brazil showed the highest interest with 51% of them scoring 10 and less than 6% scoring 6 or below. In India 36% scored 10 and 13% scored 6 or below. UK responses were the lowest with 26% scoring 10 and 11% scoring 6 or below.



To assess the reasons for high engagement in each country we have analysed the responses of those scoring 7 and above, using Flow's Three Lenses framework⁶⁰.

⁶⁰ More about Flow's Three Lenses framework <https://bridgetmck.medium.com/mapping-the-future-with-3-lenses-1231960afe98>

<p>1) Self and family Enjoyment of eating; food is central to family; concerned with nutrition; personal well being; budget concerns; environmental concerns ascribed to futures of grandchildren & children.</p>
<p>2) Community and society Food production in relation to local community & regional environments; food justice; indigenous rights; poverty; waste; loss of local landscape; fair distribution; supply chains.</p>
<p>3) Ecosystems and climate Emphasise vegan diet; wildlife/nature within a full-spectrum response; systemic awareness; general statements e.g. 'care about the planet'; raise multiple issues across self, community & planet.</p>
<p>4) Ambiguous or incomplete People whose responses aren't clear or they haven't quite understood the question. Antagonistic e.g. attacking vegans.</p>



Self, family and a focus on food

In Brazil this was the largest category, with 45% of responses. These respondents often cited personal and family health, budget, personal initiatives to change eating habits and/or concern stemming from professional and educational knowledge:

- *I have an autoimmune (skin) allergy, and over the years I've noticed that food has a huge impact on my health. I am lucky to come from a family that has always tried to eat healthily and buy fresh food from small local producers. But I still have a lot to improve and learn. (Brazil)*
- *To maintain quality of life, health and longevity. (Brazil)*
- *I'm interested in good food and organic products. And ways to plant things that I can use in my food at home. (Brazil)*

In India this category was higher still, with 57% of responses. 'Food as basic need' and 'food for nutrition' were the most popular themes that emerged, along with general healthy choices or food as a way of life:

- *We get nutrients from food (fat, proteins, carbohydrates, minerals and vitamins, fibres) which we can include in our balanced diet. To maintain growth and health, minerals and vitamins are components which keep us away from diseases and are a vital part of one's life.* (India)
- *Our health (physical as well as mental) lies in the food we eat so it is very important to eat a balanced diet.* (India)
- *The raw materials which we use for preparing food are now not having that much nutrients. Organic food is always a good option.* (India)

The UK respondents were the lowest of the three countries in this category, with 26%. People mentioned enjoyment of food, nutrition, and concern about losing choice both for themselves and future generations:

- *Food is important to us all. In particular I don't want to end up having to live on an intensely restricted diet if we walk blindly into food production problems.* (UK)
- *I want every child in every country to enjoy a healthy and enjoyable diet. What we do with food today affects every place and the future of the planet.* (UK)
- *I was trained to teach Home Economics and feel the subject is an essential in education. Access to good quality food and the ability to cook it is essential for everyone.* (UK)
- *I am a vegan so have to constantly be aware of what I am consuming.* (UK)

Community and society

In Brazil 33% of responses have a community and social dimension, with respondents commenting on food waste, increased hunger and malnutrition in the country, especially during the Covid-19 pandemic, and criticisms of current environmental and social policies:

- *Brazil has rich soils in its regions, so waste and hunger are unacceptable. Hunger causes health problems and without good health, people cannot have education, leisure, sport, tourism and culture.* (Brazil)
- *I believe that there is uncontrolled food waste, and most people are not in the habit of recycling packaging.* (Brazil)
- *Increase in social inequalities and a proportion of Brazil's population on the poverty line.* (Brazil)
- *I am very interested in the issue of world hunger and the curious contrast with the emerging group of malnourished obese people.* (Brazil)

In India 24% of respondents fit this category. They spoke about food disparity and non-availability of food for financially weaker sections of society, in India and beyond. Other respondents mentioned the effects of population growth on food availability, wastage of food and issues faced by farmers:

- *Food insecurity and malnutrition are major challenges facing humanity. In particular, people in the developing countries of south and southeast Asia and sub-Saharan Africa are severely affected.* (India)
- *In India, food scarcity, agriculture problems (drought and flood), food grains mismanagement, food cost increase and farmer problems are rising day by day, making food unavailable for most of the people due to which I talk about food issues.* (India)
- *Having grown up in a country of tremendous income disparities, food shortages and malnutrition could be seen all around. And yet one knew that this was more a problem of distribution and access rather than insufficient production.* (India)

In the UK only 16% of responses showed a specific concern for communities or society as a whole, or impacts on local infrastructure. Those who did tended to focus on equality and food waste:

- *As a church member, I heard about Fair Trade and how important it is many years ago. We are an Eco congregation.* (UK)
- *There is enough food to feed the world. So why don't we do it?* (UK)

- *We can grow enough food to feed the world's population, but still people starve. In Britain we throw away a huge amount of perfectly good food. The food industry's aim is to sell more, not sell better food.* (UK)

Ecosystems and climate

In Brazil 21% of responses show a wider concern about the world, their answers were often in-depth, suggesting systemic awareness. These responses bring in broader views in relation to the food debate, citing the importance of protecting the environment and human and non-human life:

- *A fundamental right for human and non-human beings.* (Brazil)
- *What we eat directly affects the environment. If we reduce meat consumption, for example, it could have an effect on forests and bring greater respect for animals, who are on the planet to have a life, not just to feed us.* (Brazil)
- *I understand that food is an important source of energy and connection with the whole. Does our food nourish life within us? And does it nourish life on Gaia? Is what nourishes me produced in a dignified and respectful way for all involved in the entire process, including the earth's micro-organisms, water, plants, life on Earth? Does this production have a loving connection with the spaces and beings that participate in the chain? If so, it's probably good and flavoursome.* (Brazil)

There were some, especially those at the lower end of the scale, who have wide concerns but do not necessarily feel able to act:

It is a concern, both on a personal and global level, but it ends up being an issue that is often neglected and pushed into the background by practical everyday issues. (Brazil)

In India this group included 15% of responses, the lowest of the three countries. Those with a more macro aspect tended to touch upon topics of climate change, pandemic and sustainability. Other mentioned depletion of forest areas, loss of habitats for animals and plastic pollution, these more singular issues tended to be mentioned by those scoring lower in the scale:

- *I am concerned about climate change and its impact on agriculture and its produce. Issues like depletion of underground water and its effect on soil & crops and its produce is worrisome.* (India)
- *Demand for food items, whether it's palm oil, seafood or avocados, (all things that I eat regularly) has resulted in the drastic depletion of forest resources, loss of habitat for animals, many of them already endangered, rise in plastic packaging that then turns into waste amongst many other things. With so much information available to us on how our consumption habits affect the environment and the lives of people, it's almost impossible to stay neutral.* (India)

For the UK this was the highest category, with 52% of responses. Many of these respondents touched on a wide range of issues, including those impacting on self and communities, but focused on the wider impact on the planet and living sustainably as the main issue:

- *I worry about the effects of the Western diet on the health of the planet and those living on it, and also about the systemic unfairness between more and less powerful people.* (UK)
- *I worry that people are starving in parts of the world and food is being wasted in others. As the climate changes we will all have to adapt. I am not sure that we are prepared for this.* (UK)
- *Food is the one thing we all have in common, and the current industrial farming practices threaten the planet in terms of carbon emissions, sustainability and continue to be damaging for the poorest on the planet.* (UK)

Some at the lower end of the scale felt unable to act despite an awareness of need, such as this parent who scored themselves as 7:

I have children and want to do my bit to make the planet better for them but also have a budget to stick to so have to pick and choose changes that we can afford. (UK)

Reasons for low or neutral interest in food sustainability

In the UK, those at the lower end of this group indicated they were more concerned about other issues, feel disempowered, or knew they should be interested in this subject but it didn't fit in with their lifestyle:

- *There are many more things which take up more of my time to think and act. Whilst I know this issue is serious, it's effectively a pecking order of serious issues.* (UK)
- *I think these kinds of issues are concerns for corporations and governments more than individuals.* (UK)
- *I'm concerned but I still have a bad habit of liking 'out of season' food.* (UK)

In Brazil this was also evident in the responses where fewer than 6% scored 6 or below:

- *I'm not completely disinterested, but I know I don't take much action to find more sustainable food, especially when it means leaving my comfort zone.* (Brazil)
- *It's a subject I haven't had time to stop and think about yet.* (Brazil)

In India, most of the respondents choosing scores of 6 or below either did not respond to the open question or were indifferent towards it:

- *I feel we should think about it, and at the same time, I guess it is not my cup of tea.* (India)
- *Don't want to get involved in issues.* (India)
- *I have neutral views as my knowledge about this is limited.* (India)

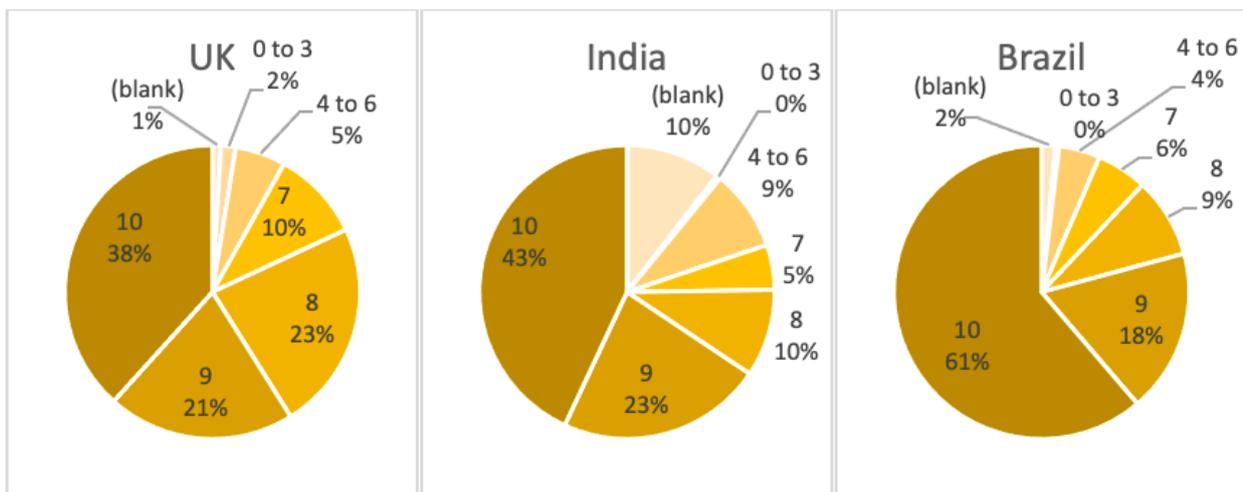
A few respondents in the UK and India scored low but still mentioned concerns about food. These were in general focused on the quality of food available to eat, or the impact of wider issues on their own families:

- *Interested from a health point of view, feel as though I ought to be interested from a green and welfare point of view but not really.* (UK)
- *Worried about climate change and environmental issues for the kids.* (UK)
- *Food must be conserved for future need and should be judiciously used.* (India)
- *Food is the resource which human beings need for energy to work. Genetically modified crops, poor aquatic life. Vegetables in the vendors are chemically washed so that they look green.* (India)

3.5 Concern about the environment

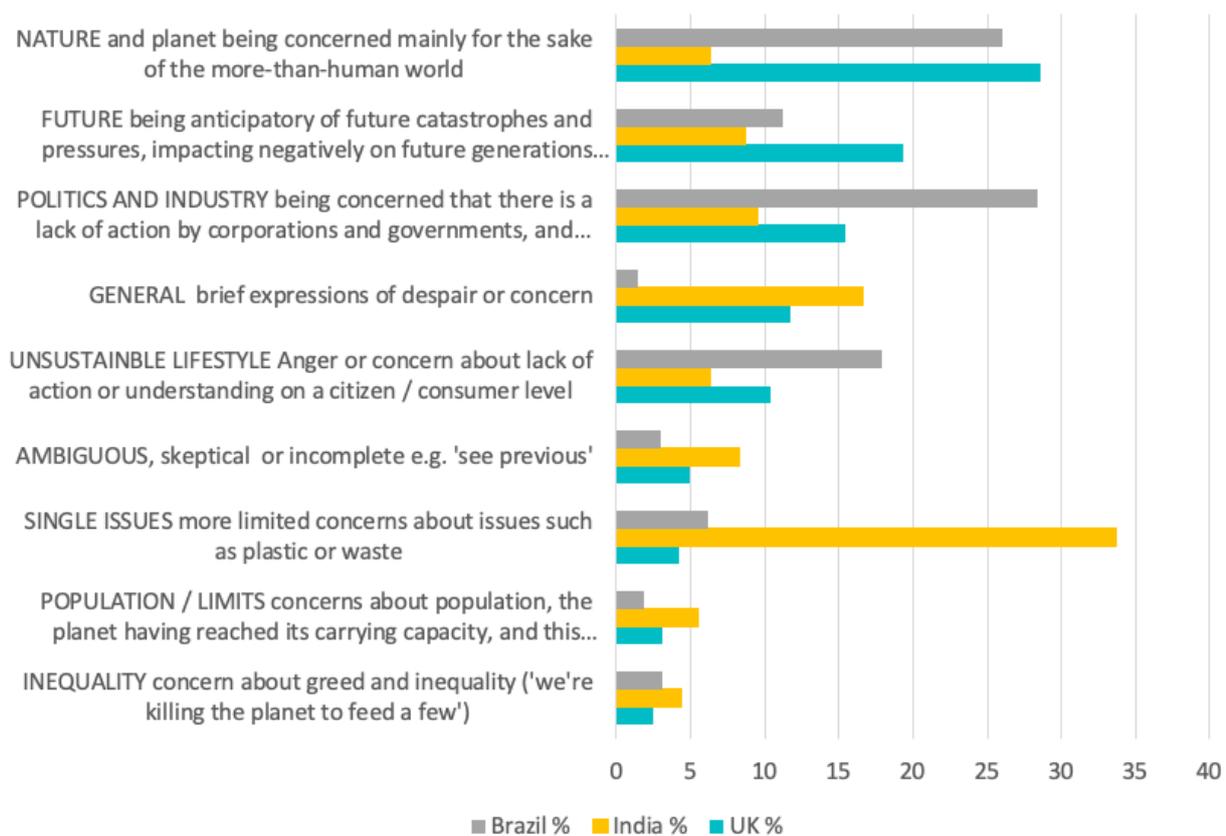
This question asked: thinking about your concern about the state of the environment, where on this scale are you?

Respondents were invited to score themselves from 0 to 10 depending on their level of concern, where 0 is low and 10 is high. Across all three countries the majority of respondents scored even more highly on this scale than the previous question about food.



Respondents were invited to tell us their reasons for their score in an open question. To code their responses we first analysed the answers in the UK, and then applied these categories to the Indian and Brazilian branches of the survey. Responses align with the reasons given to the previous question about food, with the UK sample being most concerned with wider matters affecting nature and the wider world and in anticipation of future catastrophes; responses in India mentioning a wide range of specific issues or concerns; and people in Brazil responded to the current situation, mentioning actions of politics and industry, and showing concern for nature and the wider world.

Reasons for concern about the environment



In India those scoring 7 to 10 had the widest range of concerns, with 34% mentioning single specific issues such as climate refugees, the pollution in Delhi and food waste, and 17% making general expressions of despair or concern:

- *Climate change has already proved to be devastating for people especially in poor countries. In the Sundarban area of south 24 Parganas in the state of West Bengal in India (country I belong to), climate refugees abound as they flee from their native homes because of the rising sea level. Climate change is causing loss of both lives and livelihoods.* (India)
- *Being in Delhi it's very difficult to live in a polluted city, it has an impact on our health.* (India)
- *Wasting food is totally unacceptable as in many parts of the world people are still facing scarcity of food.* (India)

Those at the top of the scale were more likely to have wider concerns about nature and the planet than those lower down, and more likely to mention the culpability of government, industry and consumers:

- *Now more than ever, we are seeing catastrophic climatic events happening across the world due to climate change. Our food choices have a far greater impact today on every part of our ecosystem and existences than almost anything else and by controlling what we grow, who grows it, how it's grown, who get compensated fairly for it, how it is packaged and transported, how it is cooked and consumed and how much is wasted and what happens to the waste--we can make a significant change in the wellness of each other and the planet.* (India)

- *Have a negative feeling about the livestock sector's contribution to the environment.* (India)

Respondents who scored themselves at 7 or 8 were concerned about a growing population's impact on the environment, particularly thinking about our habits and lifestyles, and the impact on health. They also expressed general despair about people's individual and collective agency to bring about change:

- *Looking at the present condition in India where there are more mouths to be fed than that of the hands that produce food (owing to various factors) and where this gap is increasing gradually, it's all the more important to work towards bettering the environment.* (India)
- *The environment is becoming polluted and this is further leading to diseases and illness.* (India)
- *Environment issues are complex and multidimensional, they require concerted efforts.* (India)
- *The only thing that stops me from being extremely concerned is probably my desire to preserve my mental health. Although a lot of us make individual changes in our diet or in our buying habits for the sake of the environment, it's the big businesses that work on scales large enough to make any kind of recognisable difference so for me to feel that the weight of the planet rests on my shoulders is unhealthy and useless. What businesses have become really good at doing is shifting the blame on individuals instead of taking stock of their actions. So, I do what I can - trying to not buy goods that don't come in plastic packaging or carrying cloth bags or using public transport as often as I can but not beating myself up too much when I cannot. (something I've done in the past.* (India)

In Brazil the top category for people scoring 7 and above was Politics and Industry, with 28% of comments mentioning the role of these sectors in environmental issues. Among these it's worth mentioning concern with Brazil's environmental and social policies, the use of agrochemicals and pesticides, hunger and food waste:

- *All the atrocities being committed in Brazil with the Amazon, the lack of fairer sanitation legislation. Climate change is visible and there are still many people who deny it.* (Brazil)
- *It's impossible not to be worried when there's a government that wants to relax legislation, strips down environmental protection agencies, legitimises illegal mining practices and land grabbing on indigenous lands, and encourages monoculture and large farming estates.* (Brazil)
- *I'm very concerned about the situation with the environment, especially due to federal policies in this area since 2019. I've even dedicated myself to reading up on the subject and following the news and organisations in this field. Unfortunately, I can't do much about it. But I'm very interested in the topic.* (Brazil)

The second highest category at 26% was nature and the planet, with a slight skew towards people who scored 10. These comments were often detailed and show an awareness of the systemic nature of our relationship with our planet:

- *I'm in love with nature; I have a huge affection for animals. I'm convinced that, no matter how much we destroy nature, it will be reborn. However, the more we destroy it, the more we destroy ourselves too, and we don't have the ability to be reborn like nature. We're the ones who depend on nature, not the other way around.* (Brazil)
- *Global warming is only getting worse, we're about to face a lack of non-renewable resources that are essential for our survival, such as water.* (Brazil)

The third highest category with 18% of responses focused on people's unsustainable lifestyle and our actions as consumers:

- *Our planet is asking for help. The lifestyle of a large part of the population (including myself) is no longer compatible with what we need in order to have a sustainable world.* (Brazil)
- *I think I'm more concerned about social inequality (responsible for hunger still existing in the world) than necessarily about the environment. But both are linked, see the issue of water (the lack of it, its contamination, privatisation), for example.* (Brazil)
- *The vast majority of the things we consume come from the environment, so it's inevitable that it's a focus of extreme attention, as we urgently need to change the chaotic situation in which we live.* (Brazil)

In the UK the top category for people scoring 7 and above was Nature and the more-than human world, with 29% of responses. These people tended to touch on other categories in their response, illustrating a wide awareness of issues and how these cumulatively impact on our planet:

- *I am concerned that ecosystems are being destroyed as the population increases and we live beyond the planet's means. There is no slowing down, it is only getting worse. I think it's too late.* (UK)
- *Where our food comes from, how it has travelled to us, packaging, sustainability and how what we eat is contributing to polluting our planet enormously.* (UK)
- *Too many trees are being chopped down, too much pollution is being generated, we are rapidly turning previously green areas into deserts and we are running out of time to turn this around.* (UK)

The second highest category was people with concerns for future generations, at 19%. Many mentioned grandchildren (reflecting the older demographic of the UK sample) and their hopes for their futures. Others expressed worries that we have reached a tipping point:

- *I'm thinking of my Grandchildren and how it will affect them.* (UK)
- *That we need to pay more attention to the environment otherwise the crisis will impact the future generation.* (UK)
- *Tipping points for several environmental factors have already been breached...Not sure we as humans will be able to pull it back. Consequences will be unpleasant to say the least.* (UK)

Third highest at 15% was concern about the action of politics and industry, from supermarket packaging to 'greenwashing' and a lack of joined-up action between world governments:

- *Supermarkets should stop all plastic bags, plus cut down on the vast amounts of packaging they use.* (UK)
- *As above. I am concerned that governments and big companies are greenwashing themselves, as with the government's new targets without adopting the means to achieve them or better and Shell's sponsorship of the Science Museum's climate exhibition while planning more exploitation of fossil fuels.* (UK)
- *We have had an effect on all the Earth's systems and need to get world governments to instigate changes in law for the long term benefit for the environment. This includes trying to support less able developing countries.* (UK)

Reasons for low or neutral concern (6 or below)

In the UK, 7.3 % scored 6 or below, in India this was 11.5% and in Brazil 4.9%.

In Brazil reasons for low concern or neutrality on the subject tended to have little interest or commitment to changing eating habits:

- *A very complex issue. I do my bit, but it depends on all of the earth's inhabitants.* (Brazil)
- *I don't really understand it, but I care, and I worry.* (Brazil)
- *Again, I have opinions on the subject, but I don't do anything to change it.* (Brazil)
- *A lack of information about it.* (Brazil)

In India, those at the lower end of this group have indicated that while they remain concerned about the environment, their individual thoughts and actions will not be enough as this needs everyone's attention and efforts:

- *Only thinking or giving speeches...can't make any change. It's everyone's responsibility to work on it.* (India)
- *I alone can't do anything.* (India)
- *We all should actively participate in it.* (India)

The majority of their concerns were focused on environmental pollution impacting health:

- *Polluted Delhi.* (India)
- *Pollution and water scarcity.* (India)

In the UK these individuals were likely to see the impacts or solutions as not affecting them, or out of their hands:

- *I never go on foreign holidays (or holidays really) I have no children, I am poor in health and wealth and I don't see why I should do without.* (UK)
- *I am concerned however I haven't seen the damage first hand so it is harder for me to be as concerned.* (UK)
- *I do what I can but ultimately it's in the hands of governments motivated by private profit and xenophobic ambition.* (UK)

Those in the UK who did mention specific concerns tended to mention the big things they can see in their own environment or hear about in the news:

We destroy the environment, too many cars and too many trees etc being cut down. (UK)

Ice melt and pollution from China worry me. (UK)

3.6 Thinking about food and the environment

To gauge the main factors that shape respondents' views about food sustainability and the environment they were asked to choose the 5 categories that first came to mind from a list of 22, covering factors which we coded in three clusters: Self & Home; Community & Society; Ecosystems & Climate. The top four choices in each country indicate the factors that they are most aware of in relation to food and the environment, which in turn reflects the current situation that these populations are facing, such as hunger in context of Brazil's political and socio-economic climate:

- Brazil (437 responses) main focus on Ecosystems & Climate:
 - Pesticides, Deforestation, Hunger and Malnutrition, and Food waste
- India (329 responses) main focus on Community and Society:
 - Food waste, Pollution affecting health, Hunger and Malnutrition, Population
- UK (421 responses) split between Self & Home, Ecosystems and Climate:
 - Packaging and plastic, Deforestation, Food waste, Loss of biodiversity.

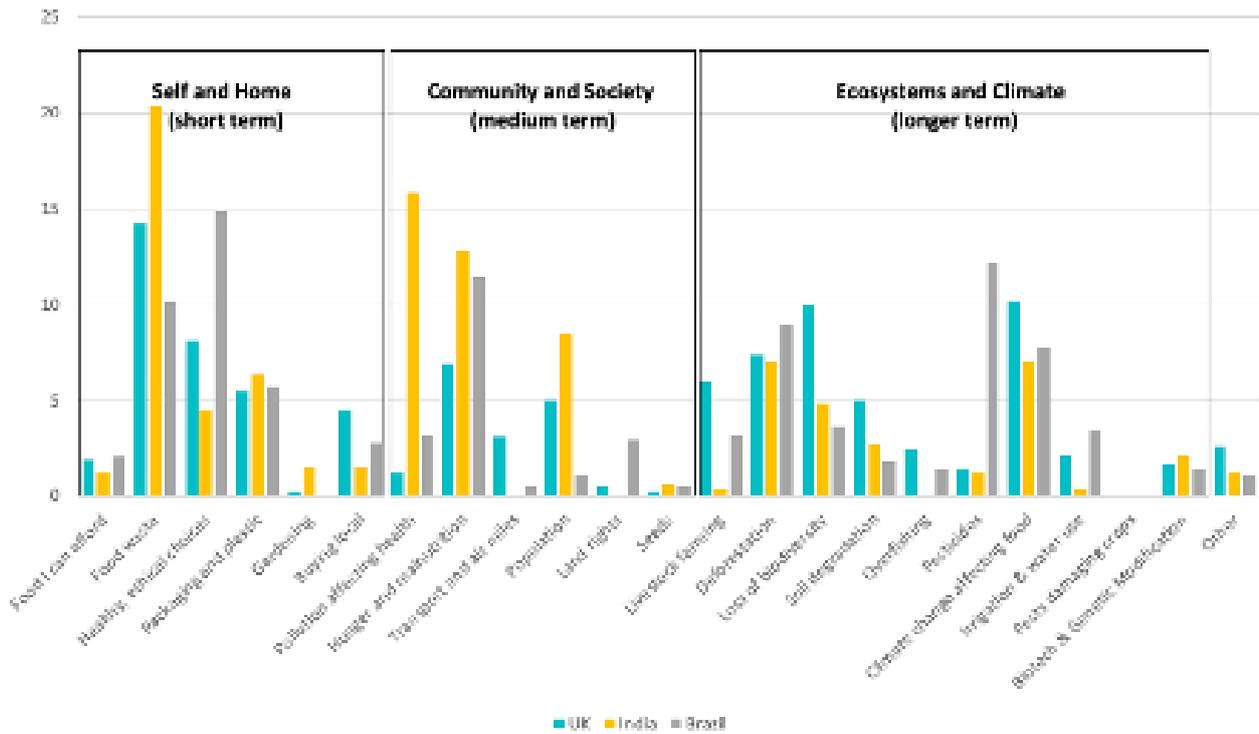
Respondents were then asked to select the ONE issue from their original five which they feel is most important:

- Brazil: Healthy, ethical choices; Pesticides; Hunger and malnutrition; Deforestation
- India: Food waste; Pollution affecting health; Hunger and malnutrition; Population
- UK: Food waste; Climate change affecting food, Loss of biodiversity; Hunger and malnutrition.

While in India the order of priority stayed the same for both questions, in Brazil the first choice shifted from 'wider world' issues to do with ecosystems and climate to more personal healthy ethical choices, and in the UK food waste replaced plastic and packaging as the top issue. This suggests that despite having a wide range of concerns, the more practical 'low hanging fruit' options for tackling them are seen as the highest priorities across the whole sample surveyed.

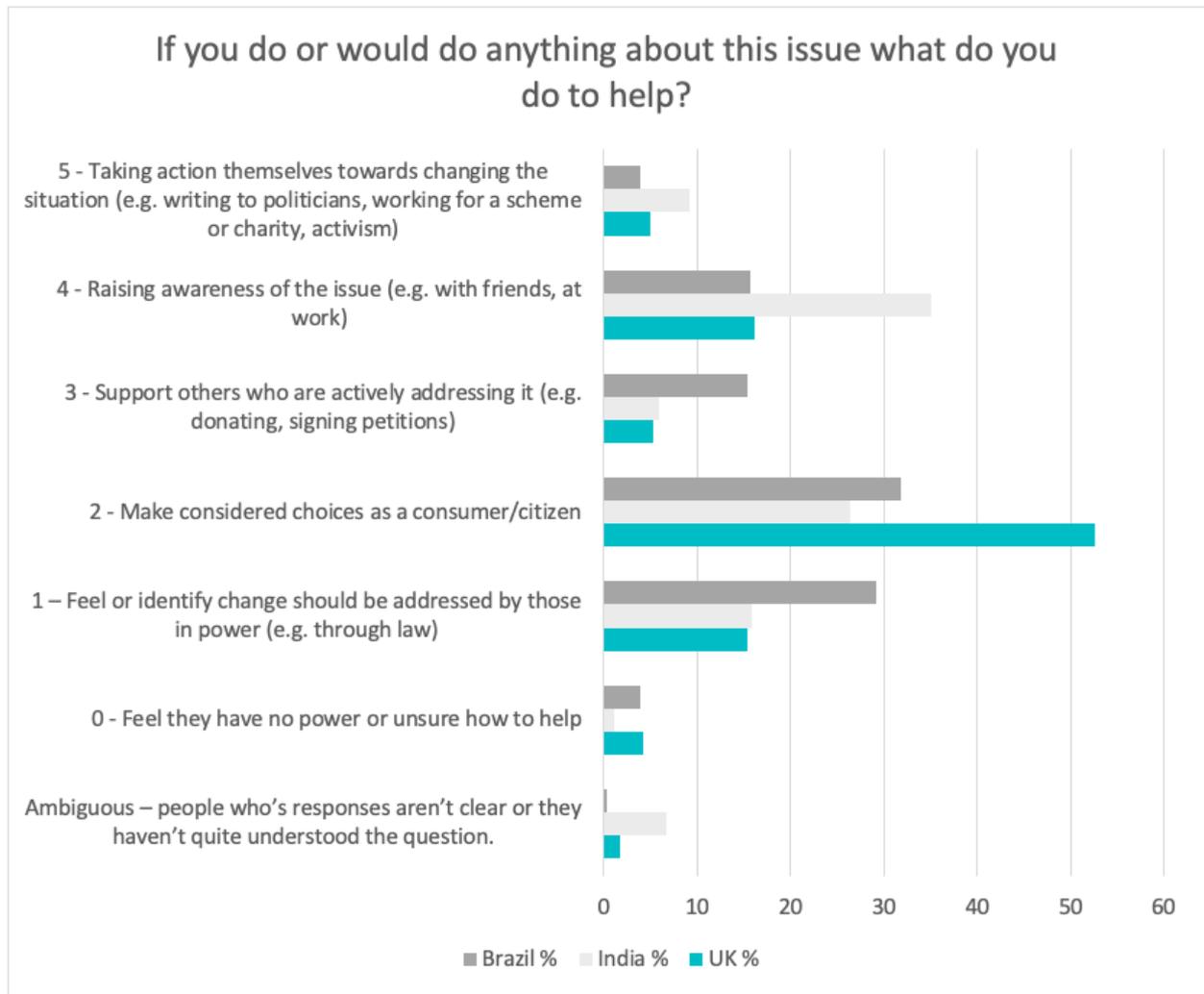
Because if we don't urgently start making ethical and healthy choices, seven years from now environmental losses will be irreversible. (Brazil)

Which ONE is most important?



3.7 Actions

If you do, or would do, anything about this issue, what do you do to help?



Our final question asked people to reflect on the issue they identified as a priority, and tell us what they do or would do if they could to help tackle it. We grouped people’s responses depending on how empowered they feel to act. Those who feel they have no power or are unsure how to help at the bottom, and those who are actively pushing others for change at the top. We found that almost all of the respondents were already doing something, however small, to help tackle the issues discussed.

Overall, respondents in Brazil appear to be the least empowered. 29% of them suggest that changes should mainly be made by those in power, with proposals to revise environmental legislation, create educational programmes on the subject, as well as social programmes to combat hunger:

I would create educational programs to combat waste and reuse food. I would encourage the implementation of food distribution networks for all. In fact, this issue involves political change and the implementation of social programs and improved incomes. (Brazil)

However, the biggest group at 32% recognised their personal responsibility and feel able to make considered choices as a consumer such as choosing vegetarianism, growing food in gardens at home and waste reduction practices:

I'm vegetarian and whenever possible I eat local, organic produce and strive for food autonomy at home. (Brazil)

A significant number of respondents also stated that they raise awareness about the debate among people close to them, such as friends and work colleagues (16%). Others support initiatives related to the subject, such as signing

petitions, donating food to social projects, helping movements related to sustainable food and other initiatives (15%):

- *Informing people close to me about the subject, who can transmit it to other people close to them and thus spread knowledge.* (Brazil)
- *Contributing to organisations whose aim is fighting hunger and malnutrition.* (Brazil)

Respondents in India were the most empowered, with 9% saying they are or would like to actively help to tackle the situation:

I am working in the research institute of the State Agricultural University and providing technical know-how to farmers and laymens about growing green cover in their areas. Moreover I'm already doing my part by growing trees at our office premises. (India)

The biggest group at 35% want to raise awareness of the issue, recognising the importance of spreading the word with family and friends or using their position as teachers or with colleagues to educate those they work with:

I have organised some awareness programmes, created articles and videos or posts on social media to encourage people to think about food waste and do something to prevent hunger and malnutrition. (India)

26% described the choices they could make as individuals, from simple everyday actions such as shopping locally, to bigger consumer decisions such as switching cars or energy suppliers:

First of all we all should buy from local sources. Why should we purchase brands like Aashirwad when we can buy wheat directly from the farmers? (India)

Power your home with renewable energy. (India)

15.79% of the respondents indicated that they expect those in power should take a lead in addressing key issues particularly around matters of population control, pollution and agriculture:

The government should take a lead in demonstrating climate resilient technologies to farmers like rain water harvesting, conservation tillage, groundwater recharge, advancement of planting dates of rabi crops, water saving paddy cultivation like direct seeded paddy, community nursery for delayed monsoon and diversifying livelihood options and sustainable cropping pattern to adjust to changing climate. (India)

In the UK there is a lot of awareness about the choices people can make as consumers, and 52% described actions from eating less meat, to avoiding palm oil or shopping locally. Many said they are already doing this and have been for some time:

- *I always recycle and follow a plant based/vegan diet, try to walk as much as possible.* (UK)
- *Try to buy seasonal produce and have a veg box that focuses on surplus produce.* (UK)
- *Try & avoid unsustainable palm oil products. Buy locally produced food from local shops. Buy minimal carbonated drinks in glass bottles.* (UK)

A further 16% also try to raise awareness either within their circles of friends and family, or those they reach through their jobs. 5% said that they offer support in other ways such as signing petitions or volunteering, and 5% are more active in running schemes, projects, and activism that could tackle these issues on a larger scale:

Raise awareness and support of initiatives like the ULEZ in London, encourage more use of public transport and walking/cycling. (UK)

All environmental issues are of importance to me. I support Greenpeace and Friends of the Earth, plus a host of other environmental and nature charities. I sign petitions, write letters, and take part in direct actions and protest marches where I can. I also tackle these issues by the choices I make in my everyday life, and encourage others by sharing environmental news/info and petitions on social media. (UK)

I already try to influence by example and by writing up in our local magazine. I am on our Neighbourhood Planning group promoting preservation of green spaces. (UK)

16% felt less able to act on their own, but suggested changes that could be made by people who are in a position of power:

Try not to buy food grown unsustainably - but that's bloody difficult without government action and clear labelling. (UK)

Support local farmers. Heavily tax imported goods to make them less attractive when compared to home grown and locally sourced produce; deter the consumer from being too reliant on them. (UK)

4. Conversations in Brazil

- Motivations: How do people think about their own food practices and their agency to create change in relation to global environmental issues? What motivates and i
- Awareness: What do different audience groups know about the causes and solutions to harms of the food system?
- Solutions: What kinds of interventions, and support would help them to reinforce beneficial – and to alter deleterious – food practices, and to effect systemic change?
- Engagement: What museum and science education experiences will engage them? What do professionals in public engagement consider the role of informal science education and museums to effectively engage people?

4.1 What motivates and interests people?

The participants demonstrated their interest in the subject, making reference to affective memories and the need to reconnect healthy habits to family roots and the ancestry of native peoples. They emphasise aspects of self-care and physical health. They also demonstrate respect for cultural diversity and political sensitivity on the subject of hunger, as well as empathy for those living in poverty.

4.1.1 Mobilising, positive relationships

Connection to growing and time to prepare food

Among the adults and families interviewed who demonstrate that they are mobilised by the subjects of health, food and sustainability, their relationship with time and preparation is different, and more healthy habits are upheld despite “obstacles” of time. They have developed a taste for healthy food, linked to knowledge, awareness and contact which seems to overcome their lack of time.

In these cases when they participate more actively in the stages prior to food preparation (selection, contact with the producer, planting and harvest), the affective link with food seems to increase and is not just limited to “eating”. Growing one's own food is what most strengthens this connection.

Affective memories and reviving roots

When talking about their own food, the interviewees relate experiences of connecting with other people through sharing food. The main affective bonds with food and the environment raised are linked to family experiences and often linked to childhood: *Moqueca is the family dish that is special to us because my mum is from Bahia and making this recipe brings back fond memories of my grandmother.* (D., female, age 25)

In one of the families F. (45-54, father) says that he was educated having direct contact with the land thanks to his father who taught him to plant when he was a child. For his wife J. (35-44, mother), it was very different. She reports having grown up in an apartment and only came into contact with environmental and food sustainability issues as an adult.

S., from a family in the north of the country, also has childhood memories associated with the land: *I've worked a lot in it [family farming], my family was from the North. It even reminded me of my childhood. We planted a lot.* (S., 45-54, mother)

Family customs involve cultural, regional and ancestral traditions and influence the formation of positive or negative eating habits. When there is a personal bond with preparing food, this process is also incorporated into the interviewees' affective memories of food:

- *Back in Ceará we only ate rice, beans and flour. I didn't have many options.* (A., 45-54, stepfather)
- *I really like farofa. My grandmother makes it and it's delicious. It comes from manioc.* (A., 8-13, daughter)
- *I'm from the South and the food there is very heavy. Traditionally German, Italian. Everything with potatoes, rice, beans. And, as an adult, you need to re-educate yourself. Because family traditions are not healthy in Brazil.* (Gringo Cardia, art director and museum expert)
- *I love eating. My family has always enjoyed cooking and we have learned to cultivate ourselves about cooking, eating and learning about food. I recently had an endive salad with green apple that I learned from my father.* (R., male, age 25-34)

The comments of an engagement professional from Salgueiro *favela*, whose father was a baker and whose grandmother was a herbalist who grew up in a *quilombo* (settlements established by people who escaped slavery) helps to illustrate this type of revival. He reports that he grew up in a house full of plants and that his father developed the habit of taking him to the kitchen:

- *My grandmother was this great teacher who initiated me by preparing dishes, and syrups she used to make with medicinal herbs.* (Marcelo Paz, Community-based food activist)
- *I always made tree seedlings as a child just by intuition. I took the seeds home, planted seedlings and then gave them away. For me it was a natural step.* (M. male, 45-54, educator)
- *Handling food is also ancestral, another relationship with nature. Another perspective of consumption.* (L., female, 25-34, educator)

Health and well-being

Food also appears as a strategy for health and longevity for adults and families. In general, this view is given by people who relate more directly to food preparation and demonstrate more awareness in their choices:

- *I've been diagnosed with irritable bowel syndrome and am lactose intolerant. Before meals, I began to eat a plate of arugula with lettuce and sometimes cabbage, I squeezed lime juice on it and a bit of salt and would relish eating these leaves, chewing the fibres and that's how I regained my health.* (K., female 20)
- *I'm responsible for choosing meals. I try to do everything nowadays, I even make bread at home because we know this is an investment in the family's health. We eat fried foods sometimes, but we have this focus on balanced nutrition, with salads and vegetables.* (P., 45-54, mother)

Students demonstrate concern about the origin and quality of food and the consequences for personal health and especially family health: *I think it's an issue not only with food, but with several other products. I try to buy from smaller producers, who don't use as many pesticides. For health reasons, my dad has a heart problem, so we've been trying to eat better.* (C., female, 19, student)

When talking about food, some interviewees also mentioned the medicinal qualities of some foods:

- *The first medicine is food. Many illnesses result from the poorly nutritious food we have.* (Ernesto Neto, visual artist)

- *I hardly ever eat sugar and flour. I usually germinate seeds and make green juice. I understand food as a source of health. When I was 19, I was diagnosed with HIV. In 2007 I had a Near Death Experience. I remember everything that happened "on the other side": in my "dream", while in a coma, I was immersed in pools of green juice and ozone capsules. So, I started doing loads of research on SDGs, the Earth Charter, Human Rights, Diversity of Knowledge, Common Good, Good Living, etc. (F., female, 45)*
- *We worry a lot about food. We try as much as possible to eat more healthily, knowing the food's origin. Always looking for more organic food. (J., 35-44, mother)*

Among the families interviewed, one that produces food in a rural settlement is more concerned with healthier eating compared to low-income families in cities: *What we produce on the land, we eat. We really like bamboo shoots, food that comes from the earth itself. (C., 55-64, grandmother)*

R. reports experiencing a strengthened connection with food by growing the food himself: *I recently ate wonderful greens planted by me in one of the beds. I made a delicious arugula salad. (R., male, 32)*

In addition to the pursuit of health and healthy habits, the positive connection with food is associated with experiences of well-being and pleasure in the sensory activation of taste, smell and touch:

- *I grew up surrounded by medicinal herbs and spices. Food marked my childhood, through flavours and knowledge, while my grandmother cooked, she told the stories of her ancestors. (Marcelo Paz, Community-based food activist)*
- *I became a vegetarian 20 years ago. I started practicing yoga and met many people with a philosophy of life that advocated animal life as equal to human life. (J., 35-44, mother)*
- *My favourite food is tomatoes. We have a vegetable garden and Mum lets me take care of it with her. We plant mint, basil. At my school there is also a vegetable garden. (I., 8-13, daughter)*

In addition to demonstrating that they're more attentive to personal health, some of the interviewees also showed greater awareness of what food production does to the environment and greater concern about the origin of food: *We're concerned about the origin of the food we eat, even though we don't have control over production. We buy products with less packaging, from brands that respect environmental legislation. We reduce our waste as individuals, as we're aware of the absurd impacts on the planet. The case of fish is a good example of these impacts and the loss of biodiversity. Soya, meat, sugar, everything. (P., 45-54, mother)*

The understanding of the impacts caused by food production also encourages the growing of some foods or the search for more sustainable consumption, as demonstrated by the engagement professional Alessandra Roque, when talking about her personal experience of planting in the back garden:

- *When we get involved in projects on this subject of food sustainability, it turns out that one thing leads to another. I just wanted to plant and only for myself. Before we knew it, we started to produce more than we could eat and gave the surplus to neighbours. I usually say that I don't like the term "environment". This idea divides between those who like and take care of nature and those who don't need to care and only take care of other things. (Alessandra Roque, Community-based food activist)*
- *With this relationship with nature, I can have better quality because I know where my food comes from, then I compost the leftovers. Have a circular and holistic view of the food. (L., female, 25-34, educator)*

The impacts of food systems are raised by other interviewees, including R., from a producer family directly affected by climate change:

- *Due to the growth of agribusiness, the growing attack on fauna and flora is visible to all of us, we feel the weather conditions on our skin (literally), for example, different seasons of the year...Me and my family live in the countryside and sometimes we plant something that needs plenty of rain, so we plant at the*

right time, and often the rain doesn't come...These sudden climate changes are related to the destruction of our forests, the poisoning of our rivers. (R., male, 25-34)

- *It's a very serious problem. It affects the environment, with forest fires, it also affects water courses, animals. What burns becomes pasture. This impacts rivers, with silting. The impact is not only in the regions, it also affects cities.* (R., female, 65+)

4.1.2 Ethical dilemmas and everyday challenges

Other elements that prompt the people interviewed to worry about the subject are ethical dilemmas and daily tensions in their choices and decisions to change or maintain habits. Issues related to the availability of time, the affordability of quality food and also access to information pervade the adults' and families' comments.

Among young people, ethical dilemmas related to consuming animal-based food and animal-tested products emerged as a motivation to change consumer and eating habits:

- *I'm kind of policing myself about where this cosmetic comes from, what it's made of, how it's made, clothes too. But not so much with food, really. I'm starting now.* (N., female, 18, student)
- *I don't want to eat food that came from suffering, from an unhealthy force-feeding process, from growing and enriching meat through development that isn't right. It's an abusive process for animals that are living beings. This is very questionable.* (T., male, 20, student)

Difficulties in changing eating habits

The interviewees' eating habits are affected by often fast-paced lifestyles and by their financial and geographical circumstances. For food-secure families living in urban spaces, time (or lack of it) is raised as an essential element in decisions and habit formation.

Many feel they have no time not only to prepare the food itself, but also to select products, organise shopping, or think of a more varied menu. Many women report feeling overburdened and even those who say they do not like cooking are in charge of keeping up tasks involving food in their families.

- *I really lack the right attitude. I really want to study how to reuse food. I want to compost raw waste, use solar energy, and recycle packaging (I do a bit). But I need to devote time to all this. I work all day and only go into the kitchen at night. And I also look after the house, my ageing mother, my siblings and family who need help due to the lack of work in the pandemic. I say all this because being sustainable requires sophistication, research and time.* (V., female, 45-54)
- *I used to eat out a lot. My daughter always had lunch at school. I don't have anyone to cook for me. Just a cleaner who comes once a week and sometimes helps me organise food in the fridge.* (J., 35-44, mother)
- *I reached an important position at work, but my lifestyle was very busy, with literally no nutrition.* (C., female, 35-44, educator)
- *I speak about food from a privileged position because I have time to prepare and eat it.* (L., female, 25-35, educator)

Homes with different social contexts choose easy and practical food solutions. Frozen foods, processed foods and delivery services (especially during the pandemic) are the most common choices for eating at home when there is little time to organise and prepare meals: *In urban centres, the general population eats very badly. "Fast food" and frozen foods continue to set the tone, not only because of the cost but also because of the lack of time to cook in our lives.* (Vera Saboya, Food and Culture specialist)

The family of V. and F. illustrates this situation well when they report that V. (mother) is the only person in the house who cooks, although she doesn't like cooking. V says she feels overwhelmed, especially during the pandemic, and that to make their routine easier, they end up choosing simpler foods like 'pasta with sausage': *Due to the need to prepare food faster, I end up choosing pasta or frozen foods. I realise that by doing this I made our food quality worse. We eat more bread, potatoes, and pasta. Flour, carbohydrates.* (J., 35-44, mother)

Among people who say that they often eat processed foods, there is awareness of the negative impact on food quality, although the difficulty of changing habits due to a real lack of time is a recurrent theme:

- *I always say that we need to be healthier. With the pandemic, everything became more difficult with the hygiene measures. It's very tiring. We end up choosing the most practical option.* (F., male, 45-54, father)
- *I love fried food, biscuits, and Danone products. I think I'm like a child.* (A., 35-44, aunt)
- *I think and feel guilty about what I eat.* (P., 40, mother)

Even among interviewees who have less healthy eating habits, there is concern and understanding that food is an important factor in health. Many show concerns about the rates of obesity, weight gain and malnutrition in the country, due to eating foods with poor nutritional value, especially among the most vulnerable classes: *We are what we eat. I know sugar and sodium are bad for us and we avoid them as far as possible. My daughter loves savoury snacks and noodles. We don't deprive her of them but try to make her aware, saying that they're not good to eat in the long term.* (F., 35-44, mother)

When talking about the context of the pandemic, eating too much delivery food was also brought up as a concern: *The pandemic caused a big change for us. I ended up ordering a lot of food for delivery, using apps like Ifood.* (J., 35-44, mother)

On a smaller scale, eating meat (in a group more involved in the subject of food and sustainability), sugar and fatty foods are also seen as bad for the health: *I've never liked sweet food or soft drinks since I was a child. I've always liked a more natural diet. I come from an obese family. Obese people who've had bariatric surgery. My mother died aged 41 and then I lost another sister who was 43, with the same problems as my mother. Many have chronic heart problems, diabetes. And what's incredible is that because of my diet, I'm the healthiest person in my family.* (A., female, 45-54)

Difficulties in accessing healthy food – food prices

In addition to time, the cost and accessibility of food are decisive factors in the interviewees' eating habits. Foods that cause obesity and hidden hunger continue to be the most available and affordable foods for low-income populations:

- *I find access to sustainable food almost impossible in Brazil. Eating is very expensive, so eating well is a luxury. We give up doing other things to eat well. In Brazil, it's very incongruous to talk about eating organic food while people go hungry. It's still a matter for a very privileged group.* (J., 35-44, mother)
- *Most people still don't realise how much it affects them. There's a demand for cheap food and organic prices keep rising. I'm aware that this type of food is less and less available to most people.* (G, male, 48)

A., the stepfather of one of the interviewed families which lives in a favela, reports that since the pandemic began they've started buying fruit and vegetables only on the local market day, and that they often take the market's leftovers as it is much cheaper than buying from the grocery store. Access to organic produce does not come up as a concern. What is more urgent is being able to buy fresh food that can guarantee better health.

Mariana Aleixo, involved in a culinary enterprise project in the favela in Rio de Janeiro where she grew up, illustrates the reality for thousands of Brazilians when she says: *Different income levels lead to different dietary patterns. Many give up fresh foods for ultra-processed foods because they are cheaper and more accessible. Hunger*

is increasing in Brazil. We need to think about the conditions these families will have to be able to live and exist in a country that has very expensive healthy foods. And think about the obesity map too – a diet based on ultra-processed foods for fast-paced lives, and meals made outside the home. (Mariana Aleixo, Community-based food activist)

As a result of food insecurity, choices are significantly reduced, and the guarantee of food often comes from donations and looking for leftovers from other families:

- *I manage the best I can. Families help each other here. Sometimes the residents' association gets me a food parcel, sometimes I go to church to get leftovers. But I can't always get them.* (L., 18-25, mother)
- *I think people are going through the same difficulty as us. We still have rice and beans to eat. There are many neighbours that don't even have that. If I could help, I would. But if I give ours away, the children will go without.* (Y., 42, mother)
- *In Duque de Caxias we have areas of poverty. A resident has a great project to collect and donate food parcels with basic items, but she went on TV to say she wasn't able to cope anymore because so many people knocked on her door asking for help.* (M., male, 35-44, educator)

In the most socially vulnerable families, it seems more industrialised and ultra-processed foods are eaten than in families with better economic conditions. This point seems to get worse in urban centres.

- *I like eggs, meat and noodles.* (L., 8-13, daughter)
- *I like 'Danone' products and noodles. Danone contains milk, I don't know about the noodles.* (Y., 0-4, daughter)

In addition to ultra-processed foods, many families are very concerned about eating foods with pesticides. GM foods are also mentioned:

- *I'm worried about pesticides. I try to buy organic produce when possible.* (F., male, 45-54,, father)
- *I'm opposed to GMOs. There are studies that say it's possible they cause cancer and other diseases. We have natural, traditional food available that is much more nutritious. And there's a reason food is the way it is. I prefer not to eat what is genetically modified, and I don't let my daughter eat it.* (J., 35-44, mother)
- *GM food is not natural so we don't know the impact this food will have in the future.* (M., female, 35-44)

Students emphasise the financial restrictions to eating better quality food. In particular, those who study and work full time report that they eat many meals away from home and find it difficult to follow a healthy diet.

Lack of access and information: I don't know the origin, problems and alternatives

Healthy eating, including knowledge about it, is hindered by the country's economic inequalities. There is a lack of access to healthy food in the most vulnerable classes, especially in urban centres: they report the lack of natural food available in shops in favelas, for example:

- *I speak as a resident of Providência favela. Here, it's very difficult for people to have access to this type of sustainable food. Many friends in the cultural sector tell me I'm the only poor person who eats this way. Because there's still an idea that healthy food is only for the rich and not for everyone. And that's a huge problem in cities.* (Alessandra Roque, Community-based food activist)
- *We know that being able to eat quality food is a privilege, right? Being able to choose what to eat is a privilege. People in more vulnerable situations can't choose what to eat and end up eating more processed foods because of the cost.* (P., female, 35-44)
- *Unfair food distribution, in which much is produced and exported, but not eaten by the poor part of the population. Organic foods are often very expensive or have limited access.* (R., male, 25-34)

Engagement professionals and educators speak about “food deserts” to describe the lack of healthy and quality food available in these places at affordable prices:

- *You must know the concept of food deserts. These are areas where the population can't easily buy fresh food such as fruit and vegetables because of accessibility, but also because of prices, consumer power.* (Italo Guedes, agronomist, Embrapa)
- *I feel that for marginalised classes, food is also based on oppressive relationships. What makes it there is part of a political project to give these people the remains of the remains. Supermarkets close to favelas and marginalised neighbourhoods are poorly stocked with cheap food varieties and brands, and processed foods. It's a scarcity mentality project.* (L. female, 25-34, educator)

In the case of one family, access to quality food happened when they left the urban centre: *Many people in cities are starving. We came from the city, an urban environment, with no idea what it would be like to have contact with the land. And we notice the difference in the quality of food after coming here! Today on the plot where I live there are a lot of ants, capybaras, I use grated manioc to disturb the ants. There's a lot of inequality, right? It's an old debate.* (C., 55-64, grandmother)

4.1.3 Subjects which mobilise adults and families

The subjects of hunger, inequality and food waste are the ones which most mobilise people. They feel uncomfortable, saddened and indignant about the reality of concurrent hunger and waste. Among those interviewed, there is broad interest in issues related to reducing inequality: *Despite being a guaranteed right, many still don't have access to food, others don't have access to quality food, free from toxins. In other words, we have some people with difficulty accessing any food whatsoever, and others with difficulty in eating quality food. Two sad realities!* (T., male, 25-30)

Families in different social conditions report experiencing hunger, or permanently living with the reality of the country's inequality on the streets and in cities:

- *There are a lot of people who could help us here and who throw food away. Sometimes I walk along the street and see rice and beans in the rubbish. It makes my heart ache, I think it's cruel. They could give it to us. We often have nothing to eat.* (L., 16-24, mother)
- *The homeless population has grown massively over the last two or three years. In my neighbourhood, the number of people living on the streets is striking. If someone has nowhere to live, they're even less likely to have anything to eat. And people have no money to buy gas, the price of a canister is absurd. Basic conditions to cook food don't exist.* (G., female, 45-54, educator)

4.1.4 Changing habits: the pandemic's consequences

Many reported that their personal and family diet changed with the pandemic – for better or worse. Among those who found themselves having to work from home there were two trends:

With no means of eating in restaurants, or university or company canteens, and with no time to organise and prepare their own (or their family's) food, many reported choosing practical solutions and poorer food quality (high consumption of processed foods, carbohydrates, food deliveries):

- *In the pandemic, we changed our diet a little, eating vegan snacks, processed foods and other rubbish, we noticed our glucose increased as a consequence.* (M., male, 35-44, educator)
- *During the pandemic, my diet got a little worse due to anxiety. Before, I used to buy junk occasionally when I was out, during lunch hours at work. Now I'm bringing sweets home. I notice that people are eating more processed foods, ordering more food as well.* (C., female, 35-44)
- *During the pandemic food became more expensive and we ate more sweet food.* (J., female, 35-44, mother)

Another group reports that by spending more time at home and being able to eat at home (previously impossible due to the work routine) they started planning their eating habits better, shopped more carefully and cooked (more) and saw their diet improve. In some cases, moving away from the city to work online from places closer to nature brought contact with the land and improved food quality.

- *Before we were in formal employment and our diet was worse. We ate a lot of processed food. Now we're at home making our own food, our diet is healthier.* (F., 35-44, mother)
- *We moved to the countryside, where we grow some things and we're rescuing our diet.* (L., male, 45-55)
- *With the pandemic we had more time to think about and prepare the family's food. We eat together and have strengthened our family ties.* (P., 45-55, mother)

Another impact of the pandemic is that many families have been affected by the economic crisis and the increase in food prices. In many cases, there was mention of cheaper choices and reduced consumption of some more expensive items, especially red meat. One vulnerable family reported having sought help from institutions that distribute donated food.

- *Things are very expensive in the pandemic. With one hundred reais, you can only fill a small bag that doesn't last a week.* (A., 35-44, aunt)
- *People are going hungry. I see this in the municipality where I work, where there are people suffering from hunger. In Duque de Caxias we have areas of poverty, like in Saracuruna. There's a resident there who has a great project collecting and donating food parcels, but she went on TV the other day to say that she couldn't cope anymore because many people knocked on her door asking for help.* (M., male, 35-44, educator)
- *We made an escondidinho [Brazilian shepherd's pie] with mincemeat but only a little because it's expensive.* (M.L., female, 16-24, student)

Some interviewees reported that psychological factors associated with the pandemic negatively impacted the quality of food: *During the pandemic, my diet got a bit worse due to anxiety. With the speed of everyday life, it's difficult to take a lot of care with food. But I try to be attentive, especially because I'm a mother.* (C., female, 35-45, educator)

In this reality, the burden of household chores on women got worse, especially for mothers concerned with ensuring their children have quality food: *Women are oppressed by this business of producing food. This even happens in the movements.* (C., 55-64, grandmother)

However, community and social help from people and non-governmental institutions to combat the increasing problem of hunger to which many people were exposed during the pandemic was highlighted: *During the pandemic, the greatest solidarity in combating hunger came from the community itself getting organised.* (David Hertz, Social Gastronomy movement)

4.2 What do people understand about food sustainability?

4.2.1 Equality and sustainability

Among the adults and families interviewed, the understanding of food sustainability is structured by a combination of reducing impacts on the environment and guaranteeing quality food for everyone. They mention global responsibility and the need to rethink food systems in relation to their impacts on the land. They reinforce the need to think not only about sustainability of the environment, but also the dignity and security of human beings.

- *I believe that food sustainability is very important because it's interconnected, and feeds back various, fairer, life practices on the planet. The safest way of thinking in the future is by promoting access to food for more people in a continuous and integrated way. This leads to sovereignty and collective living, moving people towards sustainable action, with dignity, and through humane principles.* (R., male, 28)
- *Food sustainability is a way of guaranteeing that everyone has a satisfactory amount of food, without exception. To achieve this, farming practices are required that consider all of the issues, which produce food for the next generations – food security and feeding the world. Creating global responsibility, so that there is food for everyone, equally, maintaining the environmental capacity of the planet.* (A., male, 25-34)
- *A healthy, dignified, and prosperous future. Where nature and man coexist, so that plants, animals, rivers, and seas, are respected, guaranteeing our access to water, land and healthy food, thereby ensuring the future of the next generations. Love - respect - ancestry - future.* (R., male, 31)

Although the concept of “food sustainability” was hardly known among students, the relationship between access to healthy food and the cost and quality of food was discussed, pointing out that “*healthy produce is more expensive*”. Other students highlighted the lack of information on the issue in mainstream media and were surprised by the data on food insecurity: *We always see things about deforestation and climate change, but the other problems of hunger and GMOs are not really talked about on TV and the internet.* (T., male, 20, student)

The main food sustainability challenges for adults and their families

The main challenges to food sustainability for the adults interviewed, and their families were:

- Hunger and social inequality in access to food, and its distribution
- Food waste
- Food paradox: food production vs. food insecurity
- Food systems in place in Brazil (monoculture and commodities for export, bad use of the land, deforestation, CO2 emissions)
- Distances and the logistics of urban centres
- Misinformation and maintenance of bad habits - the culture of meat consumption.

4.2.2 Hunger and reducing inequalities

The reduction of inequalities and guarantee of food security are essential when we think about sustainability, an understanding that appears to be strengthened by the perception of an increase in the number of people experiencing food insecurity in Brazil.

On being asked about who would be affected by global issues associated with food sustainability, adults and families answered that people are already affected by climate change and food systems around the world, involving

people from the most vulnerable sectors: affected in relation to the price of food, lack of access to food free from pesticides, housing exposed to flooding, the reduction of biodiversity, and difficulties in food production.

Among all interviewees, the perception is that the same people will also be those most affected by lack of access to food, and a lack of information in the future.

- *The fact is hundreds of thousands of people in my city are already affected by this situation. Those most affected, at least immediately, are always the poorest (and do not have access to productive land), both at the local and global level. Populations who live in locations affected by desertification and nearby extremely polluted water are particularly affected.* (J.V., male, 60)
- *The base of the social pyramid are people who will be more affected, not only by the lack of food, as they do not have access to information.* (F., female, 45)

Adults and families more involved in the subject provide a critical perception of the economic and food system, which produces hunger and inequality: *What attracts the most attention is the food paradox. We have enough food to eat, but, even so, millions of Brazilian people go hungry. I believe that the key issue is how to change this.* (D., female, 19)

Educators highlighted that the debate about healthy food is a privilege of those who don't live with food insecurity.

- *The debate about food is still very centred on privileged groups. Those who are hungry can't think about what they eat. Social reflection about this is a privilege.* (L., female, 25-34, educator)
- *In higher social classes, as in the case of my school students, I notice a better-quality diet with a healthy variety of foods. Children who are vulnerable in terms of diet, eat more processed foods, while I notice that my students eat very well.* (C., female, 35-44, educator)

4.2.3 Inappropriate use of soil

Families and adults more involved in the subject are incisive in their critical comments about cultivation methods, and the impacts of agricultural activity and monocultures for export in the country.

For these interviewees, the agricultural system in Brazil is associated with the degradation of natural resources (deforestation, soil depletion, water pollution, and effects on climate change), inequality in the country, and the food insecurity faced by many Brazilians.

Extensive use of pesticides in these systems is also understood as a serious problem, and an obstacle to guaranteeing people's food security. A further concern associated with this situation is the conservation of traditionally-used seeds (*sementes crioulas*). Family farming is seen as an alternative which is able to deal more sustainably both with the problems connected to land use, and economic accessibility to food.

- *I believe that we're already affected and, unfortunately, many people will be affected by intense production and industrial forms of farming, as well as by climate change. We're affected by poor income distribution, unemployment, and hunger caused by the unfair distribution of food, in which many produce and export, but it is not consumed by the impoverished segment of the population. Organic food is often very expensive or has limited accessibility. On the climate issue, there are recurrent, more severe dry periods, as well as general changes in temperatures and rainfall regimes, affecting production. I believe that cities with sanitation problems will be affected by climate change in the coming years, since there are problems with flooding or landslides in areas that are less prepared for heavy rain or overflowing rivers.* (R., male, age 28)
- *For example, the Landless Workers' Movement (MST) is extremely important for the debate on agrarian reform in the country. Unfortunately, following national policy, I see that these movements are*

vulnerable, and open to persecution. And not only this movement, but all small producers. We need to think of family farming as the great solution to these challenges of waste, and the internal market model in Brazil. (J., female, 38, mother)

Excessive consumption of meat

Maintenance of regular meat consumption is also put forward by some of the more engaged adults (many of whom are vegetarians) as an obstacle to sustainability, from the understanding that agricultural production is one of the greatest threats to the environment.

If we continue with this need to eat meat, this will become unfeasible. If we maintain the current production standard, I believe that, in the long-term, it won't be possible to feed everyone using this form of production. (A., male, 25-34)

Food waste

The high amount of waste, and contradictory relation with the number of people living in food insecurity, is seen as a challenge to food sustainability. Some of the interviewees link structural waste to market decisions, and strategic choices in the food system.

- *We see this with the waste in street markets, don't we? That leftover food at the end of the day, which they don't donate. The same for restaurants. The food is often good, and they don't donate it.* (S., female, 45-54, mother)
- *The products are all the same in the supermarkets, of a certain standard. And all of the production outside this standard is disposed of, and not used. Often it is just thrown away.* (R., female, 65)
- *Waste comes from various factors; the producers even throw away part of the food to increase the price of a product. This has a direct impact on consumers' pockets, with high food prices.* (M., female, aged 38)

The young people were very aware of food waste in Brazil, highlighting the losses associated with the inadequate transport system and the long distances between production and consumption centres: *There is a lot of retail loss at markets, there is a lot of waste. It's also the case for road transport, with inappropriate and poor vehicles transporting food, especially organic food that needs refrigeration and greater care.* (T., female, 16-24, student)

Waste was also mentioned by educators and young people regarding consumption by individuals, the way in which food is prepared and eaten, and commercial systems at open markets: *Producing food isn't a problem. We aren't going hungry because we don't produce food but because we waste it. Waste and poor distribution.* (C., female, 35-44, educator)

Decrease in distances, nature, and views of the food cycle

An idea frequently suggested by the interviewees, since associated with food sustainability is the location of production, and its proximity to consumers.

The costs associated with transport logistics, the emission of greenhouse gases, and the rate of food loss on the journey to consumers' tables are suggested as negative factors of the current food production model in the country by those more involved in the subject.

- *Investing in a product that would be more consumed by each region; bringing cities closer to food production.* (B., male, 30-40)
- *We need to rethink more local initiatives, particularly in urban spaces, such as vegetable gardens and agroforests; these are initiatives that bring the urban population closer to food production. The distance between the city and countryside produces crazy logistics, with high carbon gas consumption and energy expenditure.* (C., male, 65+, educator)

Distance, and a lack of knowledge, are understood as an obstacle to maintaining healthy habits. For some families, such as F.'s, the distance between food production and urban spaces is also understood as a determining factor why people who live in cities are removed from their food practices and journeys taken by products. This understanding also involves people's (lack of) connection with nature.

- *Waste occurs because people don't know the work it takes to grow food.* (C., female, 55-64, grandmother)
- *Since we no longer have contact with nature, there is a lack of vision of the full cycle. A dysfunction of not understanding the cycle; wanting everything; wanting papaya the whole year round; living under the illusion that you can have everything the whole time; that is unsustainable.* (A., female, 55-64)
- *I think a return to nature is important, having contact with the land, preserving what we have, and passing this awareness on; having an awareness of what we eat, so that we don't multiply this hegemonic food system.* (F., female, 45)

Foods at risk of extinction

At the meetings with families, the main foods at risk mentioned were:

- Traditionally used seeds (*sementes crioulas*) and grains
- Fish
- Fruit (*pitanga* and original banana seeds)

"*Now this is our present*": in the adult focal groups, they remembered some items of food that are already in the process of extinction in the country: *abiu* (fruit), the fruit salad plant (*monstera deliciosa*), and *cambuci* (fruit native of Brazil).

The reasons put forward as causes for the possible disappearance of food in the future are:

- Monoculture system, pests, and GM foods
- Pesticides
- Disappearance of biomes, and deforestation.

"*But ending, like that? wow!*": Young people confirmed that they had never thought about the possible disappearance of food. As with the adult group, other students discussed some foods already becoming extinct or hardly available, such as the *carambola* and *jenipapo* fruits.

- *I saw in a study that bees are starting to become extinct, affecting food that could soon end.* (N., female, 18, student)
- *Pine nuts are becoming extinct, people are cutting down their trees and I only find them on sale when I go to my grandmother's house in the country.* (L., female, 19, student)

The main causes mentioned were climate change, fires and deforestation. They gave a critical view of capitalism and man's greed which, for them, upholds a system of exploitation and raw material extraction, in addition to economic interests that influence production means and food supply: *What makes it to our table is decided by someone else, not us. When we go to the supermarket, what is available for you to buy was decided by someone else, it's not necessarily what that population wants to eat.* (C., female, 19, student)

4.3 What do audiences think are the effective and relevant solutions?

Actions used and valued by adults and families

They are micro actions, but they are successful. (C., female, 35, educator)

Waste, recycling, and composting

Concern, on an individual level, with the destination of waste is applicable to all the groups interviewed. The habit of separating rubbish for recycling is understood by many as their main contribution to the issues of sustainability and, in many cases, was the only example of sustainable action implemented as an everyday habit.

- *I separate rubbish, thinking about these issues, and avoiding contamination of the sea and soil.* (C., female, 42)
- *I separate my rubbish and my neighbourhood has selective collections, but it saddens me to know that it is carried out on a small scale in my city. I try to recycle as much as possible at home, and I should soon have my own composter.* (R., male, age 28)
- *Recycling is fundamental. Through recycling we can create jobs and decrease the large proportion of dumping in nature; recycling is the real way of disposal for people... selective collection is fundamental.* (R., male, age 32)

Although it is common practice for the interviewees, many were outraged by the fact that there are still a lot of people, and many cities in the country, that do not have conscious attitudes towards recycling and maintaining public spaces - they do not separate rubbish, throw rubbish in public spaces, cities do not separate waste, and the presence of landfills in unoccupied spaces of the city.

- *I do not understand how, in the 21st century, so many people do not separate their rubbish. This has to be a basic thing in people's homes, because working within this logic of rubbish being completely mixed together, and landfills, makes absolutely no sense.* (J., female, aged 38, mother)
- *We know that Brazil is the country which recycles the most aluminium because it offers a quick financial return to those who need it: the waste pickers. It is not recycling through awareness, but survival.* (F., male, aged 38)

Encouraged by a teacher, the young people involved in a socio-environmental project displayed more awareness of the impact of small, individual attitudes related to the decrease in waste: rubbish disposal, taking their own reusable cup to events, and avoiding plastic bags. They mentioned the charge for plastic bags in supermarkets (a recent change in some cities in the country), as a way of changing people's habits: *A teacher always says: if everyone went to a place and took their own cup, that is one cup less, and it helps.* (M., male, 16-24, student)

Among the more engaged adults, consumer habits are influenced by the issue of less waste -avoiding plastic waste, preferring bulk purchases, and reporting the search for biodegradable packaging.

- *I don't prefer biodegradable packaging, since I always buy in bulk, which is fresher. But if I need to buy something, I choose biodegradable packaging.* (C., female, 55-64, educator)
- *People need to be made aware, providing data on the impacts of waste. I know about specific practices by people with composting projects, and others of reducing waste.* (M., female, age 38)

Some people, who are more involved in the topic, reported that they produce compost from organic waste in their homes. Young people from an environmental social project demonstrated that they were greatly involved with this practice in their homes: *At the project, we learned to make a composter, and the banana skins are producing other things of benefit to me.* (F., female 16-24, student)

For many, the factor which determines not having a composter at home is the time and effort required. In the case of this family's account, they also indicate that taking part in separating waste is the result of a community movement encouraged in the neighbourhood: *I still think that these practices, such as composters, are in the universe of the privileged few. We separate rubbish at home because there is an initiative in the neighbourhood.* (F., 45-54, father)

As a solution, some of the interviewees reported that they separate their organic waste, delivering it to a project that collects household materials for composting in Rio de Janeiro. However, this solution requires an income that can pay for a collection service. Not everyone is able to pay the monthly charge.

- *I take part in the Organic Cycle, which is a really cool idea. That is education. I am the only one who does this in my building, and when I explain it to the neighbours, they don't understand. It's a lack of understanding, which is our responsibility.* (C, female, 35-44, educator)
- *I participate in the Organic Cycle here at home. They put in a composting bucket and take it every fortnight. It's really great. They give fertiliser in exchange, and I give it to my friends.* (J., 38, mother)

In the case of extremely vulnerable families living in cities, we noted that this subject and practice are not familiar, nor easily accessed, and this reinforces the need for basic rights to be guaranteed, such as housing and sanitation, so that sustainable practices can be discussed, and engaged in: *The issue of waste is really serious. I even wanted to learn how to make use of peelings, that kind of thing. But I don't know how to do it. I don't do, or know about, composting and that kind of thing.* (S., 42, mother)

Generally speaking, the subject of composting arouses great interest, and people are open to finding out more, and understanding how important it is. Although it is an old technique, it appears to now be gaining more visibility, and be going through a familiarisation process among people with different levels of engagement: *Having a composter at home and taking care of waste disposal. They're micro actions but they work.* (C., female, 35-44, educator)

Supporting family farming

Among the enthusiasts, educators, families, and adults engaged in the topic, many reported that they buy food directly from family farming producers, through food boxes, and cooperatives. Direct involvement with the producers and knowledge of cooperative practices strengthen their confidence in food quality, particularly if they are organic.

- *I buy agro-ecological food products from MST. I trust in the excellence of the food, and the issue of land ownership. Within my limits, I prioritise consumption of agro-ecological and organic products.* (M., male, 45-54, educator)
- *I try to buy food from family cooperatives.* (C., female, 42)
- *Completely adept. Besides guaranteeing development, it puts food on everyone's tables. Fresh food, which is very cheap; there is no waste, and it is returnable.* (F., male, age 38)

Although family farming production in the country is not always free of pesticides, the mention of small family producers is almost always associated with the purchase of organic food: *We need to think about family farming as a great solution for the challenges of waste, and the internal market model in Brazil. Here at home, whenever possible, I buy organic food from small farmers.* (J., 38, mother)

Urban community vegetable gardens

Community gardens in urban spaces are seen as an important action to guarantee food security and to generate income for vulnerable communities in urban centres.

An excellent alternative, as it has already been noted that urban vegetable gardens have fed a lot of people who didn't have anything during the pandemic. Governments, whether federal, state, or even municipal, need to be aware of this, and help to implement structures such as these. (R., male, 32)

Many displayed knowledge or their own experience of successful practices, also during the pandemic. Despite the “restricted” impact, their benefits are considered highly relevant for the communities involved: besides access to nutritional food for many vulnerable people, it provides the educational practice of proximity with food, awareness of the production cycle, and the effects of community involvement on the well-being and self-esteem of those involved in the practice, through maintaining the space: *In my opinion, it's an activity that doesn't have a great impact on the supply problem, but it may produce a change in habits in the community. In other words, more empathy with the cause, and more awareness of the topic.* (A.P., female, 51)

The students from underprivileged communities who take part in a social and ecological project, were extremely mobilised and sensitive to the practical experience, both in sharing solutions and growing techniques, and in the sense of extending the reach to other communities: *Here where I live, there are a lot of people in need, who do not work. And what if these people always had a community vegetable garden, so that they could eat? And what if they worked in this vegetable garden?* (M., male, 16-24, student)

In an interview with a family living in a *favela* in Rio de Janeiro, the mother showed great enthusiasm for the possibility of a vegetable garden in her community, although she was not aware of any projects of this type which had been held in the city, also in the more deprived regions, like some of the projects cited by the engaged people consulted.

Reducing or stopping meat consumption

Enthusiasts, educators, young people, and adults more engaged with food and environmental issues, reported experiences of awareness, and the consequent giving up of a familiar element in their relationship with food. Changes in family food habits are made both due to health issues and engagement with the topic of global environmental and/or food sustainability: *I became more conscious about the quality, much more than the quantity of food, after graduating in agronomy and, mainly, starting work at Embrapa.* (Italo Guedes, agronomist, Embrapa)

Giving up is triggered through education, access to information and art (documentaries, reading, exchanges with engaged people, and music).

- *I researched the subjects, watching films and documentaries. That helped to reconfirm my choice, on account of the awareness of the harm of the meat industry, violence towards animals, and my health.* (J., 38, mother)
- *Perhaps we think about eating the wrong food. There is a major focus on the issue of meat. There is a publication in The Lancet, with a proposal of food that respects planetary health. It talks about the reduced consumption of animal protein.* (R., female, 65)

The most frequent habit broken is (partially or completely) escaping the tradition of the high consumption of red meat in the country, a choice which is usually related to environmental impacts (deforestation is the second most common topic which comes to mind when thinking about food and sustainability), but also health.

- *I stopped eating red meat after watching the documentary Cowspiracy; all of this use of water resources to raise cattle, the wear on soil, and deforestation, but I feel that this change also took place because I wanted to improve what happens inside my body.* (E., male, 57)
- *I don't eat meat due to the issue of environmental impact, such as soil contamination and gas production, but I am also concerned about the high use of hormones and antibiotics.* (F., female, 45)

Among those who cut down, or stopped eating meat, there is the issue of tackling the family understanding which associates the idea of nutrition to eating meat, and thinking that a meal without meat as being insufficient. There is also the negative stigma of status, related to financial conditions in meals in which there is an absence of meat.

- *If I make pasta for F. (daughter) with carrot and broccoli for example, they (the family) think that it isn't food.* (J, female, 35-44, mother)
- *Since Bolsonaro was elected, we cut out red meat and soya here at home because we're against deforestation.* (I., female, 16-24, student)
- *I tried to cut out fish, due to river pollution.* (M., 35-44, mother)

Waste reduction

As a practice on an individual level to combat waste, making total use of food is frequently put forward by people who are more involved with food. Many reported a lack of knowledge but demonstrate an interest in learning about practices to reduce waste, and to find out about projects that improve the scenario of waste and inequality.

- *It would be great to have internet content on making full use of food, and explanations on how to grow your own food. In the settlement, we have taken various courses on making use of food, learning about making sweets, and recipes that we use.* (A., female, 35-44, mother)
- *I don't know anyone who does this kind of work in my neighbourhood, but I support it, and would like to learn more.* (R., male, aged 28)

Enthusiast, David Hertz, the founder and director of Gastromotiva in Brazil, describes that in the Refettorio Gastromotiva (restaurant school) project, the idea is to only work with food donations and unprocessed ingredients. Hertz said that, at the start, the food supplier they operated with burned approximately 120 lorries filled with food per day; food that was left over or came back from supermarkets: *We all pay the cost of food waste; there is a lack of public policies that include food disposal.* (David Hertz)

Public policies and the role of the state

Among families and adults, it is understood that there is a need for public policies in different areas involving food and sustainability. The role of the state in the face of inequalities is raised as a necessary element to face the challenges that arise: *Without a shadow of a doubt those already affected by the lack of food and other resources will be most affected (by climate and environmental changes). Thus, public policies and voluntary actions will be even more important in this coming scenario.* (J., male, 24)

The most relevant: subsidies for small farmers; education; investment in research for sustainable technologies that are not associated with agribusiness; bringing deforestation under control; control of the use of pesticides and GMOs; certification transparency.

- *Policy on certification/seals needs to be revised as it is very difficult today to obtain a seal of approval as a small producer. Just because something has a seal and/or certificate doesn't make it "beautiful" after all, today we have agribusiness sectors that also invest in healthy, pesticide-free products, but with the same production mentality.* (R, male, 32)
- *I believe we have to have public policies that increasingly subsidise family farming. We need leaders who are focused on this idea and with a mindset geared to resolution, cooperation, and not opposition or a death drive.* (F, female, 42)
- *It's very important to have rural credit for small fruit and vegetable producers. The Federal Government has got rid of CONSEA – the Food Safety Council, which thought up public policies and ways of regulating foreign food companies in Brazil and access to quality food in public schools. We have a government that gives precedence to agribusiness, the approval of pesticides, large commodity producers that impact the*

environment and whose means of production are substandard, provoking the expulsion of small farmers from their land. It's important to think about how the rural environment is increasingly consuming ultra-processed foods and migrating to urban areas in search of a better quality of life. (Mariana Aleixo, Community-based food activist)

Educators addressed issues about public policies for schools highlighting the need to increase knowledge about food and sustainability, especially in marginalised regions.

Clearly, environmental policies that guarantee sustainability need to be expanded. Because if there is no sustainability in food production, our future is impossible. Reasonable and socially environmental policies for the regions where production takes place. Policies offering incentives for recycling packaging and plastics, tonnes of which end up in the oceans, are also needed. Policies for reusing food and for separating waste for collection are necessary. (C., male, 65+, educator)

Incentives to buy essential food items for school meals from small producers and the support of local authorities for family farming and feeding children are considered essential to guarantee access to fair and sustainable food of nutritional value for children and young people. Some highlight that the issue isn't a lack of resources but bad public management.

For me, the biggest cause is bad public management of resources. For me this is the worst of all evils. Second is the population's lack of information about their rights. And this political situation where public social policies are being scrapped. This is a political proposal, which is necropolitics, the politics of death, represented by those currently in charge. (M.J., male, 55-64, educator)

Students, on the other hand, discuss the need for legislation to regulate consumer dynamics, using the law requiring supermarkets to charge for the use of disposable bags as an example. They believe that public policies can cause changes in consumer habits and, consequently, in the environment, using financial and not just ideological means.

Actions using technology and new alternatives

Main themes

"In a more natural way" - Solutions understood to be of natural origin are better accepted, and artificial solutions are less well regarded

"But who will have access?" - Access to solutions is an important point for different solutions to be accepted or not. Solutions that are available to all strata of the population are more accepted, especially among those most engaged. Expensive solutions are considered unsustainable in the country.

"With reservations" - Among those most engaged and involved in the subject, the technological solutions presented are received with uncertainty and mistrust about their real environmental, social and human health benefits. This view appears to be associated with the reality of current food systems in the country, seen with a critical eye.

"Technology as an ally" - High tech use in food production was enthusiastically welcomed by most educators, who recognise technology as a possible strategy in favour of guaranteeing food sustainability: *I took my students to visit the state university's biotechnology unit where they're developing a high-tech greenhouse. They even gave me some seedlings for the students to take away. I think it's great to show how we can use technological development*

in a healthy way. (M.J., male, 55-64, educator)

However, some teachers are concerned about the nutritional value of these foods grown in large-scale systems.

No-till and low-carbon farming methods were mentioned by some interviewees as solutions for large-scale agriculture in the country.

Greener aquaculture

This solution is unknown to most adults and students. Among adults who know about aquaculture, most understand that it is a solution with potential and lacking in investment. There is concern whether it is actually sustainable and ecological.

- *It has a lot of potential, both in rivers and in the sea. But care needs to be taken – species that are not from here risk causing environmental problems through bio-invasion and pesticides; growing plants could be more interesting, a lot of algae is produced on the Brazilian coast, mostly in the NE, and I think it would be interesting in sewage treatment - using water nutrients to cultivate plants and fish exists, but on a small scale. There is a lack of investment in these initial research studies, algae to make biodiesel, but agribusiness dominates BER policy, so lack of interest.* (I., female, 45-54)
- *This is so controversial, isn't it? Because it ends up using soya-based animal feed. You think you're eating fish, but you're eating soya.* (R., female, 65)

Some educators see it as a promising path, and highlighted it as a means of increasing productivity, especially to grow vegetables near consumer centres. Despite the high cost and energy consumption, it's possible to guarantee more crops throughout the year: *You can use solar energy, and water consumption is minimal. Water is recycled in the hydroponics process. Removing carbon dioxide from the atmosphere, producing next to consumer centres. Transport can be done by bike! This type of solution, I see as very promising.* (C., male, 65+, educator)

Vertical farms: “I'm an enthusiast” vs. “who will have access?”

Opinions on vertical farms are split between enthusiastically favourable and unfavourable. Among the favourable reactions, they are seen as a good solution for bringing production closer to the city and for occupying unoccupied urban spaces. There is concern that they should be made to be sustainable.

Among the unfavourable reactions, the removal from Brazil's reality is mentioned, due to the high cost and accessibility issues, and its continental size.

- *As I live in an urban centre, I'd like to have a farm inside a building, to feed this urban population that's so far from the countryside. The countryside is no longer consigned to the earth as it was before, today we find technology and machinery in the countryside, just as the city is no longer consigned to concrete. Without the possibility of having a productive farm in a city, I believe in production projects with this type of technology in buildings.* (Alessandra Roque, Community-based food activist)
- *I'm an enthusiast, I think it's a possible solution that should start to be studied. I myself have already had initiatives and conversations with several government bodies here in Rio de Janeiro to implement vertical farms inside abandoned properties in the city, for example. Hydroponics are used and you can produce food, mainly vegetables, close to consumer centres. Instead of having three harvests a year, you can have nine harvests a year. It increases productivity, despite the high use of energy. This is expensive. Removing carbon dioxide from the atmosphere, producing food close to the centre where it's consumed. It can be transported by bike! I see this type of solution as very promising.* (C., male, 65+, educator)
- *They are suitable solutions for Nordic countries, but it doesn't make sense for Brazil.* (F., 45-54, father)

Edible insects

The reaction to the idea of eating insects is almost always disgust and a lack of interest in trying them. Many believe that it wouldn't be well accepted in the country, for cultural reasons:

- *I confess that it would disgust me. Even if it were flour.* (M., 35-44, mother)
- *Several cultural paradigms would have to be overcome.* (J.V. male, 60)

Some report (family and educators) memories of eating insects associated with situations of hunger. There are regions of the country where one type of larva is usually eaten with flour, as F. reports, remembering that he used to eat babassu larvae - called bongo. It's a larva that has a lot of fat and that his mother used to toast with flour to satisfy his hunger as a child. F.'s daughter reports having seen her mother eating them but says she was never brave enough to try it. The family finds the idea strange. Others recall eating atta ant (*tanajura*) flour. Even though it is eaten in some parts of the country, it is seen as an extreme solution.

- *When I was little, I used to go to the vacant land here in the community and collect lots of ants to make flour. It's delicious.* (M., male, 35-44)
- *Edible insects are more difficult. For us it used to be more common to eat atta ants, because I'm from the Northeast. We fried them in butter and ate them. But apart from atta ants, I think it's difficult.* (M.J., male, 55-64, educator)
- *The insect issue shocks me a little, it seems desperate.* (A.C., female, 55-64)

Some people (especially those more informed on the subject) are interested and open: *There are some people in Piracicaba who are studying introducing insects into food. I think it's cool, but I don't know much about it.* (C., female, 35-44, educator)

Lab-grown meat

“Swapping something bad for something even worse”

Lab-grown meat is viewed with surprise - many were not aware of this innovation. It isn't seen as an effective alternative to the country's food sustainability problem due to its high cost. It is opposed in particular by engagers and more highly engaged adults for the following reasons: Artificiality; Ultra-processed; High cost, inaccessible to the wider population (niche market); Energy consumption.

- *I find it very strange, it's like something from a film. But if it doesn't harm anyone.* (J., female, 35-44)
- *I didn't know there was meat produced like this. It's not an animal, is it? I had no idea it existed. I think if people are really keen on eating meat, it's better than killing animals. But if it's expensive and consumes energy, let's change our habits, for God's sake.* (J., 38, mother)
- *I'm against it. I don't think that would be the way to go, because besides the high costs, it's not something natural, organic.* (M., female, 38)

Educators gave conflicting opinions; some saw a possible decrease in the environmental impacts of livestock and others highlighted that this technology uses a lot of electricity in the process and is a market niche that supports an addiction to eating meat and does not contribute to the fight against hunger: *I didn't know the lab-grown meat. It must be good at reducing methane and reducing the erosion of native vegetation. I just don't know how it's done on a large scale, this is the challenge that prevents it from advancing because of the high cost.* (M.J., male, 55-64, educator)

Students were worried about the possible high cost of this type of food, making it accessible only to a minority.

GMOs

The feeling is, by and large, one of insecurity regarding their benefits, both in terms of environmental impacts (the extinction of primitive seeds) and human health (fear, doubts about the nutritional content, studies that point to carcinogenesis). The issue was raised of them having been used and studied for only a short time: *I don't think we've lived long enough to know the price we will pay for GM food. I'm not the type to say whether it's safe or not. Science says it is, but we still haven't lived with it long enough to know. But we already know there are effects on the agri-food system.* (C., female, 35-44, educator)

Among engagement professionals, opposition to GMOs is stronger, and the subject of seed monopoly is also pointed out as a negative factor.

Interviewees draw attention to the lack of transparency in relation to information on GMOs in Brazil – the country has removed the advisory label from packaging:

- *In our country, governors have removed the information from packaging saying whether or not food is genetically modified. There's already research showing people have allergies to these GMOs, in addition to the environmental effects. And here many people, due to this lack of legislation, often don't even know they're eating GM foods.* (M.J., male, 55-64, educator)
- *Genetically modified organisms appear to be a good solution; however, they can compete with native plants and create resistance among pests, in addition to the production and purchase of these seeds being limited to large companies, making production costs much higher.* (D., female, 19)

Some more engaged students criticized GMOs because of the impacts of production on environmental systems and risks to human health: *GMOs cause allergies, are resistant to antibiotics and have a lot of pesticide residues, they're a health risk.* (T., female, 16-24, student)

Certification and eco-labels

Many claim to know little or nothing about them. The organic badge is the one most recalled. Among engagers and engaged adults, there is a concern about access for both producers and consumers: *I worry for small farmers regarding green badges. I, for example, have never bought fertiliser, not even a natural type. And I'll never be able to get these seals, because I plant in the middle of a favela. These certifications are for those who have land, property, almost like agribusinesses.* (Alessandra Roque, Community-based food activist)

For families in general, the high cost of certified products influences consumer decisions. Even among those interested in purchasing certified products, there is the problem of economic access and the worry and distrust concerning fairness in the processes, marked by the industry.

- *I always look for them, but they're very expensive!* (J., female, 35-44, mother; F., male, 45-54, father)
- *The label that I know of and buy is 'Orgânicos Brasil'. I believe they work, but I imagine there must be those that work and those that are fake news as well. I recently watched the documentary *Seaspiracy* that discusses a label that was super fake. So it's good, but you need to keep an eye out to see if it's actually a real certification.* (J., female, 38, mother)

Students showed little knowledge about it and say they don't pay attention to them when buying food.

Educators find badges and certification interesting, but they are also reticent and critical, distrusting their credibility and the lack of transparency and regulation. They question the bureaucracy to obtain certificates, which is a barrier for the small producer, in addition to the cost: *I like green badges, I think they're essential, but I think that there is hardly any idea about what they are, what they represent in the food industry and how much of a*

commitment they represent. Sometimes I feel a little duped as to whether it's really green or not. It's effective, but I don't have much information. (L. female, 25-34, educator)

Agroforestry and regenerative agriculture

The agroforestry cultivation system (AFS) is well received by most interviewees as a solution to protect soil from harm and maintain diversity. However, there are reservations about its reach as a larger-scale solution. There is little or no knowledge of the system by people less involved in the area.

- *I think agroforestry systems are fundamental, especially in the context of cities. This expands the idea of rights to the city, of a relationship and closeness to nature.* (L. female, 25-34, educator).
- *It's extremely important to publicise this management method because in rural areas this consortium model is still a very big taboo, even for small producers in my region. In the farm where I live and work, I have an AFS and for many it's crazy! So, we need to work on this issue, that's why I think it's also necessary to have an education system tailored to local circumstances so that agriculture and forms of management are made part of knowledge in a way that meets local needs.* (R., male, 32)
- *Agroforestry systems are interesting for semi-arid environments or for populations that live naturally in a protected environment but who, at the same time, want to have agricultural production, upholding ancestral practices. Even so, I think the role of systems like this in the food security of a population of 8 billion people will be very small.* (Italo Guedes, agronomist, Embrapa)

In general, regenerative agriculture is a system well received by the participants, who see it as an important alternative to monoculture and pesticide use: *The planet is very generous, you can regenerate devastated land and see it really flourish, we are lucky in life, I believe it's important to invest in soil and forest regeneration techniques.* (V., female, 55-65)

The dissemination and implementation of AFSs is seen as a challenge, given the predominant practice of monoculture in the country:

- *A really important alternative to improve the food production chain and replace current agriculture, the use of pesticides, the depletion of water resources.* (A.P., female, 51)
- *I believe it's a fantastic path. However, there is a big challenge, mainly to implement and maintain this in family, community or small farms.* (G., male, 48)
- *A smart way to keep the soil healthy by rotating crops in the area. These practices need to be disseminated in rural spaces because, being part of this group, I realise there is a very strong belief in monoculture.* (R., male, 32)

Non-conventional edible plants (PANCs) to democratise food

Some people engaged in food activism already automatically know about, practice, and have a growing interest in the use of Non-Conventional Edible Plants (PANCs) as an alternative linked to food sovereignty.

Unknown to the general population, PANCs are plants with great nutritional potential that grow spontaneously, with many of them rarely attacked by pests and requiring little care. They still represent a small field, but are being increasingly disseminated with activities, research and projects growing in the country.

They are a way to democratise food, are self-sustaining, and a way to bring food security to families, a form of food sovereignty. Each region of Brazil has its own PANCs. There is a lack of interest on the part of the government in generating policies to bring this issue to schools and institutions, to create a broader network, even involving cooks, chefs, consumers, to complete these plants' cycle and generate demand for small producers. Many farmers are familiar with these plants. There is a lack of policies to expand this. It is important that this subject reaches

schools which have teaching gardens so that this subject becomes more and more evident. (Marcelo Paz, Community-based food activist)

4.4 How do audiences like to explore and learn about these issues?

And, what is effective to engage the target audiences?

4.4.1 Sources of Learning and Information

In their interviews, adults, families, engagement professionals, teachers and young people shared how they got information and learnt about food sustainability. Among the different sources of information mentioned are pedagogical practices in environmental and food education, social projects and initiatives which the interviewees take part in as collaborators and/or creators, the internet, books and audiovisual tools.

Environmental and food education

In all the groups, the interviewees spoke of the importance of ongoing education in schools (from pre-school education to higher education) with a focus on raising awareness about food and the environment, aiming to reinforce food practices that benefit personal and global health. It is worth pointing out that Law 9.795⁶¹ has been in effect in Brazil since 1999 and sets out the National Policy on Environmental Education. However, many indicated the government's lack of support, lack of funds and the need for incentives for projects in this field.

For engagement professionals and educators, the presence of these subjects in schools plays a social role of informing marginalised communities and raising awareness about practices that guarantee food security for residents:

- *Any action has to be in partnership with schools and parents, drawing children to cooking, teaching them how to value food, seeing it grow and everything else.* (Gringo Cardia, art director and museum expert)
- *We need to think of wide-scale public policies to encourage activities within schools that increase knowledge about food and sustainability, especially in the city's marginalised neighbourhoods. Educational processes offer little information about food, nutrition and crop diversity. These practices end up being limited to only socioeconomically privileged young people and families. Information doesn't reach marginalised neighbourhoods, favelas, where it would greatly transform the relationship with food.* (L., female, 25-34, educator)

Regarding the benefits of including environmental education in schools' pedagogical programmes, educators highlight the potential transversal use of content addressing the subjects of health, food, nature, sustainability, equal rights and science in the school curriculum: *Three years ago, the school chemistry teacher and I did a really great project on food sustainability. We discussed the issue of chemicals in food, the nutrients. Students made everything with recycled material.* (G., female, 45-54, educator)

Direct contact with pedagogical practices in food sustainability and the establishment of a link with parts of the process are understood as fundamental in transforming children's awareness and eating habits.

⁶¹ Law 9.795 (1999): http://www.planalto.gov.br/ccivil_03/leis/l9795.htm

- *In pre-school education, playing in nature, the natural elements, the seasons, all of this is part of the teaching process that establishes another view of food in children, because it doesn't detach life from nature.* (L., female, 25-34, educator)
- *What works is integrating children into the process. Gather everyone to cook together and lend a hand. See what fruits are like, what seeds are like, where the juice they drink comes from. Culinary and permaculture activities to plant and germinate, encourage participation in food production.* (T., female, 35-44, educator)

Two young women who were asked about experiences that motivated their interest in food and sustainability talk about the result of their active participation in school gardens and projects:

- *Planting, seeing it grow and being able to use it later is incredible, like fruits and medicinal plants.* (L., female, 16-24, student)
- *When I went to C.B. school (private school), there was a huge hanging vegetable garden, with automatic irrigation, all made by us.* (T., male, 20, student)

In these projects, the systematic and continued contact with the practice improves connections, the development of taste, and the bond with beneficial habits: *We started doing some things with recycled paper, but it takes time which is bad, then when a vacancy arose on the permaculture course, this whole issue of sustainability, the importance, of knowing the types of soil, fertiliser, we smelled the earth, there was even one that smelled like chocolate.* (T., female, 17, student)

When filled with a sense of participation, with a collective purpose, experiences in schools and social projects seem to strengthen awareness in favour of the community and the bond with people: *What makes a difference: the experience – as students replicate the methodology, preparing hot meals for hungry people and donating them, this interaction makes all the difference in changing perspectives. The connection this experience offers you is transformative. The transformation is cultural, one of values.* (David Hertz, Social Gastronomy movement)

It is also noticed that, by feeling part of a more sustainable system not only personally, but also locally and globally, many demonstrate interest in expanding the effects of their practices, reaching more people, and creating new links, expanding the network and connections in favour of the community:

And in this great chain, everyone benefits. we strengthen biodiversity, we generate local income, we include children and teenagers in it. (Marcelo Paz, community-based food activist)

4.4.2 Sources of Information

The most cited sources of information among participants were those accessed via the internet - such as social media and applications, podcasts, databases and academic research - and audiovisual resources, such as films and documentaries. The interviewees also highlighted the importance of reading inspirational books, newspapers and magazines to establish more sustainable habits.

Internet and social media

Educators and students use social media as a source of information and to bring the classroom closer to the students. For teachers, using the internet has become a space for exchange with young people. Through the pages of digital influencers, NGOs and movements engaged with the subject of sustainable food, young people have been learning and using this virtual space for debates and to share experiences.

On social media, young people said they follow experts and digital influencers, as well as using platforms such as Youtube and Google to access videos and other content. They also mentioned apps such as Instagram, TikTok and WhatsApp, in addition to participating in forums, with lectures and online courses.

I think the internet is a great space to exchange ideas with young people. I feel that when I go to schools to have a conversation or give a talk, they already have several references of influencers and NGOs. They have an immediacy of information and this is their space, we need to explore it. Young people are more focused on action, on transforming scenarios and changing habits. The same happens with food. They then take what we discuss in the classroom to social media, it's amazing. The debate continues on the internet. (L., female, 25-34, educator)

Considering the strong interest among different groups of society in social media and influencers' content, the link with personalities with large audiences (influencers, artists) can help people engage and connect with the subject:

- *The work between science and digital influencers has to be well done to raise awareness and change eating habits.* (R., female, 65+)
- *I think about the use of audiovisual material, animation, shorter forms of communication, in partnership with public figures to generate greater empathy and engagement among the public.* (Gringo Cardia, art director and museum expert)

Among adults, using the internet has a complementary role in the search for information, where family, education and the internet are interconnected as sources for learning and expanding knowledge.

- *School, of course, in the beginning, but my family has always been very involved in environmental issues, sustainability and food justice. Recently the internet has been where I watch and comment on news.* (R., male, 25-34)
- *I think I had a school and family background that drew my attention to the subject. I currently use the internet to increase my knowledge. Naturally, consolidation only happens through conversations with people who know and dominate each subject.* (J., male, 55-64)

Audiovisual content

After the internet, audiovisual experiences are those most thought of as a means of becoming informed. In their comments, adults and engagers spontaneously mention the importance of watching documentaries that address the topic, such as: *Seaspiracy*, *Cowspiracy* and *Ilha das Flores*⁶².

- *I researched the subject, watching films and documentaries. This helped to reaffirm my choice because of my awareness of the harm done by the meat industry, the violence against animals and health itself.* (J., 35- 44, mother)
- *I only got to know about high-tech greenhouses through documentaries. I've never got to go and see what these types of greenhouses are like.* (M., female, 35-44)

In experiences at school, educators report using audiovisual resources in the classroom, through debates on the content of films and documentaries, as well as through school trips.

- *What works most in education for young people are films, audiovisual productions are more effective in informing and involving students of this age group.* (E., female, 35-44, educator)
- *There is a Brazilian documentary called 'A carne é fraca'⁶³, which I have been using as a history teacher to give an overview of deforestation. I only use the first part, because the second part of the movie is more*

⁶² *Ilha das Flores*, by Jorge Furtado (1989). <https://www.imdb.com/title/tt0097564/>

⁶³ *A Carne é Fraca*, by Denise Gonçalves (2004). <https://www.imdb.com/title/tt2388080/>

disturbing. These are strategies to discuss this data in the classroom, to debate this environmental issue.
(M., male, 45-54, educator)

Reading

Educators and adults also mentioned the use of newspapers and magazines that address the subject of sustainable food, in addition to academic databases and podcasts as sources of information used:

- *I follow a great deal of academic work, databases and I use a lot of interesting information. Even internet search engines, publications and podcast channels, Instagram profiles focused on this area.* (R., female, 65+)
- *I look for information in newspapers, magazines, television programmes.* (C., male, 55-64, educator)
- *Today I use a lot of newspapers aimed at children, such as CHC (Science for Children), as well as scientific articles and federal government websites with data and projects.* (C., female, 35-45, educator)

Books were also cited as sources of inspiration for positive changes in eating habits among respondents. Adults, engagers and educators report transformative experiences through reading that have contributed to greater awareness of more sustainable food and lifestyles:

- *My source of information comes a lot from scientific and academic literature linked to permaculture and agroecology, such as Ana Primavesi, Altieri, Artur Nani; and from the exchange of experiences between agro-ecological collectives.* (J., female, 25-34, educator)
- *Nowadays, as everything is in a virtual environment, I search the internet a lot. But I've always liked using books as a source.* (C., female, 35-44, educator)
- *I contacted an NGO that shared content and lectures on the topic. The journalism course at college brought a more systemic look at food. I use materials from authors such as Célio Turino and Vandana Shiva.* (F., female, 45-54)

Access to information

Among the groups, many interviewees commented on the challenges of accessibility and dissemination of information. The lack of easily accessible information is one of the challenges faced to bring collective awareness and transformation to eating habits in the country.

- *Brazil suffers from the evil of social media, which is a hub for this information. It exists, but it isn't accessible to everyone. You have to dig deep. Practical knowledge is lacking. People have made entrepreneurial niches in the field of PANCS (Non-conventional edible plants). For information, you must pay for courses. I bought some books, paid for courses. But there should be a platform, like media channels, with this material available for free. Online courses, such as Embrapa and CNA, are not very well publicised and restricted to the agribusiness niche. A repository is needed, a website that's available, financed by the number of visitors. Allowing people from different realities to access this knowledge.* (M., male, 45-54, educator)
- *People should be given classes about waste. I want more information and I don't know where to find it.* (A., female, 35-44, aunt)
- *I find it difficult to access data on the effects of pesticides on water.* (B., male, 35-44)

Awareness campaigns

Access to information through public campaigns is mentioned by many as a way to reach and sensitise more people to the issues. This form of collective communication is especially thought of in relation to the topic of food waste,

where respondents report the importance of broadening the public debate to bring greater social awareness about the conscious and comprehensive consumption of food.

- *Waste reduction only comes with awareness, that is, education. I would very much like there to be a campaign for this topic.* (Alessandra Roque, community-based food activist)
- *In addition to more collective communication and marketing awareness strategies, through collective campaigns that focus on food and the environment.* (M. male, 45-54, educator)
- *Campaigns; educational activities on subjects that no one wants to talk about: agrarian reform; regulation of water use; prohibition of pesticides.* (A., female, 45-55)

Experiences in museums

Among positive recollections of exhibitions and experiences in museums, educators and young people recall interactive experiences, involving people, living spaces or playful experiences: *If it's not interactive and very dynamic, nobody enters and participates. I always took my students to museums. I realise that everything that is interactive works with people's emotions, mobilises them more.* (M.S., male, 55-64, educator)

Regarding visits to the Museum of Tomorrow, young people have a taste for interactive experiences in relation to space and knowledge:

- *The coolest thing about the Museum of Tomorrow is that in addition to learning new things, you also interact. With the equipment, the employees there, between you and the environment.* (L., male, 20, student)
- *The one where we lay down on the floor is the coolest; it feels like you're in the galaxy.* (C., male, 23, student)

Concerning the exhibition *Pratodomundo – Food for 10 Billion* (Museum of Tomorrow, 2019), many remembered the vegetable garden created and which still exists today. According to the exhibition's artistic editor, Eduardo Carvalho, the room that the public most liked was Health and Society which dealt with the topics of: Consumption; Combating waste - recipe book against waste; Use of insects; Hunger vs. excess production and absence of food. After the exhibition, 80% of those who participated said they wanted to change their eating habits, especially regarding meat consumption.

General considerations about information sources

The following strategies emerged as interventions and ways to sensitise people, positively influencing their eating habits:

- Environmental and food education in schools and social projects
- Social activism to awaken a sense of the collective and connection with the community
- Educational and awareness-raising campaigns
- The main means mentioned by the interviewees as ways of learning and becoming informed are the internet, videos, films and documentaries.

4.4.3 Museum of food: What would be effective to involve target audiences?

When asked to imagine a museum exploring the themes of food and sustainability, the interviewees made many contributions both in terms of content and form. The words and ideas that most emerged in their contributions

were: interactivity and active participation, visuality and impact, sensory experiences, playfulness, diversity, cycles, route, ancestry, and the land.

Impact, urgency and visibility: *“something that really grabs the public's attention”*

Harmful impacts on the environment

As a way to present content and information that they believe are important to inform the public about the subject, many raise the idea of an impactful experience - in the sense of impacting the public and also in terms of the dimension of the impacts themselves (individual and collective, as human beings) with regard to food production and global environmental issues.

Regarding information considered urgent and necessary to show and talk about in the present, impacts on environmental and collective health are mentioned, as well as impacts on personal health: *“the direct impacts of the way we eat”*; *“the strong impacts of eating animal products and industrialised products in general”*; *“negative impacts of agriculture and livestock”*; *“the local and regional impact of food”*; *“the impact of how food is produced.”*

- *I believe that reality needs to be seen in the most incisive way possible, many people are not aware of the size of the problem and what causes it, in large part, is the upholding of standards that are no longer sustainable. This experience would be very important to construct a viable future, as well as a sustainable one. (J.P., male, 24)*
- *To show how much water is used to produce each foodstuff, the resources in general. (J., 41, mother)*
- *A process that talks about what we excrete, waste, should also be part of this proposal, because it is also part of the food system. (R., female, 65)*
- *It has to shock at times, with urgent data and information to be dealt with. Provoke a reflection about our role in the world. (M.S., 55-64, educator)*

Hunger and economic & social inequality

The real situation of hunger and inequality in access to food also emerges as an urgent issue to be presented in an impactful way to sensitise people, raise awareness, and transform habits, including in relation to food waste: *Mainly this museum should bring up the concept that food and the right to food are universal and that no one should ever be deprived of this right. (R., male, 32)*

Among socially vulnerable families there is a suggestion that the public could experience the reality of hunger in some impactful way.

Show what the poor have and what the rich have. To somehow experience the feeling of hunger. (L., 24, mother)

As a way to present and create impact, audiovisual resources are suggested in different formats (short videos, animation, large screens, cinematography, public figures).

- *Short videos with animations about food sustainability so that information reaches people faster and more easily. (Gringo Cardia, art director and museum expert)*
- *Interview clips with people, short videos with precarious situations in the world. We are very impacted by images. (M.S., male, 55-64, educator)*

To address these topics, other striking experiences using visual and sensory resources appear, on a smaller scale, as suggestions: the use of virtual reality, dimensioning and scaling experiments (the relationship between human beings and nature).

- *Take advantage of virtual reality to provide this type of contact. Design the experience of entering a forest, an agro-forest, a GM soya plantation, a corn plantation in the Brazilian outback. A radical experience, which doesn't have to be just cute: try the perspective of fish towards the fishing net. It's an ontological experience, suddenly being a fish, being a plant. It's an aesthetic and sensory experience that can be more revolutionary than photo captions.* (Vera Saboya, food and culture specialist)
- *Have a laboratory that shows the harm that pesticides cause to health and nature. People can see the environmental damage. A place that gives a reality shock.* (F., 40, father)
- *Make a comparison of the human body with the environmental system, thinking micro and macro.* (F., female, 45)

Food routes and cycles

In many comments, the visual reality of the food production chain, the route they take to the table and the movement back to the earth are brought up as a way to bring the public an understanding of the food cycle, both in relation to the environmental impact and the cyclical reality of nature, with its phases and seasons. “*Itinerary*”, “*map*” and “*route*” are words that appear frequently as a way to represent information about the food chain.

- *I think the museum would have to reproduce the food system, a micro-reproduction. From production to the moment the food is digested. Because the food system goes up to the moment the food enters our mouths, from the earth to the fork.* (R., woman, 65)
- *I think that some way to demonstrate the entire food production and transport chain would be very interesting.* (T., male, 32)
- *It could have various food itineraries to arrive in various places.* (A.P., female, 51)

The ideas of routes and cycles also appear as inspirational for the audience's own experience - a movement between the present, past and future, in the relationship of human beings with food and the cyclical experience of the life of food and beings.

- *I would create a journey, like an installation. In one environment we would be gatherers, picking fruit and stuff like that. Then we would be hunters, we could hunt fake animals, things like that. Then we would become farmers and we could plant things in the space, something like that. Then we would arrive in the present with a lot of rubbish and plastic, a dirty space, with people and animals dying. Turtles with stomachs full of plastic. Then we could have two doors. One pitch black, where we would be in the dark meditating for a while. And the other, a door to sustainable food with solutions and proposals for transformation.* (J., 38, mother)
- *(Food) is the greatest wealth we have on the planet. All the food we have today has been cultivated by people, it's 13,000 years of agriculture, of humans cultivating species, selecting them, so when we eat, we are in contact with all this. That's why it's so beautiful for us to continue this diversity and value it.* (Lorena Portela, environmentalist)

The possibility of perceiving and accompanying the dimension of time in cultivating food on the land, in all its stages of development, is also brought up by the interviewees.

- *Show people in the city how a manioc plant, or beans, are produced in family farming. Know your own food.* (A.B., 25-34, mother)
- *It would tell the story of each foodstuff. What it's like, where it comes from. Things like that!* (A., female, 55-64)

In relation to the food cycle on earth, the ideas put forward seek to ensure greater involvement, invite experiences with real contact, stimulating more senses and recalling the history of food on earth.

To show the food cycle: the biological cycle, how seeds germinate, how seeds are stored. The relationship between soil and trees, rain, sun, climate. More symbolic plants, herbs to manipulate, to be discovered. It would have to have a real vegetable garden, a laboratory museum, which would allow young people and children to have this experience of interactive cultivation, where they could plant, see germination. Information on traditional and ancestral cultures, the origin of the main products, traditional foods such as manioc and its presence in the eating habits of native and riverine peoples. (E., female, 35-44, educator)

Sensory experiences: "*lots of smell, lots of touch*"

Ideas about experiences of handling food and the earth, and sensory experiences involving taste and smell emerge more frequently to account for our bond with food and knowledge of its complete cycle.

- *A visit to the farm, with people participating, getting their hands dirty.* (A., female, 55-64)
- *I would put out different foods for people to try.* (M., female, 38)
- *To approach food as the centre of the world. There is nothing that does not need food. The body is the food of fire, coal is the food of fire. A food museum has to be physical in order to raise awareness.* (Bia Lessa, art and theatre director)

Educators and families mention the need for touch to stimulate and interest children and young people.

- *For children everything has to be concrete, you have to touch to understand. Show the deforestation of the Amazon, where they could touch a tree, connect.* (G., female, 55-64, educator)
- *As activities, I would use experiences of producing food outside what industry does. I would have a huge room with lots of soil and seeds, where children could plant and accompany the growth of what was planted.* (L., female, 25-34, educator)
- *An experience of planting. And create a vegetable garden inside the museum. If there was a kitchen, we could harvest it and take it straight to the kitchen for people to cook.* (C., 55-64, mother)

Cultural diversity and roots

When imagining an environment where food becomes the protagonist, the idea often arises of providing a greater revival and consideration of the diversity of both food and cultures - what is eaten in each region, how food is prepared in a given community:

- *Try to show the variety of things that exist, the variety of vegetables. How many colours and possibilities corn has!* (C., female, 35-44, educator)
- *Food varieties, show non-conventional edible plants (PANCS), regional plants and how food and culture interact.* (M., female, 38)

The sacred dimension of food, including food acts and rituals are also part of this revival, as well as the existence and ancestral knowledge of food and medicinal plants:

- *A revival of local cultures and their ancestral ways of making things. Show varieties of food. Diversity of different cultures and the eating habits of countries. Different food acts and rituals. Bring people in to demonstrate these eating practices.* (F., female, 45)
- *In the last exhibition, we held a ritual meeting where guests brought a dish. One of the guests spoke about the history and use of dendé (palm oil) and highlighted the relationship between food and spirituality. It*

was fantastic. I also remember the story of an indigenous healer who, when asked what God was, replied: "God is the manioc plant". This is beautiful, food is what keeps us alive! (Ernesto Neto, visual artist)

When talking about the food of traditional peoples, relationships with natural elements emerge (fire, sun). The relationships with different cultures and peoples bring an important dimension of empathy and of valuing the identity relationships with food and the "*affective memory of territories*", especially in Brazil, which is an immense and diverse country.

- *For me, it's a museum of the future that will reflect on the past. I would look for references, especially from the African continent, how they took care of the land and what went out to the world of this knowledge and wisdom. This recognition of Africa as the cradle of the world, a fundamental decolonising revival of how we were born in the world and how strong our relationship with the land is. It would include original peoples with the reflection of how they relate to the world. Then they would go to another room with cooks and experts, to learn how to cook, try new foods and seasonings, chop, enjoy all the food, and cook. Then another room just for waste, with a giant composter and at the end return to the first room. It's not a futuristic idea, it's something very basic. But very structural. Respect for ancestral values, respect for land use and how to use it. My idea for an exhibition would be circular, it starts from a base and ends in the same place.* (L., female, 25-34, educator)
- *It's important to have this historical decoding of our detachment from the land, the result of colonisation, and to revive the traditions of original peoples, planting cycles, seasonal cultivation. It has to show other technologies and planting knowledge. I would highlight three processes: planting, harvesting and eating. You have to highlight fire, which is the basis of preparation. The sun is great nourishment for the earth. We feed on it too. It has to show the entire universe of nutrients that come from the soil. Then it moves to cooking, (the meeting of water and fire) of food preparation. In the third stage, it would have to talk about the Earth's biodiversity, this living organism that is also nourished by the sun.* (Ernesto Neto, visual artist)

Revival and knowledge of native, primitive, unmodified seeds.

- *It would be interesting to have a grain bank, with native seeds. I think it'd be very interesting if this was encouraged. The revival of original, highly nutritious food.* (F., 41, father)
- *Highlight the importance of seeds, of the life that springs from food.; the importance of fire that brings people together. The importance of rivers.* (Bia Lessa, art and theatre director)

Table and kitchen: "*an experience of exchange and empathy*"

The interviewees suggest a lot of experiences of preparing and experiencing food in the museum. A kitchen space is often mentioned as critical. Tables and a canteen are also mentioned as spaces for the complete eating experience.

When imagining the presence of meals in the museum space, the social dimension of interactivity emerges, as an experience of sharing, empathy and exchange: *A huge kitchen where people cook and discuss important food issues.* (L., female, 25-64, educator)

The possibility of trying a variety of foods, some of them forgotten or revived, would be one of this kitchen's activities:

- *Bring non-conventional food. Most people have never seen or experienced purple corn, for example. There could be small tastings.* (M., female, 38)
- *A food museum has to have a lot of food to try.* (P., 39, mother)

- *It could have a big kitchen for people to try other foods, get to know other ways to cook food. It would trigger several discussions (food diversity). Trying, testing, knowing the colour. Offer forgotten food, try cockroach flour.* (A.B., 25-34, mother)

The possibility of sitting at the table and sharing a meal with different people; bringing the reality of inequality, the issue of hunger and the guarantee of food for all to the experience, as a stimulus for the creation of more humanitarian and empathetic exchanges, was the contribution made by David Hertz, the chef responsible for implementing the Gastromotiva project in Brazil:

How will food offer you an act of humanity? Here at the Refettorio, for example, there are magical things that happen because of that moment when the food is served, when you serve someone who lives on the streets, but (at that moment) is sitting at a table eating with a plate, a fork, a glass. I think (remember) this human experience. Think about how we can create a human experience of empathy and solidarity using technology. Maybe that's what I want to see in a museum. My dream is that everyone sits at the same table, regardless of social class or race. What would this table be where everyone could sit and have access to food with dignity? If we can put this table there so that when people leave the museum, they understand that food is only good when it can feed everyone on earth, then I think it will be worth it. (David Hertz, Social Gastronomy movement)

In the same way, the idea of the kitchen as a space for exchanges and experiences could help to reflect on waste and encourage food donation:

- *The Food Museum is a great kitchen. A place that cooks a lot, that people can take part in by seeing, eating. And what is produced in this museum is given away every day. At the same time, it's a way to make food in a playful way, providing information on health and sustainability. A place where food is understood, what each type of food contributes to our health. A combination of food and science. Show longevity through food in a playful way. A museum which is a kind of restaurant, where you can try different, tasty things, prepared well and with seasoning.* (Gringo Cardia, art director and museum expert)
- *The key word is interactivity. A space where it's possible to discuss the differences in diets and hunger. I would like a museum that fulfils its social role, perhaps with popular restaurants that encourage sustainable, healthy eating. Connecting people and good projects in this field through interaction, exchange and knowledge sharing. Exhibitions that raise awareness, doing away with the idea that economising is something for the poor.* (G., female, 55-64, educator)

Games: interactive role

As a form of interaction to engage with the public, especially younger people, playful language, while being critical and reflective, is seen as a crucial tool.

- *Games drive youngsters and adolescents crazy. They would work really well in the food museum.* (M.S., male, 55-64, educator)
- *Games help to convey the theme in a playful and critical way with content.* (Eduardo Carvalho, curator and journalist)

Ideas are suggested linked to games in particular and challenges involving the universe of solutions for problems related to the subject. The importance of enabling the public to play an active role in creating solutions to major food sustainability problems, such as hunger, is mentioned.

- *People like quiz games. Create a game that somehow makes people propose things, such as: 'How are you going to feed people without food on the street? What would you do as a menu for them? Why?'. Draw the person into an active role in the debate. I think this would be a fun way to do it. And nowadays everything is gamified. Make people think a little, giving them a critical and creative role in the solution. Make participants the creators, thinking about the subject. I create many museums around the world and*

increasingly I see that it has to be interactive, pleasurable and light, with entertainment and education. If they leave having been entertained and playful, people will reflect on the value of things that are not even listened to. That's what works! (Gringo Cardia, art director and museum expert)

- *Develop a game where participants try to intervene in the problem of hunger while learning about the production of food systems. A collaborative game where participants have contact with practices that can mitigate the hunger issue.* (A., male, 25-34)

Perspectives and Possibilities - present projects and future solutions

The interviewees highlight the importance of knowing solutions and alternatives to the various issues associated with environmental issues.

- *Show everyone how we are and how we will be if we don't change course. And how we will be if we change. Have training on these issues and themes for children, young people and adults.* (C, female, 42)
- *Show people getting low-price or free food and different recipes, because it's not enough to raise awareness, it also has to give examples, alternatives.* (K., female, 20)
- *The museum needs to be interactive and show what can be done with alternatives. With data on the destruction that man has been causing in nature, but with access to possibilities for reversing it.* (F., male, 38)

In addition to presenting innovative solutions and their processes, the engagers also mention the importance of mapping what already exists that people are often unaware of, especially solutions that are geographically close and relevant to their reality:

- *It's important that this museum catalogues local movements: what urban gardens there are, organic markets, producers, cooks who use clean raw materials. a map with the location of these projects, which is always updated so that visitors have easy access. a way of disseminating these initiatives.* (Marcelo da Paz, community-based food activist)
- *It's essential to map the places for eating, places used for planting and production in the region where the museum is located.* (Bia Lessa, art and theatre director)
- *It wouldn't be recommended, for example, to use tractors and technologies that are very far away. New technology is agroforestry - combating water waste and reducing pesticides.* (Eduardo Carvalho, curator and journalist)

In relation to solutions involving technology, the idea of experiments, science and the direct relationship with education was raised:

- *I've never seen an exhibition in Brazil that recognised the importance of agrarian sciences and the scientific advances made in this field. I know that the museum at the Federal University of Viçosa is dedicated to soil, but it's a small place, the target audience is very small. As an example, it could show advances in agroforestry systems. Say how it's done and what the scientific foundation is. Teaching a chemistry class with a hydroponics kit, for example, is a wonderful science experience! You explain to the boy what a chemical element is, what concentration is, what solubility is, the economic importance of chemical elements, the importance of the periodic table. They are science teaching tools that are hardly explored. It would be an interesting way to show the importance of micronutrients, industrial chemistry in human nutrition.* (Italo Guedes, agronomist, Embrapa)
- *Visit these high-tech greenhouses, a part with insects talking about the proteins they contain, an experience that explains how meat can be made from vegetables.* (M., male, 37)

As a way to publicise and connect practices that are beneficial to the environment, some adults suggest they can contribute during their visits by sharing local or personal solutions they already practice: *It would be interesting for each visitor to also contribute before leaving, writing down a solution somewhere that he already uses to help others: 'I do this in my building, I plant it at home'* (A., female, 45-54)

Health, nutrition and education

The aspect of health, and information regarding the positive and negative impacts of eating different foods are brought up as relevant topics to be addressed, as a form of education and awareness for adults and children alike.

Promote bringing science closer to everyday life. Address the processes and consequences of eating industrialised and ultra-processed products.

- *Problems related to diets and making people as aware of them as possible.* (M., female, 38)
- *Show where food comes from, my daughter has no idea about sources of healthy foods.* (F., 35-44, mother)
- *I would think of the museum in three parts: the food production cycle up to it reaching the plate, food tasting options and different textures, PANCs (non-conventional edible plants), and also the nutritional approach. How each food benefits human health in contrast to processed foods.* (M., male, 45-54, educator)
- *Use food from people's daily lives. What is behind some foods, people may be shocked.* (M.S., male, 55-64, educator)
- *Show the idea that the less food is processed, the more nutrients it has. I would go for the issue of biology.* (F., female, 45)

It was also suggested the medicinal aspects of the plants that feed us could be highlighted. Lorena Portela, environmental engineer, highlights the importance of knowing plants' healing properties, from sensory contact, through smells and handling: *Show food as medicine and show the active ingredients of plants that are used in medicines. Nowadays, almost nobody knows that many active ingredients in medicines come from plants.* (Lorena Portela, environmentalist)

Social Activism

The theme of food sustainability was closely associated with addressing social issues such as hunger, the fight for land rights and for nutritious food from a historical perspective and in connection with social struggles for equity and the guarantee of basic rights: *I believe there must be a part to remember the history of the struggles for equality and justice in the countryside, including remembering the struggle of people like Chico Mendes and Sister Dorothy. This experience would be amazing and could reconnect people with the fight for decent food.* (R., male, 28)

Also raised was the reality of women and gender oppression, especially women from marginalised neighbourhoods, and the possibilities for strengthening autonomy.

- *Think about the role of women as upholders of culture. Address different circular, economic models. Women from the lower classes have always occupied the kitchen. Think about gender inequality, because when it becomes a means of financial gain, it is men who occupy most places in the kitchen. Include the issue of marginalised communities, of women from favelas and the search for autonomy.* (Mariana Aleixo, community-based food activist)
- *I think I had to talk about women being oppressed by this business of food production. This even happens in the movements.* (C., female, 55-65)

Exchanges, ethical training and increasing awareness

There is frequent mention of creating links with spaces and practices outside the museum, amplifying the effects through dialogue, sharing and education: *I think of farming as a broad concept: the topic has to be cultivated, to be permanent and present in different environments.* (G., male, 55-64, educator)

"It has to be everywhere" was a message suggesting the importance of occupying public spaces (squares, urban interventions) to attract and engage with more people.

The involvement of schools is considered fundamental, the creation and maintenance of educational and debating experiences and spaces as part of the museum is also mentioned.

Any action taken about food has to be in partnership with schools, parents, and bringing children to cook. Teach them to value food, watch it grow and everything. There must be lots of interactivity and activities that promote debates among young people, such as conversation circles and lectures. Spaces for dialogue, active stances. A contextualised and integrated vision: local, cultural, social, environmental spheres. (Gringo Cardia, art director and museum expert)

The workshop themes suggested include: practices to reduce waste; recipes; planting; composting; sustainable art; natural props; dyes from food.

Accessibility and sustainability

The importance of maintaining coherence with the subject is talked about in relation to a museum space and its use of resources.

- *It's important for the site's architecture to be fully sustainable, coherent.* (Vera Saboya, food and culture specialist)
- *A collective idea that puts into practice projects and solutions like the ones we've seen here. Showing the responsibility of each one. I'm thinking of activities about wind energy, solar energy, and others about water. Models showing how water sources work.* (G., female, 55-64, educator)
- *A museum that provokes this debate and thinks about biodiversity, environmental sustainability, making its members feel part of the entire food chain process. Use of technology that doesn't harm the environment, clean energy for this space to use, e.g. use the presence and the movement of the visitors themselves as a stimulus for generating energy, solar panels, rainwater collection.* (Marcelo da Paz, community-based food activist)

About museums being accessible spaces - Accessibility, not only for people with disabilities, but for all layers of the population is also brought up as a point, among educators, engagement professionals and also by people who report not having access to museums for financial reasons: *For us to go to this museum, it has to be free, right? If not, it's not possible for us.* (A., female, 45-54)

Engagement professionals and adults with greater involvement in the area reinforce the importance of integrating with society and connecting with existing actions, involving local exchanges and collaborations with agents involved in the subject.

- *Museums and cultural spaces shouldn't be isolated bubbles around the city. They must integrate into society, promoting meetings between food sustainability activists, small producers, chefs, community*

leaders and groups that seek to develop actions to combat hunger and food waste. (Marcelo da Paz, community-based food activist)

- *This experience could be a broad project of debates in rural communities, enabling commercialisation, seals, machinery/structures in general. Organisation and qualification of existing markets and the openings of other places, seed banks/massive distribution of these.* (R., male, 32)

Also, the link with educational institutions is mentioned, to exchange knowledge and encourage research:

- *The idea of research internships and incentives for there to be several museums like these, teaching about food, giving advice etc.* (D., female, 25)
- *Such a museum should be accompanied by a consortium of universities that are already studying the issue of food in these four dimensions: production, distribution, consumption and preparation.* (C., male, 65+, educator)

Art and education together

On a smaller scale, artistic expressions are brought up as relevant experiences for engagement.

- *Art and education together, because art by itself, in a country with as many problems as Brazil, needs to be associated with education.* (Gringo Cardia, art director and museum expert)
- *I thought about building objects that only made sense in the wind, such as large installations, or works in which rain was essential for them to exist. A way of remembering that food totally depends on natural phenomena.* (Bia Lessa, art and theatre director)

Young people also mention the importance of having presentations, performances, plays and musicals as a way to involve them and inform them about the topic.

Activities for children

In addition to the presence of environmental and food education in schools, children's involvement and participation in the subject in cultural experiences is understood as essential. Among the many reasons, it is because this is also a relevant and necessary topic for the future.

Playfulness, participation, education, stories and enchantment are ideas that arise when thinking about a museum for children.

- *If we think about an audience of children, it always has to be concrete. They need to feel, try things. How was the fire made? Try to do this, experience the story in some way. Children have very short attention spans, attention needs to be captured.* (C., female, 35-44, educator)
- *Museums mainly serve to educate children. The older generation is already on its way out. The new generation is going to change the world. You have to focus on them, the youngest ones. The food museum has to be a children's museum. I always think about this, every museum has to be accessible to young people. To present the values acquired for humanity so that children can move forward and not backwards.* (Gringo Cardia, art director and museum expert)
- *For children, there are indigenous tales, with enchanted beings and their relationship with water. Tools that facilitate them through playfulness, the understanding of the relationship with the world and the environment.* (L., female, 25-34, educator)

In their contributions to thinking about a food museum, children are very interested in interactive experiences, with games and virtual reality. They are interested in knowing more about the food they eat and its relationship to health: *Show foods that are good and bad.* (A, 8, daughter)

The presence of (tasty) food and plants:

- *With lots of chocolate. It could also have seedlings.* (M., 8, daughter)
- *It could have an entrance hall full of plants for us to get to know the plants, the types. Smelling, knowing where they come from.* (I., 11, daughter)

The relationship with storytelling and interest in ancestry: *My grandmother could tell ancient stories, like the one about Abayomi.* (A., 8, daughter)

The taste for open spaces: *Does everything have to be inside the museum? Could it be an open space?* (I., 11, daughter)

The desire to share ecological experiences and to create opportunities for exchanges and contact with the land and with people: *It would be great for people to know that we don't produce poison here. And create a vegetable garden inside the museum. If there was a kitchen, we would harvest it and take it straight to the kitchen for people to cook.* (A.L., 9, daughter)

5. Conversations in India

5.1 What motivates and interests audiences about food and the planet?

5.1.1 Independent adults

Taste

This seemed the most important factor in the respondents' interest in food: *For me taste is the primary factor in my choice of food. For instance I know that I can get enough protein from a vegetarian diet too but I eat meat because I enjoy the taste.* (AB)

Fresh food

Access to fresh and good quality food products was a priority for nearly all the participants: *I buy vegetables directly from the farm as well as from a vendor sometimes and I can see the difference in quality. The farm vegetables last more than a week in the fridge whereas the others begin to rot within a couple of days.* (PD)

Local produce

For me, taste is an important factor but a lot of my food choices are also governed by whether something comes in plastic packaging or if it has travelled a long distance to come to my plate. (JM)

Cost

Price and budgetary constraints were a common theme when asked about factors that determine dietary choices: *Many vegetables marketed as super-foods are exotic and expensive. I feel we can easily find affordable alternatives that have a similar nutrient profile.* (AV)

Health and nutrition

Our body is our best guide. I like noodles and pasta but immediately regret consuming them because I start to feel bloated. So I prefer food that is fresh and easily digested. (PD)

5.1.2 Teachers

An ideal meal according to me is one which provides the kind of nutrition that holds diseases at bay. It should enable good health and provide energy to work out. Food should have variety, taste good and be affordable. (KM)

Diverse cuisine

This group stated that access to different kinds of cuisines was a major factor in determining food choices they made by providing room to experiment with multiple flavour profiles.

Media

The media and its role in influencing choices that people make is something that the educators identified as playing an important role in popularising any particular food or foods by highlighting its merits and health benefits or by identifying the latest food trends and fads.

Availability of food

While recognising that access and availability is a major factor affecting food choices, the educators surveyed also stated how this is a critical issue for many, especially for children living in marginalised communities: *When we talk of food sustainability, it means access to healthy food for all without causing any harm to the environment. India is basically an agriculture based country with a significant part of the population involved in agriculture or affiliated activities. So, food sustainability in India refers to a chain of food supply that is good and nutritious. But unfortunately, even though food is available for most people, it does not meet their nutritional requirements.* (RB)

Presentation of food

Another factor influencing and motivating educators about food was its visual appeal and presentation.

5.1.3 Secondary students

Availability

Food that is easily available and accessible is one of the primary factors that influences what students choose to eat.

Region

Food that is local to a particular region is often what determines choices that this group makes in terms of what they decide to eat.

Taste

Some students choose taste as the main factor in making decisions about the kind of food they consume: *Food should be healthy but not at the cost of taste or availability.* (A)

Health

Consciousness about nutrition and its corresponding impact on health is one of the factors that this group considers when they think about food. Being healthy and aspiring towards a balanced diet is a motivational factor which determines how they choose to eat: *As children we like junk food, but our parents eat more vegetables and fruits, they are more health conscious. I would like to change my habits and eat like them so that when I grow old, I continue to remain fit.* (S)

Habit or culture

One student stated that habit, or food that he is accustomed to, is what shapes his food choices. Having developed a palate for a particular kind of food, it is now the direction he veers to:

- *If something becomes a habit then it is very difficult to adjust to anything else. I choose food according to the taste I am accustomed to. (H)*
- *I think our culture determines what we eat. For example, in India many people are vegetarians not because they choose to be but because of cultural and religious reasons. (P)*

Climate

Each season brings with it a change of fruit and vegetable, and different dishes are prepared accordingly. Food choices are also shaped by these seasonal changes.

Cost

The cost of food products is one of the key factors which determines access and consumption of particular kinds of food.

No-fuss food

Non-intensive preparations and ready-to-cook foods are popular with this group: *I feel advertising is one of the main things that influence our food choices and create cravings for junk food. (S)*

5.1.4 Families

Culture

Food is closely linked to the cultural and religious lives of Indians.

Health

This was the primary factor that emerged in the conversations about interest in food. Most families wanted to minimise their consumption of processed and junk food, but gave in at times as children preferred it: *We prefer healthy and light food so that our children do not face any problems in digestion. These days, we hardly get food that is unadulterated and of good quality, so I feel that it is safer for them to eat light, easily digestible food. (SN)*

Diverse ecosystem

In India, families feel that they are lucky to be in an ecosystem that allows for great variety in food and dietary habits. The diversity in topography and climate allows for greater availability of different kinds of fruits and vegetables.

Access to fresh produce

Respondents felt they had ample access to fresh food in the market and preferred this over canned and chemically preserved food: *I prefer home cooked food instead of ordering it from outside. I have been cooking a lot in the lockdown. I have also taken up a challenge of exploring India through food so every week I pick up food from a different region and cook it up at home. (AS)*

Taste, nutrition and cost

These seemed to be the prime considerations for family units while making food choices. They felt that if cost was not an important consideration, they would be buying better quality food items or perhaps be able to afford more organic food.

At a general level they felt plant-based food was a healthier choice than animal-based food.

- *I prefer vegetables to meat as it is healthier, can be cooked as per my taste and are easy to digest. (S)*
- *It all depends on what kind of foods we choose to include in our diet plan. If I want to have a lot of fibre, it would come primarily from the fruits and vegetables that we normally eat in salads. Thus, the source is plant-based. Overall we are also noticing the rise in veganism. People seem to be leaning more towards plant-based foods than being dependent on animal sources. Thinking about the source of food is now key. (RD)*

5.2 What do audiences understand about food sustainability?

5.2.1 Independent adults

Population pressure

Respondents highlighted how the per capita availability of agricultural land has reduced drastically over the last 50 years as the population has increased manifold.

- *This has meant more fragmented, smaller land holdings that are not cost-effective to employ new technologies on. It has also affected small farmers as they now grow food for sustenance rather than income. (AV)*
- *Because we have less land and more population, to balance it we want more productivity in a lesser area. So, we use more chemicals and pesticides. This has impacted our life. Today the number of cancer cases we have, was it the same 20-25 years ago? (PP)*

Poverty

The poorer, more vulnerable sections of society who also happen to be involved in the production of food would be most affected by climate change and its consequences. (JM)

Malnutrition

A majority of the population lives on very limited financial means and often is only able to afford staple grains that are easily accessible and available. Access to fruits and vegetables is very limited owing to their higher prices.

Deforestation

A rapidly rising population has meant losing forest cover to agriculture as well as urbanisation over the years and this has had adverse consequences for the environment.

Food diversity

Only certain kinds of staple grains are available for most people leading to a very limited choice in the nutritional value that can be derived from food we eat regularly: *A large number of grains that were previously available have disappeared from the markets because farmers choose to produce cash crops. Unless other grains are incentivised, the situation is unlikely to change. (AB)*

Commercial considerations

Most respondents felt that food diversity and quality were intrinsically linked to monetary gains. Farmers grew what was financially viable and in order to maximise gains, overused pesticides and fertilisers.

Lack of food infrastructure

Other than the lack of storage facilities and a reliable cold supply chain, the uncertainty around agricultural yield and its dependence on the weather have made crop insurance a difficult issue to address: *Transporting food in a vast country like India means that it will have to travel for thousands of kilometres, this mindset of maintaining year-long supply of seasonal foods needs to change.* (PD)

Overfishing

This was a major concern among the non-vegetarians. They enjoyed eating seafood and were worried about it running out considering the high levels of consumption.

Quality

There is general distrust about the quality of food items available in the markets. People feel there is not enough regulation and too much corruption in certification in the food industry.

- *We export most of our best produce. Why is export quality food not available easily? I think consumers should be allowed to choose what they can afford.* (PD)
- *The things that are considered when crops are genetically modified such as pest-resistance, high yield, low consumption of water etc. make the process very selective and result in certain crops and certain strains being preferred over others.* (JM)

5.2.2 Teachers

Locally grown

The teachers stated that food sustainability for them means food which is easily available, suits the climatic conditions of a region and does not require chemicals. Hence, it is also nutritionally rich.

Water efficient

Another key aspect they identified was that it is produced through means which are water effective such as through new irrigation techniques like micro irrigation/ tube irrigation.

Access

Another factor determining food sustainability that this group observed was the last mile connectivity and reach of this food so that everyone is able to access it equally.

Storage

Storage capabilities were also identified as being critical as food that is not safely and hygienically stored will spoil and result in wastage at a large scale.

Migration

Migration was identified by the group surveyed as one of the factors putting families at risk. Compelled to earn a living, families who migrate to urban cities from rural areas are often unable to meet the nutritional needs of their children because of endemic poverty: *I teach in a government school and the students there come from underprivileged homes. A few times students have fainted in the morning assembly because they had not had breakfast. So, for these children or for this society, food means not going hungry, bothering about nutrition is secondary.* (DM)

Consuming chemicals

Another factor identified by the group was that food is laden with heavy chemicals, which is affecting people's immunity—and this is evident in how areas that were once booming with the Green Revolution are now facing health consequences such as a spike in cases of cancer.

As Albert Einstein said, 'If the bee disappeared off the surface of the globe, man would have only four years to live.' Honey Bees are so important in our food chain for pollination and collecting honey. Recently, some honey was collected from the forest that was near a farming area, and it was found that many of the larvae, pupae were dead as they contained DDT and urea. That was because we have used chemicals in these farms. We have to work towards food sustainability aggressively and understand these interconnections. (AS)

5.2.3 Students

Consumption of fresh produce

The intake of fresh produce such as fruits and vegetables is seen as a sustainable practice by the students surveyed—one that is healthy both for humans and for the environment: *I am aware that consuming too much meat is an environmental threat as increasing livestock farming has increased the amount of carbon dioxide and other greenhouse gases that have worsened climate change. (A)*

Population

One of the issues identified by this group was that because of a high population, farmers are compelled to choose quantity over quality in terms of food production. The use of chemical fertilisers enables them to increase productivity and hence profit.

Soil degradation

The group identified soil degradation as one of the issues connected to food sustainability. The use of chemical fertilisers and the continuous use of the land (without any fallow periods for renewal) has led to a depletion of nutrients in the soil, thus affecting sustainability.

Forest depletion

Another issue identified was that of the depletion of forests as land is increasingly being cleared for agricultural purposes. Consequently, this is contributing to the climate crisis and in turn, food sustainability: *I have read that growing more cocoa trees to meet the demand for chocolate has led to deforestation as tropical forests are cleared for this in some countries. (S)*

Eutrophication

As residue of chemicals from agricultural farms enters the sea through surface runoff, they create a thick film over the water, decreasing the oxygen level inside the sea water thereby affecting aquatic life and depleting fish and seafood. This was another factor identified as affecting food sustainability.

Water table reduction

The choice of crops cultivated also affects food sustainability. One of the examples cited by the group was rice. Grown in coastal areas traditionally where there is access to ample water sources, cultivating rice in semi-arid regions depletes the water table, making it unsustainable.

5.2.4 Families

Food security

Given that India is a developing economy, most people expressed concerns about food security more than sustainability. At a general level, people acknowledged that beyond the issues of food waste and sourcing chemical and pesticide-free food, they were not aware of the global effects of unsustainable food practices and their connection with climate change. The survey had spurred them to think about these issues more deeply.

People did not think any edible commodity would run out completely in the near future. The respondents felt certain commodities would become more scarce and consequently, more expensive. They also felt that cultivation methods would change as a result, for example a more widespread adoption of hydroponic and vertical farming techniques.

Climate change

They felt there was an increase in global warming and humans were largely responsible for it. Although, as previously mentioned, food was known to be affected by this warming but did not seem to be a great contributor: *The drastic change in climate within a few years due to global warming and the melting of glaciers is causing a change in the food production cycles thereby impacting food patterns and also the taste of the food items.* (TH)

Pressure on land

They were acutely aware of the pressure of population on the land in the Indian context and how forests were being cut to make way for more agricultural land: *Crop productivity is decreasing day by day. Farm lands have either been acquired by the government or are being developed for residential purposes, resulting in the decrease in available land for cultivation.* (RG)

Pollution

Pollutants and contaminants in air, water and soil were major concerns for family groups looking at the future. They felt food quality had suffered because of an excessive use of chemicals and the associated depletion in soil quality compromised nutrition today.

Industrialisation of agriculture

Families were generally wary of the industrialisation of agriculture that emphasised commerce over health. They believed that more pesticides and fertilisers were being used to increase production and profits which was hazardous for the environment and the health of the consumers.

Quality

Many food products are available round the year that were earlier found only in their season. This means they are stored in an artificial environment or chemically enhanced in other ways and do not retain their nutritional value: *If we over-consume any food, there may come a time when these items will be artificially grown and then the nutrition value of it will get depleted leaving behind only the taste.* (S)

Adulteration

This was an important area of concern for parents. They felt this was widespread in a price-sensitive market like India and needed better checks to reduce the vulnerability of the consumer: *Nowadays there is a lot of adulteration in food. Today, flour is not fibrous, pulses are polished, vegetables are unusually large in size. This is impacting children's diet and in turn their immunity.* (ZW)

The role of Government policy

- Lop-sided agricultural growth: Most respondents were aware of the consequences of the Green Revolution in India. Introduced in the 1960s as part of agricultural policy to counter the problems of widespread hunger and malnutrition, it subsidised and incentivised the cultivation of high-yielding varieties of rice and wheat. This came at the cost of pulses and oil seeds and a loss of diversity in crops.
- Depleted resources: As a result, massive quantities of resources, including precious fresh-water was diverted and overused for these staple grains and lead to a decrease in soil fertility over the years as crops were no longer rotated.

5.3 What do people think are the effective and relevant solutions?

5.3.1 Independent adults

Sustainable livestock farming

Respondents felt that industrialised farming of meat was unsustainable although it was not very prevalent in the Indian context. They felt more comfortable consuming meat that was reared organically and generally limited consumption to 1-2 times a week.

Fisheries

These can substitute the demand for fresh fish from open waters and reduce the burden on natural resources.

Reintroducing food varieties

The government and agricultural research institutes need to collaborate and reintroduce and incentivise grains that fell out of favour as a result of the Green Revolution in India. (SN)

Seed banks

More seed banks should be set up to allow both farmers as well as the general public to have access to a wide range of good quality seed varieties at affordable costs: *If we have the knowledge and resources, we can grow some vegetables in our homes and exchange them with others grown by our neighbours. It will give us more choice at a reasonable cost and we would know that it was all grown naturally.* (PD)

Government policy

They felt that government policy on agriculture and food regulation is outdated and needed revisions to include contemporary trends and ground realities: *Farmers, the people who are working in the field, should be provided with good knowledge about cultivation and farming practices and new technologies that are available so that they do not rely on old technologies and do not produce those foods which are not healthy or which can harm the population.* (HK)

Composting

Nearly everyone found composting a sustainable solution to adopt personally but felt they needed more information on methods. Space constraints in urban housing made it impractical to compost inside the house.

Insects

Most people felt uncomfortable with this suggestion and said it was not feasible in India because of cultural reasons.

Ending food waste

Participants overwhelmingly expressed that this was the easiest change they could make in their lifestyles however they highlighted the problem of getting housemates on board: *In our urban, sedentary lifestyles, we are wasting food not only by throwing it away but also by overconsuming. We only need 2000 calories a day, we are eating more than we require.* (AV)

Lessons from COVID-19

- *The pandemic is a consequence of humans encroaching upon animal habitats and unless things change, this will only get more severe.* (SN)
- *The pandemic has changed our living and thinking patterns. In the early days of the lockdown, many people started sharing photos of food they cooked before they realised it was insensitive as millions were going hungry.* (AB)

5.3.2 Teachers

Self-sustainable growth is important. Children must know that in case of any disaster, if they are on their own, how will they survive? What type of skills do they require? These skills must be developed right from school. (KM)

Building awareness

One of the key responses from educators was that awareness around issues of food waste and sustainability is critical to address this issue. Sensitising children and parents to how everyday decision making influences this, is a starting point and a teacher is in an ideal position to do so.

Composting

As identified by the students, this group also felt that food composting at home was an immediate, actionable solution to food waste. They also felt it could and should be adopted at the school-level both to demonstrate how it is done and also to establish good practice at the community-level.

Media as an influencer

Another solution identified to influence knowledge and awareness on this subject was the use of media channels to spread information. The educators surveyed felt that as we live in an age of information and access to multiple sources of media, messaging that is directed and deployed through these mediums can shape how people understand the urgency of the issue.

Field visits

One way in which to build knowledge and mobilise action that the group identified, is through field visits to places like farms, dairies, nurseries, forests, etc. to make children understand the level and kinds of resources that go into food production. This can in turn make them more conscious of how much they choose to consume and thus minimise wasteful practices.

Pay attention to packaging

One of the ways in which to reduce waste connected to food, according to the group surveyed, is to refuse over packaging of food items. Wherever possible, the aim should be to choose biodegradable material to reduce the subsequent waste generated, especially in an age of easy-to-order home deliveries.

Adoption of unfamiliar local food

A solution proposed that can be implemented at an individual level was to opt for locally available food and grain that is suited to the soil and resources in that region, and which reduces dependency on staple food items.

Conduct audits

To enlist children's participation, one way suggested by the group was to conduct audits of everyday resources like the amount of water consumed. This could again bring their attention to resource usage and consequently make them conscious of how much they are using.

Spreading awareness in rural areas

Another approach that was suggested was to raise awareness about alternative, sustainable practices amongst key groups like farmer communities in rural areas. One solution was to develop communication in vernacular languages to begin this process.

Reimagining and reusing waste

By reducing the usage of plastic and reusing objects like plastic bottles to grow plants and build a garden, it can be possible to minimise the number of these products that end up in a landfill. This was a hands-on approach that educators felt could be a solution at an individual level that would engage children and help generate conversation and consciousness about waste. In addition, centres for collecting e-waste should be set up and popularised.

The role of governments

- The government must collaborate with other stakeholders to reach marginalised communities through awareness programmes.
- Mid-day meal in government schools for children so as to ensure access to nutrition for those whose socio-economic conditions may not allow for it.

Lessons from COVID-19

In India, food is available but food with the right kind of nutrition is not accessible to everyone, and particularly so for children from low income backgrounds. There is something called 'Hidden Hunger' where children are not able to get the right kind of nutrition. Due to COVID and the closure of schools, mid-day meals have stopped. This is a serious concern as it is directly impacting children's health and well being. (RB)

5.3.3 Secondary students

Reducing and reusing

One step that students surveyed said they could take was consuming food in a way that does not exceed one's requirement and also not throwing away any leftover food which could reduce food waste

Buying fresh daily

Rather than purchasing large quantities of food which increases the risk of spoilage and waste while in storage, the group felt that buying smaller quantities of food on a daily basis would ensure lesser wastage and would provide optimum nourishment as produce would be fresh.

Composting

One of the key ways in which students feel they could make a change at the individual and community-level is through composting. By taking responsibility for their wet waste at a household and community-level, it would mean nothing going out to landfills in mixed waste. In addition, it would generate compost which could then be used in gardens and for plants.

Drip irrigation

Another solution was to turn to different methods of irrigation, such as drip irrigation, whereby the pressure on existing sources could be reduced. At the same time, this would ensure that crops receive the quantity of water they need without any water being wasted. They felt this could be especially effective in terrace gardens.

Natural manure

A solution that the group shared was to opt for alternatives to chemical fertilisers, such as *bagasse* or fruit seeds as nutrients for plants. Alternative energy resources like biogas could also be useful as a way to minimise the resources that go into producing food, thereby making it more sustainable: *I have seen my mother composting the waste from fruits and vegetables to make manure for our plants.* (Y)

Preserving food with traditional practices

Home-based, traditional methods of preserving food have long served as ways in which to minimise food waste. The group felt that returning to these practices, such as using lemons to make syrups or through pickling techniques, can be an effective approach to avoid food wastage.

Role of NGOs

The students surveyed identified the role of NGOs (non-governmental organisations) as a significant influencer in working at the community-level to address issues of waste and sustainability. Whether it is those working on issues of health and nutrition, or those focusing on waste, they felt these organisations have a powerful role to play in changing practices at a ground-level.

Indoor Farming

Nowadays climatic conditions are not favourable everywhere so to address this I feel indoor farming is a good alternative as conditions can be controlled to achieve optimum yield. (S)

5.3.4 Families

Composting

This and a kitchen garden (growing one's own food) were the primary options that families were willing to incorporate into their lifestyles. These seemed accessible and practical to address the concerns about food waste ending up at landfill sites and worsening climate change.

Ending food waste

Families in the Indian context felt people did not waste food at home, as food is culturally considered sacred. However, wastage happened at events and large gatherings such as weddings or parties and in the hospitality sector, at buffets, restaurants and hotels. This they felt could be addressed by distributing the excess food immediately while it was still fit for consumption.

Buying organic, local and seasonal

- Sourcing food from farmers directly ensured safe and hygienic food and also eliminated middlemen leading to better financial compensation for farmers.
- Buying from wholesale markets and nearby regions. This way food would have to be transported over shorter distances cutting down its carbon footprint and be fresh for use.
- Since many fruits and vegetables are now available year-round, people have started to consume them more even when they are not suitable for the season and require more resources for growth and distribution.

Eating seasonal foods is good for health because we know they have been grown naturally. Things like wheat flour should not be very refined as it is more fibrous and useful in our digestion. (TH)

Tapping into traditional knowledge and recipes from the past

Parents felt that they had more diverse and better quality food growing up and dietary habits were intrinsically linked to weather, region and season. Reviving this knowledge and going back to them was essential to changing our consumption patterns.

Reinstating food diversity

As a consequence of the Green Revolution and commercial concerns, a lot of grains other than the staples of rice and wheat, such as millets and amaranth that might be nutritionally better were no longer in demand and hence fell out of cultivation.

There needs to be more accessible scientific literature on whether non-soil grown food such as in the case of hydroponics has the same nutritional value and composition as regular soil-grown produce. (SB)

Role of government policy

- Regulation: Families believed that the Government needed to have stricter regulation of the food industry to counter food adulteration and make certification more transparent and trustable for the consumer.
- Incentivisation: encourage buying other crops than the staples of rice and wheat which India now has an excess of, to increase food diversity.
- Better food infrastructure: A better cold supply chain and storage facilities especially for fruits and vegetables since these have a much shorter shelf life compared to grains and a majority of these are rendered unusable before they reach markets.
- Public distribution system: While it was well intentioned and helped counter malnutrition, it is now riddled with corruption and the quality of food is sub-standard. This needs serious reforms and reconsideration to include more vulnerable groups.

Lessons from COVID-19

The Pandemic was considered disruptive in both ways, positively and negatively:

- While families felt that they had been making healthier and more conscious choices about their food and children were more involved in learning about food and how it is grown given all the extra time indoors. A lot of them also got involved in gardening at home and developed it as a family hobby.
- At the same time, many families felt that the loss of jobs, economic instability and rising prices had made access to good quality food more difficult especially for the working class. News stories of migrant labour going hungry and walking thousands of kilometres to their homes during the lockdowns were still fresh in people's minds.

In the pandemic, for more than a year and a half, children have been at home. As a parent, I am concerned that this lack of peer learning in their growing years has compromised the vital exposure that helps them develop an awareness about food and climate issues. (MA)

We have seen how Ayurveda practices have been effective in these covid times like the consumption of ayurvedic concoctions like kadha that is considered to be a natural immunity booster. Also, spices like turmeric that we use daily in our cooking, boost our immunity. So, we should use them often. (GG)

5.4 What engages audiences?

What are the sources for learning? And how do they see the role of museums and informal science education?

5.4.1 Independent adults

Source of Information

The participants generally saw a museum as a resource centre, a place for finding accessible information related to nutritional knowledge, vertical farming, seed varieties, and composting among other things: *I would like to see something on junk food as my children are really fond of it. One of the installations can have a story in which we compare the diets and development of two children, one who eats a nutritious diet and another who loves junk food.* (S)

Repository

Many people associated museums with historical knowledge and wanted to learn the history of food commodities, ways of cooking, utensils and the evolution of agricultural methods.

I would like to see the history of food items in the museum because I am fascinated by where many of our vegetables came from and how they became such an intrinsic part of the Indian diet. (KR)

Multi-sensorial content

People generally felt that audiovisual content such as films and digital experiences in virtual and augmented reality would work well to inform and engage audiences: *Showing people the consequences of current levels of consumption is an effective way to prompt behavioural change. They are affected by their children's future lives and will probably take these issues more seriously.* (SG)

5.4.2 Teachers

Stories

- They suggested displays on themes such as how different climatic conditions and ecosystems influence food growing.
- There were ideas to relate food with festivals as it is an inherent part of celebrations

Objects

- Information and objects about genetically modified food products that are good for health.
- Enquiries such as relationships between food and the body to make the information relatable.
- A colourful display that explores the associations between food, colours and nutrition.
- Highlight food requirements as per occupations and professions.
- Comparing good food habits with bad food habits.
- Themes like bio-fortification should be discussed through display.
- Talking about alternative foods like single celled food/ spirulina.

Things to do

- A mini-food lab where children can learn, and conduct experiments related to food science.
- Hands-on-activities like sowing of seeds and other farming practices.
- Highlight the links between food and the environment.
- Virtual simulations of human organs like the heart or intestine and the harmful effects of consuming pesticide and chemical laden food on them.

People

Children could have access to scientists and researchers and discover the latest developments in science with regard to food production and especially about sustainable practices.

5.4.3 Secondary students

If there is a museum of food, I would like to see a big human statue made up of various types of food like seeds, fruits, vegetables and leaves. (Y)

Stories

Stories are one way in which to learn about issues of food sustainability and they serve as an engaging medium for both children and adults. The students suggested stories such as: Evolution of agriculture over the ages; Understanding food shortages; An imaginative display of the journey of a water droplet as we follow it through the different stages of its life.

Things

Some suggested a display of the kinds of tools and equipment used in agriculture and modern food production, to connect children to where food comes from.

Things to do

Hands-on, experiential and activity-based learning can have a powerful role to play in how these issues are understood and responded to. The students were most interested to talk about ideas under this heading, suggesting: Augmented reality games on saving the environment; Creating and building a garden space; Virtual reality experiences on 'A day in the life of a farmer'.

People

Learning more about the people behind the invention and progress made in agriculture will help develop a deeper understanding of the issues at hand.

5.4.4 Families

Most families believed that a food museum would be the right place to find information about what is environmentally sustainable and good for health. These were some of their ideas:

- Engagement for children through demonstrative mini-farms, or small food processing units, gardening and farming workshops.
- Talks and Lectures centred on food and sustainability for community engagement.
- Cooking demonstrations to get people involved and rediscover old recipes that would make our food more diverse and help counter the boredom of everyday food.
- Stories from the past about food habits, cooking methods and old utensils.
- Dietary habits and cuisines of the different regions of the country/ globally.
- Introduce people to better alternatives and offer substitutes to things that are considered harmful for the environment.
- Augmented Reality or Virtual Reality games and experiences to simulate environments and engage young audiences.
- Videos, short films and documentaries were considered effective media to showcase issues and solutions.
- Engagements in regional languages and a more local approach in audience participation was suggested.

- Information and resources to learn about composting and access to good seeds for home gardening: *I want to see the food cycle right from the seed to the consumption on my plate, maybe a simple diorama showing that.* (AS)
- Information campaigns about the implications of unsustainable food practices and climate change for people – at the museum, by the government, NGOs and large food corporations.
- They felt that if people were more aware of the environmental costs of the food they eat, they might be motivated to change their diet: *Display of food items mentioning their nutritional value and how much the quality has reduced from the past making the future generation aware about what they are eating.* (S)

5.5 Talking to public engagement professionals

5.5.1 Motivations and interests

Professional interests

- *My interest in sustainability and climate change began 30 years ago when, as a hotelier, I was posted to the fragile ecosystem of the Andaman Islands. Dealing with water scarcity and trying to straddle the demands of the tourism and hospitality industries with ecologically friendly practices, I began to look at environmental issues intuitively although I did not have the vocabulary to articulate them back then.* (Mr. Niranjana Khatri)
- *My interest right now is in exploring how can I, with the credibility, voice and reach that I have, bring about some positive change and be more impactful in how people make choices about their food.* (Thomas Zacharias, Celebrity Chef)
- *Food and Environment are inextricably linked because we must understand that the intersection of climate change, food security and nutrition are critical, given the growing evidence on the adverse impacts of climatic change on food security as well as nutritional outcomes. There is enough research to show that every 1 degree rise in the temperature is actually causing a 10% decrease in the yields of our staples, that's something that we should be worried about.* (Shweta Khandelwal)
- *Background can make a difference to motivations: I come from the district of Bundelkhand in India, which is one of the most water-stressed parts of the country. I have seen how farming and agriculture have suffered as an industry because of this scarcity, small, fragmented land holdings and archaic methods and technology compared to the more advanced states such as Punjab.* (Dhruv Prasad Soni, Museum Expert)

Understanding the link between food and environment

Respondents were concerned about creating awareness about how food plays an important role not only in our health but for the environment: *I would say in today's age, it's really important to understand the great link between food and the environment. The damage caused to the environment by unsustainable human practices has begun to reflect in our food. So, it has become a bit complicated to figure out where to buy, what to buy, etc.* (Sujata Parsai, Museum Professional)

5.5.2 What people need to understand about food sustainability

Lack of food diversity

Several said that over time in India, we have lost the variety that existed in our daily food as we use fewer ingredients now.

Loss of culinary heritage

Traditional recipes are dying out because they are labour and time intensive. Processed or ready-to-eat food has replaced most of them: *The current generation is not interested in carrying them forward. That means in 15-20 years all those recipes will be lost forever. We would have a very homogenous way of eating.* (Thomas Zakarias)

Food wastage

This is intrinsically connected to food security and the policies of the government have a lot to do with food wastage on a larger level but even in our own homes, we need to be more conscious about how we consume. Wasting food was culturally taboo but that has changed now, and we tend to waste frequently and easily: *Until a few years ago, we did not have a buffet system at weddings. Food was served by the hosts rather than at self-service buffets. This limited the meal time and the remaining food could easily be distributed, reducing the chances of it getting spoilt or wasted.* (Dhruv Prasad Soni, Museum Expert)

Status of farmers

Farmers are considered labourers rather than professionals engaged in the food industry. Usually middlemen and distributors, people later on in the food chain tend to benefit but people who work the hardest benefit the least.

Lack of awareness about food sources

Most people don't really know how our food is grown and where it comes from.

Shweta Khandelwal explained that Food sustainability in India involves 3 main things:

A: Lack of Awareness - people do not know about food sustainability.

B: Lack of Behaviour - it is very difficult to change the behaviour. Food sustainability is not something which cannot be understood by people at large but the point is nobody has made an effort to do it in a simple way.

C: Lack of Communication / Education – in schools, children are not exposed to food sustainability while they are taught about nutrients mainly.

Soil depletion

The varieties that are growing now are not sustainable as they do not tolerate climate change at all. We have become self-sufficient in the production of staple grains but this has been at the cost of oil seeds and pulses which we largely import now. The absence of crop rotation has limited the soil from replenishing itself and if the soil base is not nutritious, the food grown on it would lack those nutrients too. (Ashok Kumar Singh)

Food adulteration

I don't know how much to trust our food. What does the common man do? Where do we buy everything from? Earlier we used to think food is about nutrition and good health but today that's questionable. (Sujata Parsai)

Greenwashing

A lot of brands who are claiming to be organic or sustainable though use lot of fancy words but no one knows how it is produced as there is no regulation or standardisation

Nutrition

We have two simultaneous problems in India at the moment, one is malnutrition among the poorer populations due to socio-economic factors: food availability and accessibility. On the other hand, there is a problem of over-nutrition among the urban middle and upper classes that is leading to an increase in metabolic diseases and this highlights the disparities in our country. (Aarti Srivastava)

Poverty in rural areas

In the past, people from rural areas would eat what was growing around them. The growing population pressure has worsened this situation for the poor as access to food and nutrition have declined further: *In India, 70% of our population lives in rural areas, so the best model is a 'grow and eat' philosophy to ensure some degree of nutrition as they cannot afford to buy.* (Ashok Kumar Singh)

5.5.3 What are effective and relevant solutions people need to know about

Corporate Social Responsibility

There needs to be a greater sense of responsibility for large food corporations and they should be mandated by the government to divert funds towards creating awareness and outreach. They should also be more accountable for their own unsustainable practices: *The planet-people-profit formula or what is also known as the triple bottom line (3BL) proposed by John Elkington is a useful lens to employ to assess the social, environmental and economic consequences of businesses.* Niranjana Khatri

Using up 'ugly' produce

Vegetables and fruits which cosmetically and aesthetically don't fit the criteria needed to be sold and are generally thrown away or fetch a lower price. Many organizations repurpose these vegetables in smart ways so that they are not wasted.

Change in mindsets

Being experimental with other ingredients: *So, people need useful tools which they can easily adapt to. Generally, people wouldn't go too far out of their comfort zones. We need to engage them smartly where it doesn't require a lot of effort from their side or a major shift in their mindsets.* (Thomas Zacharias)

Creating awareness

- Incorporating sustainability issues in the school curriculum so children learn about them early and grow up to be informed citizens
- Through celebrity endorsements to give it visibility and public awareness campaigns such as the one we have right now for vaccinations.
- Activities to enhance community engagement or local ownership.

Health and nutrition concepts should be introduced from childhood through school curriculums and textbooks. Perhaps a playful intervention through stories and fictional characters can be deployed especially within rural areas. (Aarti Srivastava)

I feel the VOICE framework is a good strategy to approach food sustainability:

V – Vocal for Local campaign that advocates eating indigenous produce;

O – Opportunities to integrate food, agriculture, public health and nutrition in public policy;

I – Innovative models for advocacy – think out of the box/ Involve young adults more;

C – Capacity building / strengthening in the farming sector (skilled manpower);

E – Environment friendly techniques or practices.

(Shweta Khandelwal)

Waste management

In cities like Indore, the cleanest city in India, the garbage collector briefs new residents on how to segregate their waste. It is one of the few cities where landfills are being removed. (Sujata Parsai)

The role of government policy

The government now has to step up with more regulations and policy interventions in the following areas:

- Change in Agricultural Policy – Climate and region appropriate agriculture
- Building better food infrastructure and supply chain – to limit wastage in storage and transportation
- Improvements in the Public Distribution System, to curb corruption, limit wastage, ensure accessibility and balanced nutrition
- Advertisements and food labels by large food companies have to be more strictly regulated to address bad nutrition habits and misleading information.
- Food sustainability and nutrition should be addressed by these companies as part of their CSR.
- More public awareness campaigns to reach vulnerable populations

Aggressive marketing of children's products like cereals that claim to be 'healthy' and 'nutritious' remain unregulated and do not highlight the long-term negative impacts of high levels of sugars in them. (Aarti Srivastava)

Hotels and restaurants

These have to take the lead in discouraging over-ordering and sensitizing customers.

Seed diversity

Seed knowledge and lost recipes need to be revived as per indigenous food habits.

Integrated Farming Systems

These are models where grains, fruit, poultry and fisheries can be grown together within a small holding of 1-1.5 acres. They need to be made popular

Organic

Farmers need to be made aware about the appropriate usage and quantities of pesticides

Nutrition Bank

Below Poverty Line (BPL) Households can be supplied with seeds of food plants that can grow inexpensively in and around their houses. This fulfils multiple goals of addressing hunger, nutrition, income generation and greening.

Women

Women need to be supported as farmers and as consumers, as at the production and consumption ends they are worse off than men.

Lessons from COVID-19

In the time of a pandemic such as Covid, when you talk about immunity, what builds up immunity? So, food is a great concern. (Sujata Parsai)

5.5.4 What engages people?

What works in India

Given the wide socio-economic spectrum, tools and platforms to engage audiences on any theme are likely to vary widely across India. This could range from village fairs and religious gatherings in rural areas to cutting edge digital experiences in the urban context.

The following are some existing and possible pathways:

- Local fairs, flea markets, farmers markets, craft bazaars
- Communicating through Government programmes e.g. anganwadi, a mid-day meal scheme for children
- NGOs working with communities at the grassroots level
- Food and cooking shows at regional and national level e.g. raja rasoai aur anya kahaniyah, Chefontheroad via TV and digital media platforms
- New science museums collaborating with cultural institutions and events e.g. Science Gallery exhibits at the Bangalore International Centre and Bangalore Lit Fest
- Possible science exhibits in collaboration with art biennales, design fests, education fests
- Physical and media campaigns supported by established food retail chains e.g. Spencers, Big Basket and Reliance Fresh.

A museum is a space that activates all our senses, so why do we only talk about visual perception? We have almost forgotten about the senses of smell, taste and touch. Food is also about memories. Those memories become your history, identity and your culture. (Sujata Parsai)

Stories

- Talking about our oral traditions, mythology and texts related to food.
- Addressing myths and fallacies in the food industry
- Illustrate how food shortages and hunger can be addressed in the Indian context
- How does food come from the environment and how is it going back in it? What are the changes at each stage?

Different ways in which we are connected with food. A section on how food is grown, how it is processed, a section around packaging, a section around how food is cooked and prepared, what happens to food after it is thrown away. This is what I would like to see in a food museum. (Thomas Zacharias, Celebrity Chef)

Things to do

- A cooking demo by a chef that shows how food was cooked in the past or it could be a chef using just one ingredient being cooked differently every day
- Virtual reality installation on a day in the life of a farmer
- Hands on activities to understand how much labour goes into growing food

Themes

- Gap between the current production level and the growing demand for the food in the future
- Inequity in production/gender/ distribution/ consumption patterns/ wastage
- Ways to bridge these gaps
- People: farmers, chefs, food processors, food advocates like people who are food activists.

Objects

- Three dimensional things rather than graphics. For instance, a model showing the carbon footprint per country. Make small colorful pillars and put them on a world map, compare their heights - for each country with their carbon footprint. This would be visually appealing and informative at the same time.
- Use technology, digital devices to make it more engrossing
- Panel based exhibitions with information, visuals, audio- visual and interactive content, real life scenarios, videos of interviews with the stakeholders and people affected because of climate change.

5.5.5 What museums and informal science education can achieve

Summer workshops

As part of educational activities at the museum, children are introduced to healthy and environmentally friendly practices. Many museums conduct outreach programmes that are centred on climate and environmental awareness: *School children in the age group of 10-15 years are a very receptive and participative audience. At this age they are open to ideas and can be sensitised to become more aware and informed citizens.* (Vintee Sain)

Walks and excursions

Nature walks and farm incursions are an effective way to keep audiences in touch with their natural surroundings, especially in densely populated urban areas.

Safe space

Museums offer children an opportunity of informal learning at their own pace. Concepts are simplified and there is no pressure on being tested unlike the emphasis on rote-learning in schools: *So far the education system in India does not really support an awareness of environmental issues or even the basics of how food is grown. This gap can be filled by museum programmes where children feel comfortable in asking questions outside the classroom.* (Vintee Sain)

Information source

Museums serve as a reliable source of information on science and environment related issues. The knowledge authority of centres like these is trusted and respected by the general public.

Public art projects

Public art projects at busy city centres such as metro stations, markets and busy intersections attract attention and can reach people who do not frequent museums. Public participation in projects like the Kochi Biennale and Science Gallery Bengaluru's on site exhibitions have demonstrated this successfully: *There may be distrust about public messaging among audiences because of advertising, so practical activities and provocations for people to think about in the museum would be more effective engagement strategies.* (Dr. Jahnavi Phalkey)

Fairs and exhibitions

Travelling exhibitions and knowledge fairs at research institutes offer the chance for the public to find out about the latest technologies and techniques. They also allow rural public who otherwise may not be able to visit museums, to be reached and engaged with.

Access

In the Indian context where most schools are ill-equipped, mini-labs in museums or other interactive installations provide an opportunity that does not exist for children from marginalised backgrounds. Sensorial experiences that can be created in a museum setting would be hard to recreate elsewhere. This visual engagement works well across age groups.

Social media

This can be leveraged by museums in creating digital content that is not limited by geographical location, especially as witnessed during the pandemic when talks and engagements online were widely attended. *Social Media has had great penetration in the last few years in India and is a useful tool for disseminating information in accessible ways.* (Aarti Srivastava)

Competitions

Contests and cook-offs can be organized among the audience to engage communities and to understand what they take away from the exhibitions.

Talks and interactions

Scientists and researchers on the subject can be called for talks in exhibitions as people want to hear voices from the field rather than just looking at exhibits.

Academic engagement

Concurrent with the exhibition, there can be focused group discussions organised with government representatives, private stakeholders, domain experts and farmers. This would be an opportunity for people to witness academic discussions outside of exclusive academic institutions.

Performance venue

Museums can serve as community centres and performance venues where street plays and other performative engagements can take place.

6. Conversations in the UK

6.1 What motivates and interests people about food and the planet?

6.1.1 Independent adults

There was a sense of motivation and interest in food and the state of the planet as well as some desire to make changes to reduce negative impact. Participants appeared most motivated when discussing clear, specific actions they take which they perceived as environmentally beneficial, such as reducing red meat because beef has high emissions, or reducing food waste because it is a precious commodity. However, participants raised a number of tensions in their thinking and barriers to action around these issues, which are outlined below.

Tensions

Can't vs. shouldn't

While many participants reported not being worried about reduced access to different foods, they raised an awareness that they ought not to buy particular foods and that buying certain foods, such as red meat or foods that have a carbon footprint in terms of air miles, was associated with feeling guilty: *I feel a bit guilty because I like to eat a lot of foods that probably aren't the best, like blueberries. They always seem to come over from South America. I bought some from Spain the other day and felt a bit better about it but it's still quite far. Tropical fruits and stuff.* (B, female, 25-34, interview)

Without any policies or government guidance on what people should and shouldn't eat to support the environment, people are left to make a moral judgement on what they should buy without the necessary evidence to make an informed choice.

Organic vs. tech solutions

When discussing different solutions, lab-grown meat and GMO foods and, in some cases, high-tech green houses were often grouped together as solutions that interfered with nature. In this sense solutions such as regenerative farming could be seen as organic and natural, while GMO and lab-grown meat were 'unnatural': *I'm not keen on GMO Foods. That and lab-grown meat. They just seem a bit strange. Anything that feels like there is too much science interfering.* (L, male, 35-44 , interview)

Maintaining vs. disrupting the status quo

Some participants questioned solutions that they perceived as trying to maintain the status quo, for example, people are used to eating meat and growing meat in a lab will allow them to keep doing this. One participant described lab-grown meat as '*Encouraging people to carry on bad habits.*' Many participants felt that people should learn to change their meat-eating habits rather than looking for ways to sustain these: *And the only real fixes are like reduced consumption and that's hard, and nobody wants to do it.* (D, female, 35-44, interview)

Although many participants spoke about reducing red meat intake, they did not talk about adopting a more plant-based diet where plant food such as vegetables and beans could replace some of the less planet friendly foods they eat such as dairy or farmed fish. Adopting a heavily plant-based diet would, for many people, be a far greater change than reducing red meat intake which could simply be the exchange of red meat for white meat or fish without any major overhaul to the way they think about sourcing, cooking and eating food.

Cost vs. caring for the planet

Many participants raised the issue of food prices perceiving that consuming in a more environmentally friendly way meant spending more money with environmentally friendly products costing more than less environmentally friendly alternatives.

- *I suppose, if I think about my own shopping habits, I buy mostly on convenience and then on price and I wouldn't say that environmental factors are...they ought to be, but in reality, they're not driving my choices. It's going to the nearest supermarket and buying what is cheapest and on offer.* (I, male, 55-64, interview)
- *We're going to have to get used to the fact that we can't have strawberries at Christmas or battery chickens that cost £2.* (F, female, 65+, focus group)

Some participants commented on the need for subsidies for poorer households, otherwise a lack of money might prevent poorer families from supporting eco-friendly eating: *What worries me is families on low incomes, while there is a choice of buying stuff that is eco grown, mass produced is a lot cheaper. There might need to be subsidies so poorer families can be part of the improving ecosystem.* (G, male, 65+, interview)

In part, the perception of eco-friendly eating as high cost seems to reflect that people are considering eco-friendly living more broadly than just food (e.g. buying Ecover). Also, framed in the light of maintaining vs. disrupting the status quo, to change shopping habits to be more environmentally friendly but in a way that causes the smallest change to the status quo might involve the purchase of a lot of expensive substitutes, e.g. buying wild salmon instead of farmed salmon would be a cost increase while replacing salmon with beans or tofu would be a cost decrease. The perception of a greener diet as more expensive is inconsistent with the relatively low cost of vegetables, beans and pulses that might form the basis of a plant-based diet.

Reducing climate change vs. swelling population

A number of participants perceived a conflict between the need to tackle climate change and the need to feed a swelling population. When weighing up proposed solutions there was concern and confusion over whether interventions to reduce climate change would also meet the challenge to feed a growing world population. *Regenerative agriculture wouldn't feed so many people. It's not going to generate enough food. Animals bred to grow quickly with fertiliser helping things to grow would feed more people. Regenerative farming is good for a community but wouldn't be enough food under the current system of growing plants for eating and animals for eating. If it was just vegetarian [produce], then it might be enough to feed everyone.* (G, male, 65+, interview)

Too big and complex

When participants spoke about the state of the planet they often suggested they were not fully informed and that they did not have a grasp of the bigger picture. They often used disclaimers such as *'I'm not an expert'* or *'I don't know much about it'* even when providing well-informed answers indicating substantial knowledge. Many participants spoke of finding climate change frightening and overwhelming, and that this sometimes resulted in them disengaging with these issues.

- *A lot of people are tuning into Spring Watch and then they say something like, you know, 90% of this bird variety has disappeared and...I can't get my head around that kind of statistic.* E, female, 45-54, interview
- *And then in my previous life in my previous career doing climate change research, actually some of the well-written scientific literature. It's really stark and really persuasive and I stopped doing that work because thinking about it all the time was horrifying and overwhelming and I didn't know how to make a difference.* D, female, 35-44, interview

The complexity of food systems, from production to trade and retail to consumption, required a lot of knowledge around each element and connecting the lines between them. This leads to cognitive gaps when faced with apparent contradictions in making decisions: *We're in more of a global society and all these interlinked trade routes and I can't get my head round why it's cheaper to buy New Zealand than Welsh lamb. I don't know enough to know why.* (B, male, 25-34, focus group)

With such a huge issue, there was a sense among participants of not always being sure of what the right thing to do was and participants often expressed a desire to be told what changes they should make. For example, one participant spoke of a sporting event where a competitor from a European team spoke to all the other competitors about what they could do in their lives to help the environment.

- *[They said] here's what we can do with our food, what we can do without it, and you can collect these and that sort of thing. Giving us really tiny things that you could do that switch over.* (J, female, 25-34, interview)
- *I would really like some easy, practical steps to follow.* (R, female, 55-64, interview)

When talking about trying to source food in a more planet friendly way, one participant said: *I think that the moment the onus is really on you as the individual...you need to make it easy for people. If it's not easy people just stick to what is available at the supermarket or whatever because people just don't have the time.* (A, female, 35-44, interview)

6.1.2 Teachers

Opportunities, resources and approaches to teaching

Opportunities

The opportunities to teach on topical issues differed by subject and their syllabus. Teachers of Geography and Science cover climate change, and to a lesser degree, food sustainability: *I teach Geography, and agriculture and food security are themes taught in KS3 and KS4. Environmental Issues are also a central theme in both key stages.* (H) One Geography teacher felt that the environmental costs of meat were not covered enough in schools.

There was frustration among some about limitations on bringing food sustainability into the curriculum: *Over the years, food and the environment have played an increasing role in the syllabus...though sadly the 'reforms' of the current government have removed elements of these from some A Level courses. Environmental issues – the effects of climate change, sustainability, pollution, recycling, the nature of our food, animal rights, veganism etc.*

cannot be discussed to the same extent unless they feature under some other heading. I regard this a retrograde step. (D, Languages teacher)

There was a sense that COVID-19 further limited opportunities to teach on the broader environmental issues: *I just think about what's on the science curriculum at the moment and don't branch out. There used to be a lot of cross-curricular things and subjects you connected together but I think especially with the pandemic when...everybody's so focused on just catching up on a little bit and you don't get this cross-curricular work.* (K, science teacher)

Resources

In addition to using current standard textbooks to plan, teachers used a range of resources to teach topical issues. Documentaries on Netflix, BBC and YouTube were key sources of material. They also use news articles with several citing the BBC and Guardian as sources. One teacher highlighted the value of in-depth, well-researched podcasts to prompt deeper thinking. They reported using articles and videos covering climate protests and Greta Thunberg's activism: *We talk about climate change in the news and things like Greta Thunberg's, protests and bits and pieces like that.* (K)

Teachers emphasised the need to share a variety of resources to provide an objective picture of the issues: *You do have to trawl through them, and perhaps select several to share because you need to present a well-researched, balanced viewpoint rather than an extreme viewpoint. You need to give people the tools and resources to say, well, you know, you make your mind up.* (S)

The internet in general was identified by all teachers as an invaluable resource for all topics for information: *The internet has been an invaluable tool for the extraction of absolutely up-to-date information which stimulates interest and makes the issues relevant to learners.* (D)

There was an awareness, however, that for students, the internet was not always a helpful source of information as students did not always know the difference between fact and opinion (see below on challenges to young people's agency).

In addition, the following resources received mention:

- Information from charities such as Farm Africa and Water Aid
- Designated professional within the school who locates topical material for teachers, engaging with relevant organisations
- Educational trips, e.g., to a wind farm.

Approaches

Approaches to teaching these issues fell under the following categories:

Use of audio-visual materials to prompt class discussion

Teachers emphasised the importance of sharing provoking audio-visual material to hook students in and stimulate discussion. Debate helps to maintain student engagement and embed learning: *They really need something visual. A short video which prompts debate and discussion, they really like that.* (O)

Project-based group learning

Another common approach was project-based or problem-based learning. This involves presenting a real-world issue, having students investigate it and then solve a problem related to it. Teachers identified a number of successful examples, such as a project one teacher had run about sustainably-sourced food: *A competition Year 7 recently did on Farmers Markets was really engaging. They were asked to produce a poster to encourage me to visit the local farmers market – I said I would go (and bring back some goodies!) if they were convincing enough...this got students to think more deeply about how to encourage people to think about the benefits of sustainably sourced food.* (A, Geography.)

Another teacher described a project to help students learn about sustainable living including use of renewable energy sources and homegrown food: *One particular activity that worked really well, was the designing of a sustainable house. These incorporated: renewable energy sources, water filtration systems (harnessing rainwater and reusing grey water), air filtration systems, the production of organic and local produce in the garden - that could be traded with neighbours, bike sheds, home offices, well insulated properties, regenerated or sustainably sourced construction materials, etc...There was a lot of teaching prior, initial ideas and sketches, but it was really worthwhile from a learning perspective with some high-level evaluation.* (W)

Creative and interactive approaches

Teachers also described a range of creative approaches that provide alternative ways of engaging students to cater for different needs and learning preferences.

One teacher highlighted the value of role play within a debate to help students explore and empathise with different perspectives: *So, you're a farmer or you are a business owner or you are just a different role in society. So they have to empathise with that person as to why that person might have a particular opinion on the environment or food and sort of giving directions with that. So, I think that helps them to see other people's perspective and that perhaps it's not as clear-cut even though there is a lot of science to it.* (K)

Another teacher described a practical task to teach about sustainable fishing: *Using peas to represent fish, students are given a tablespoon and asked to "catch" as many peas as they can in a set time. Repeat with a spatula to represent different net sizes and how this influences the number of fish caught. Then repeat the experiment with a quota limit. Models some of the fishing policies in place.* (G)

School gardens were raised for teaching practically and creatively around food sustainability and other issues: *The garden was used for lots of different projects all the time, not just for one term but as an ongoing thing...across the curriculum: geography, biology, art, as well as for after school club activity.* (S)
Our school has quite a lot of land that's not used. You could look at setting up things like gardens and they could grow produce to use in the canteen. That's something they could actively be involved in with quite low input from other groups. (K)

6.1.3 Secondary students

6.1.3.1 Younger students

We ran an in-person focus group with a diverse group of 12 pupils aged 11-12 years, at Haberdashers Askes Borough Academy in Southwark. Their teacher had previously delivered art projects on food and sustainability.

Lack of choice in food habits

When asked to describe lovely food they'd recently eaten, some said it wasn't lovely! They suggested that they had limited choices, either due to parents deciding for them, lack of money, or bland food in the canteen. The most common foods they had eaten were burgers, chicken, chips and pizzas ("barbecue chicken pizza"), and cakes and sugary drinks. They are motivated by a desire for access to more choice and more tasty food.

Interest in animals

They showed a huge amount of curiosity about the topic overall, in particular about animals, alternatives to livestock farming, and the ethics of lab grown meat. In exploring the food system and solutions, they were most aware already of harm done to animals (e.g. live exports) and the harm done by livestock (e.g. deforestation, methane). None of them suggested that after thinking about harm to animals or the climate that they would change their eating habits.

Motivated by creative communication

They expressed some anxiety when exploring future scenarios of food insecurity, for example, envisaging animals being 'wiped out'. When they explored the solutions, and then were asked to design a museum of future food, they became very motivated and excitable. This suggests that young people can be engaged best by asking them to solve problems and creatively communicate ideas with peers. This accords with what teachers told us about their students.

6.1.3.2 Older students

We held a discussion with 13 young people aged 16-19 years, who were in school or college. This enabled us to obtain views of young people without educators present or influencing their responses. Two of the 13 were quiet or did not stay throughout.

All but one of their most recent delicious meals were high-carb, meat or dairy. Some are motivated to change their diets but would miss food like this, and are still somewhat governed by parental decisions or simply desire food they feel is more tasty than plant-based alternatives: *My mum usually does all the shopping so I think she makes the decisions but based on what we tell her.* (J, male)

One was a vegetarian, and another had been until recently. Concerns about animal welfare, cost, health or taste are more top of mind than environmental impacts. One said that they didn't think about sustainability factors when choosing food like cheese. Another said about eating chickens: *It's slightly different from environmental reasons on paper. It's more of an ethical concern, but those go hand in hand...100s of animals stuffed into a small space, that's sick.*" (L, non-binary)

One talked about the health impacts of eating unsustainable food, feeling some alarm about microplastics in fish: *I've already been eating this for 10 years so I'm a bit worried.*

Two in the group indicated the tendency of more young people to be left-leaning compared to the majority of older adults:

- *Unfortunately for me at least as long as we live in a hyper capitalist society corporations that are producing GM crops are doing it for profit not environmental reasons.* (L, non-binary)
- *We live in a capitalist consumer-led society so it's about knowing where to focus.* (F, male)

6.1.4 Families

The parents are motivated by a general concern for their children's futures and wanting to model ethical practices with their children. Some wanted children to be more connected to nature, to origins of food and cultural traditions, or to actively participate in community rather than be attached to screens.

Children don't know much about real food. We have to get them outside, digging and being curious. (Anon)

Their concerns are balanced across managing limited family budgets, encouraging healthier habits, and wanting to learn why and how to take positive action: *Trying to get that balance of affordable, healthy and environmentally friendly, it's so hard.* (S, parent, Yorkshire)

Some emphasised cost as a barrier to eating more sustainably, whereas others wanted to emphasise Earth-kind and cost-saving measures such as growing their own vegetables and using food sharing schemes: *I'm keen to support that app, to be able to share my leftover food, benefit from it myself sometimes, and to help others in need.* (E, parent, London)

Children can represent the conscience of some families, while also making it harder to act on conscience. While parents do tend to influence their children's views and habits, some children strongly expressed themselves with ethical challenges to adults. Some parents described children demanding unhealthy food, or knowing that junk food will save time and won't be left uneaten. However, some children made appeals to adults to take action to save the oceans, animals going extinct and their futures.

- *Maybe powerful people can say how to help stop these bad things happening, because other people don't know that this is happening.* (M, child, London)
- *Ruining the environment isn't an option. I've heard some people say there isn't a Planet B, there's nothing better than Earth now, that there's a chance that humans or the next generation of what we evolve into could go to Mars if climate change becomes too bad. I don't know whether that's true, but that might be the reason why people think we can ruin this planet.* (E, child, London)

Family groups most represented the large gap between unsustainable food habits yet *knowing* that these preferences are part of a harmful system. There was some awareness that this was culturally conditioned: *It's how we've been brought up and conditioned. It's a consumer environment. We've been spoiled with luxury and choice. It's really hard to live on less, to have smaller portions.* (L, parent, Yorkshire)
Action has to be continuous. We have to tackle challenges like food waste collectively, changing how we think about food. (E, parent, London)

6.2 What do audiences understand about food sustainability?

6.2.1 Independent adults

Food availability

Interviewees on the whole were not concerned about food availability with many explicitly stating that they had not ever thought about not being able to get hold of any foods in future because of climate change reasons. However, those who took part in focus groups displayed more concern over future changes to availability, displaying more pride in their concern in front of others: *I have to say I'm not worried about it, no...I don't think things will change enough for it to have any implications for the food I buy.* (I, male, 55-64, interview)

If people were concerned or not, many participants said they felt guilty about buying tropical fruits, most commonly bananas and avocados. The rationale behind this was that these fruits were perceived as using a lot of "air miles" to get to the UK and that carbon emissions from flying contributed to climate change.

- *There are foods that I eat that I am very conscious are not local. I'm vegan so I don't eat any meat or anything. When I was vegetarian I probably would have said fish or something but with my diet now I'd probably say something like avocados, like I do eat quite a lot of avocado, it is a guilty pleasure and I know they don't grow here.* (N, female, 18-24, interview)
- *I've been thinking about food miles and how far things have travelled to get here. I've been shopping just at my local Co-op, and was conscious of my health during the pandemic, just finding fruit and veg grown in this country was really difficult. I didn't feel so bad if they were grown in Europe, but if they're from Brazil or South America, I thought of the energy taken to get here.* (E, female, 35-44, focus group)

In some cases, participants linked their answer to changes in growing conditions caused by climate change.

- *You know, I've never really thought about it. It's a very good question. Suddenly, you think maybe in time bananas and things I might struggle to get hold of. [Why?]. Because if the temperature changes and it gets warmer, it might be that certain food can't grow in that sort of temperature.* (M, male, 65+, interview)
- *Rice really struck my heart as it's the one carb I love, which I put down to my south Indian roots. But I would miss mangoes, especially alphonso mangoes that remind me of my childhood. Just before the*

monsoon we'd buy these big mangoes. My daughter is working for the British government in Delhi, and COVID is ravaging the rural poor, and climate change, so it's ravaging crops. It's a comfort food, an antidepressant, and resonant of childhood. (A, 55-64, female, focus group)

However, many participants did not explicitly state a link between growing conditions and food availability. There were some instances where participants proposed that in future, it was possible that restrictions might be put in place on food being imported to the UK: *Well, I mean, I'm probably being optimistic, but I think that if in the future things are getting so significantly bad that we're trying to control things a bit more than things like that would potentially become those things I would imagine we might struggle to bring across [to England].* (B, female, 25-34, interview)

Geographical privilege

The majority of participants acknowledged a geographical privilege to living in the UK, in a wealthy country that offers a level of protection to climate impacts. This makes it easier not to think about food sustainability. Those who had lived in or had family in other countries supplemented this with a global viewpoint.

- *In the west we are privileged, and if a food were to become unavailable because of climate change, businesses that are selling the food will source it from elsewhere.* (S, female, 35-44, interview)
- *I think because of where in the world I live and what my income is, I can probably get what I want. Whether I should have it or not... I think because of where I live, you just sort of buy the ability to not think about that even though you should, and so you have the illusion of not having limits on what you need.* (D, female, 35-44, interview)

When participants spoke of geographical privilege this was always expressed alongside their awareness of the unjustness of this privilege and a sense that not being immediately at risk did excuse or exempt the UK from the problem of the climate crisis: *Because we're rich, people think we can pay our way out of these issues. So, I don't know if, especially in the local community, it would really affect us, not like it would the rest of the world necessarily, but then that doesn't mean that we shouldn't be doing anything about it.* (J, female, 25-34, interview)

Participants were aware of and concerned for those living in developing countries who they felt would be most greatly affected by food sustainability issues (see section 1.1.5). There was, however, a sense from many participants that they had not considered in any depth how those issues might affect themselves or others in the UK. Some who initially said it did not worry them realised that they were more worried after thinking about it: *I suppose that it's more around these bigger impacts rather than me as a person like, oh my god, I've never thought about what if I can't go and get food. So now I'm worrying.* (J, female, 25-34, interview)

Food production and the changing climate in the UK

When reflecting on how they and their households might be affected by climate change, some participants cited changes in the unstable weather indicating the potential impact of changing conditions on food production in the UK: *There are things that we're seeing already with changes in weather patterns here which are affecting farmers and what have you. Just even earlier this year, seeing those very dry fields walking around in this area in the drought that we had in April.* (C, male, 65+, interview)

One participant commented that they had recently visited Scotland and were used to seeing all the salmon jumping but there were a lot less than when they visited ten years ago.

In addition, several participants mentioned the increased prevalence of floods: *Even in our own country you see an awful lot of issues around building and the impact that both agriculture and climate change has on people here. I live in Yorkshire in an area where flooding happens. I know people who've lost houses and stuff or have had houses completely flooded.* (B, female, 25-34, interview)

When talking about food availability, one participant spoke of climate change potentially affecting growing in the UK: *I think I'd be worried about species that are native to Britain that might stop liking the conditions here, maybe something like apples...I mean, I don't know that much about it, but I think they need a temperate climate so if it got too hot here.* (A, female, 35-44, interview)

One participant remarked that the UK does not grow much of their produce, relying on importing from other countries, and this could make the UK more vulnerable to climate impacts: *Maybe we will be affected badly because we don't grow enough food in this country so maybe somewhere where you are able to grow, you're in a good position because you've still got that to rely on whereas if you're relying on external things, then maybe it's more of a problem.* (L, male, 35-44, interview)

The focus groups included people who had lived in India, Pakistan and Australia. Those who had this experience were aware of the increased effect of climate change in these countries compared to temperate Northern Europe: *Coming from Australia, we see extreme weather events, expect droughts and floods. They're happening more frequently with a detrimental effect on arable land available. Slightly overshadowed by pandemic but there have been catastrophic bushfires. I was in tears. I was living here. If global warming continues, farming is going to be so much more difficult and the land available so much less.* (H. E, female, 35-44, focus group)

Soil degradation

The issue of soil degradation was raised by several participants as an issue for food production. For some, this was simply an awareness of the term: *I am very vaguely aware that there might be ways of improving soil quality, but whether that's really to do with climate change or just general better use of the use of resources, I don't know.* (I, male, 55-64, interview)

For others, there was an understanding of the impact of soil degradation on growing and concern about the threat this posed: *I think the most immediate time bomb in the back of my head...is the soil degradation...no longer growing food. That's kind of a non-negotiable problem, right?* (D, female, 35-44, interview)

Impact on developing countries

When talking about who would be impacted the most by climate change, participants were aware of the challenges that climate change would bring to the poor in developing countries. In addition to the term 'developing country', participants also used the descriptors of living in the *southern hemisphere* or living *close to the equator* to classify those who would be most severely impacted by climate change and food sustainability issues. This differential impact was attributed to changed growing conditions as a consequence of climate change and, in turn, the potential of failing crops. Participants acknowledged a closer and more direct link in developing countries – compared to the UK - between people and the food they grow resulting in far higher stakes for those people if a harvest fails.

- *[Climate change] will affect people in the tropics and people in less developed countries where the food is growing and will potentially make it difficult to grow that food, for example, drought with no water to grow the food.* (S, female, 35-44, interview)
- *For people who already find it difficult, it is going to become even harder because if, say, a family were only able to grow enough food for themselves then that's going to become even more difficult.* (L, male, 35-44, interview)

Many participants acknowledged how the climate crisis exacerbated existing inequalities and often expressed frustration at the perpetuation of these longstanding inequalities.

- *Although we're all affected, I think the poorest people in the world are already deeply affected and have been because then I mean, there's always the exploiters and exploited and it is the already exploited that will be affected the worst.* (E, female, 45-54, interview)
- *I suppose people in the developing world would be potentially very hard hit by it because they are so dependent on the current status quo and the crops that they can grow and those two things that, if that was taken away, or that had to be massively modified, I can see that it could be a real issue for people in those countries more than in the western developed world.* (A, female, 35-44, interview)

- *I'm going to put my feminist hat on, because the people at the bottom of the pile are women and girls. They miss out on education. The baby steps we've made to empower young women, we will regress.* (A, female, 55-64, focus group)

One participant who had conducted research into climate impacts on developing countries spoke of the potential devastation that a poor harvest would cause there and that those whose livelihoods are threatened are much more conscious of climate change.

...people are living these very precarious livelihoods. If the local ecosystem isn't sustainable, that's the food for the family. That's not like, 'oh, that's a bit inconvenient that courgettes are not in the shop this season, because it was a dodgy harvest'. It's 'we don't have anything to eat and we grow what we eat, and we don't have any cash to buy anything else from elsewhere'. So yeah, it was just, it was just very, very clear that there was a much stronger understanding among people who knew nothing about climate science. (D, female, 35-44, interview)

One participant of Pakistani heritage noted that the expectations around food availability were not unique to the UK but as trade became globalised, it changed consumption across the world.

We are already affected. We expect cheap food, expect it to be out of season, readily available, expect to eat avocados and bananas. There's also crime around this. I come from Pakistan and I've seen a change. They expect foods to be available out of season and only 20 years ago you wouldn't get those foods. It's an agricultural country and we expect food to come from abroad. It's our own expectations that have changed. (S, male, 55-64, focus group)

Some participants raised the issue of migrants coming to the UK due to environmental changes.

Those producing the food will see the impacts quicker with worse impact in developing countries. These effects might then spill over into the west, for example, with climate refugees coming over. (S, female, 35-44, interview)

Impact on the poor in the UK

Participants also talked about the consequences of climate change on food prices and how those who are already poor would suffer the most from inflated prices.

Thinking closer to home, food prices are getting higher so people who are living hand to mouth and below the poverty line will struggle. (S, female, 35-44, interview)

Poverty was linked by participants, particularly those in the 55+ age group, to a frugal and low waste household approach to food.

- *I have many vices but not food waste. My mother grew up with no money, and you never waste food, and it's how I run my household and my grown up children run their households.* (A, female, 55-64, focus group)
- *This casual attitude that you cook a meal for four and put half in the bin if it's not eaten. It shocks me as someone brought up in the war.* (F, female, 65+, focus group)

Food insecurity and climate change as a distant issue

While all participants expressed belief in and concern about climate change and impacts on food, by many this was seen more as a future threat.

- *It is not something I see as going to have an impact on me within a sort of an appreciable amount of time, you know? ...It will get to be a problem later on, but it is not my problem at the moment.* (I, male, 55-64, interview)
- *Like smoking when you are younger – it is so far in the future that it is hard to be motivated by it. Health is a more immediate concern. There is a feeling that it's so far away it will take care of itself.* (G, male, 65+, interview)

One participant commented that as he was in his late sixties, he would no longer be alive when climate change impacted on people in the UK but that he felt that it would be his grandchildren who would feel the effects. *For me, less, because of my age. I'm 68 and the wife is 64. It won't be so much my children but the ones I really worry for now are my grandchildren and I feel as though the things we do today will have an impact on them in the future.* (M, male, 65+, interview)

This sense of the threat of climate change being long-term rather than now, at least for the UK, feeds into the conceptualisation of climate change as something distant, both in terms of where it is perceived to be taking place – in developing countries – and when – in the future. In this way, food sustainability and the associated issues are framed as being physically and temporally distant, i.e., it affects people far away and the impact of it will be far away in the future.

6.2.2 Teachers

Topics young people need to learn about

Teachers were asked what young people need to learn about in relation to climate change and food sustainability, and what topics museums could cover. They gave mixed answers with teachers typically listing different factors that they felt young people should know about.

Chemicals involved in food production

Two teachers proposed that the museum should address the chemicals used in food production.

The whole area around chemicals: fertilisers; in the water;...to preserve food; to grow food. They are all artificially produced and there is a deep impact of using man-made chemicals, right? Across the food production and distribution and retail. (S)

Pollution

Pollution caused by food production was raised by two teachers as a topic to be covered.

- *...pollution of air, sea and land and the consequences of this...* (D)
- *...pollution created in all spheres (atmosphere, lithosphere and hydrosphere)...* (W)

Global warming

One science teacher reported a lack of understanding of global warming. They suggested that if the mechanisms and causality around climate and other environmental issues were better understood, planet-friendly behaviours might be instilled: *There's still quite a lot of confusion over the fact⁶⁴ that global warming is creating a hole in the ozone layer...we try from a science perspective...that we burn coal to produce electricity, the more electricity used the more carbon we have to burn, and that link between the two. And I think perhaps, if they had more understanding of why leaving a light on, for example, is a problem they might have a better understanding of what climate changes and how they can themselves prevent [it] or reduce their impact.* (K)

Where food comes from

There was a sense that young people did not know or think about where their food comes from, how it is produced, and what effect it has on the environment or their bodies: *I also think it is important to educate young people about where their food comes from, how it is produced, what it contains and how this might affect the human body, how it is distributed, packaged and sold and how waste is disposed of. This all in turn has an impact on the environment and it is important for young people to be aware of how.* (G)

⁶⁴ This quote suggests that global warming caused the hole in the ozone layer, but it means to convey that students believe that it has done.

As with adults and parents, there was an emphasis from some on the environmental costs of ‘food miles’ and a concern about equality and rights in the countries’ foods are being imported from.

One of the consequences of Brexit is that now sometimes particular fruits and vegetables in some supermarkets are being imported from further away than mainland Europe and from countries with poor human rights records. D

Social justice and equality

Many teachers emphasised the importance of covering social justice and equality when educating young people about climate change issues.

Undoubtedly sustainability is probably the most important issue from the perspective of a geography teacher.

Alongside this though are issues relating to equality, respect and democracy. H

Overall, there was a sense that young people needed help understanding the mechanisms by which their and others’ behaviour affects the environment and that by understanding more about the mechanisms.

6.2.3 Secondary students

6.2.3.1 Younger students

When asked what factors might make their favourite foods less available in future, there was a wide range of creative ideas but also indications that they didn’t know very much about planetary changes. Their reasons at first revolved around humans killing or using up everything. The group was very focused on the topic of animals and meat. There was some fear that the supply of livestock would run out: *killing animals could lead to no more sheep, or clothing to keep us warm.*

COVID-19 or “a future plague” was on several minds. *I think food in the future will stop coming if pandemics keep on coming. The prices will increase until the things you need to cook are finished. Just like because of COVID-19, people are having a hard time purchasing toilet rolls because everyone wants them.* Some children were extrapolating from this disease to suggest that it could kill all animals and crops such as wheat. The pandemic was an all-encompassing threat: *Plague could kill all animals and as humans aren’t used to no meat, we might go extinct from huge change of food.*

When we prompted a focus on chocolate, they began to tap into existing knowledge to talk about rain, extreme heat, deforestation and fair trade: *If the weather is too hot and it won’t rain for a while, people will find it hard to start cloud seeding because it’s expensive.* They only used the terms climate change or global warming after we had introduced them.

6.2.3.2 Older students

This group included a few who were well informed about some issues, such as overfishing, due to recent media coverage, peer-to-peer knowledge, or from investigating due to interest. These individuals were able to talk fairly articulately about the causes and impacts of harm in the food system.

On the whole, there were indications of a lack of broad knowledge, being tentative and reaching for answers: *I don’t know if that would be a good thing. I haven’t read up about it. Increasing the amount of space it would take for one farm to produce food sounds...I’m not sure.*

This fits with a tendency of this age group to lack confidence to speak about complex matters when not fully knowledgeable, and when they are starting to form opinions.

Some first thoughts were that some foods would not be available in future because curbs would be placed on it due to their ecological footprint, rather than supplies being limited due to climate or other impacts. Only two mentioned that food supplies are impacted by climate change. *Cows produce a lot of methane so cheese might be one of the first looked at to cut down on.* (A, female)

6.2.4 Families

Very similar to independent adults, there are some gaps in understanding about global food systems and environmental impacts that could be addressed through informal education. *I don't know enough about crops to know which ones need lots of water...* (S, parent, Yorkshire)

Although adults could identify a range of causes of food insecurity, they did not show detailed understanding of environmental factors, or the potential of climate change affecting staples coming into the UK. Few referred to foods that were most threatened by climate change.

Parents, and particularly children, have picked up strong messages from the media about particular problems such as plastic packaging or food miles, or about particular solutions such as Meatless Mondays. Some have good knowledge due to involvement in particular campaigns, particularly food aid or climate campaigns, and one had studied agriculture. One strongly supported local farmers and transitioning to a local food system: *I know the idea of my gyoza came from Japan, but the pork and onion came from Yorkshire, so it's locally sourced. It's a reason why we like it. You wouldn't think it's from Japan.* (S, parent, Yorkshire)

Others struggle to understand technical terms, for example defaulting to 'plastic' or 'fake' rather than terms such as Ultra Processed Food: *All this you hear on the internet about plastic food. With lab grown meat, can you be sure it's not plastic?* (E, parent, London)

Families that visit museums are motivated to learn, and want to see more effective public education in general. Parents want more information about how to support and advocate effective solutions such as community-supported farming. Children want more information about innovative foods, to know more about the processes and how they taste, and older children want manufacturers to be honest and educate consumers more about food.

6.3 What do audiences think are the effective and relevant solutions?

6.3.1 Independent adults

Of the nine solutions we shared, the following five emerged as having particular importance in how participants viewed solutions for the UK: high-tech greenhouses, regenerative agriculture, eco-labels, ending food waste, and community supported agriculture.

What you eat and where it comes from

Changing the way we farm

Reflecting on farming, many participants raised concerns about UK farming approaches and saw the need for alternatives. Several participants indicated an existing knowledge of regenerative agriculture, e.g. *I am aware of*

farming that is less intensive and that uses less resources,' and when shared as a solution, it was positively received: *Regenerative agriculture is important...A priority, I believe, certainly in countries like ours, has been productivity per acre without necessarily looking at the longer-term ramifications and wider things.* (C, male, 65+, interview)

Regenerative agriculture was framed by participants as being a common-sense approach with a clear logic behind it: *[There are] lots of farmers trying to improve the way that they farm. If there is one crop on the soil all the time it is eventually destructive, so some are getting more progressive on that.* (W, male, 65+) For some, regenerative farming was viewed as drawing on old wisdom, working with, rather than against nature, which was seen as reassuring and trustworthy: *I think over centuries a lot has been learned about the land and how it needs to rest. It needs cycles. We still have seasons, so again I would feel that we have to be very mindful of how we work the land, not to exhaust it and not to confuse it.* (E, female, 45-54, interview)

While regenerative farming was appealing, participants were not sure how to support this solution or how to buy from farms using the practice. Some assumed that it meant reduced harvests: *It's hard to think like a farmer, how they're committed to improving soil. You are not necessarily going to get the most produce out of the land. It's not being able to give you more harvest because it's got nothing left in it. I can't see it being very popular.* K, female, 25-34, interview

Some participants questioned whether regenerative farming would produce enough to feed a growing population. In fact, regenerative methods are being shown in many places to increase yields as soil quality improves. One participant knew how it is applied in landscapes very different to those in the UK:

I used to live in Botswana, where beef is a major export and status symbol. But the Kalahari desert has grown and the cattle farmers have drilled bore holes for the cattle and the bushmen who've lived there for 1000s of years can't get water so are reduced to serfdom working on cattle farms. Botswana got a deal to import beef to the UK. So, regenerative agriculture can help with this. (P, male, 65+, focus group)

Alongside regenerative agriculture, Community Supported Farms (CSF) were also very popular with participants. CSF's were perceived as ethical, potentially educational, supporting communities as well as the planet:

- *I really like the community supporting farmers...I think sometimes in terms of farming, we separate it a lot from capitalism but it's all very, very interlinked.* (N, female, 18-24)
- *Community supported projects are the best form of education. Involvement and active feedback are the best ways to get people to change.* (S, male, 55-64, focus group)

Some remarked that they would like to buy from CSFs but would not know how to recognise it: *If I was in the supermarket and it said 'Community-Supported Farm produce' or whatever I'd be more likely to support something from that.* A, female, 35-44, interview

High-tech greenhouses were seen by some as a positive approach to farming. Some referenced urban projects such as an underground farm in Clapham, London where crops are grown in former air raid shelters, and because they are in the city, the food does not have to travel far. The farm has received substantial media coverage: *I've seen on telly that you can grow in darkness with special lights (tunnels?) and you can get better growth.* W, male, 65+, interview

Participants made comparisons between high-tech greenhouses and wind farms arguing that while they may not be pretty, for their impact on the landscape, their value in food production outweighs this cost.

- *Yes, it's not aesthetic, but the density of food production in a much smaller space and because it's a managed environment, you might be able to put them in places that you wouldn't normally be able to grow crops.* (C, male, 65+, interview)
- *The greenhouses remind me of the wind farms and things like that. Nobody likes them but at the end of the day, they must help.* (M, male, 65+, interview)

The familiar concept of greenhouses as an environment to aid growing made the idea of high-tech greenhouses familiar too: *Around here there are plenty of greenhouses and polytunnels that can grow food better. In Lancashire there are lots of big greenhouses that make tomatoes and you can generate bigger, better yields.* (W, male, 65+, interview)

There was, however, some suspicion about high-tech greenhouses with some perceiving them as discordant with nature along with high use of energy and water.

- *It feels so high-tech that it's anti-nature and it's just interference and it's not going to be helpful in the long term.* (E, female, 45-54, interview)
- *Do we want vast areas of land covered? And I don't know what the energy and water usage is.* (E, female, 35-44, focus group)

Change the way we shop

Participants spoke positively about food labels to inform their choices and the potential of eco-labels to add more knowledge:

- *If that became a thing, I would definitely look out for that on foods. I already look out for things that are grown in the UK, rather than buying things grown abroad. And I also pay attention to the Rainforest Alliance, organic and Fairtrade, if I can.* (A, female, 35-44, interview)
- *From Aldi the other day I got some chilis and on the package was the message 'Use all of me – these have come all the way from Argentina'. When I read it, I'd never considered it before, the energy used. So yeah, maybe more understanding of that might be good for me.* (J, female, 25-34)
- *I want to know what country it's grown in, not just where it's packed. My orange juice says it's from Milton Keynes. They don't grow oranges in Milton Keynes!* (P, male, 65+, focus group)

As well as having the potential to inform consumer behaviour, some participants raised the potential of eco-labels to influence producer practices: *I think if we tried, companies would try and drive those down as well, which is good, as long as they are manufactured in a way that there aren't any loopholes.* (N, female, 18-24, interview)

While eco-labels were appealing, for the labelling to be effective, many participants expressed the need for a public education accompanying the introduction of the labels so that people were able to read and understand them: *I've always really liked the idea of that [eco labels] but with that needs to come a lot of education because...it would need a lot of culture change to get people to see those and to understand and to care about what they're telling you.* (B, female, 25-34, interview)

One participant voiced scepticism about how much impact eco-labelling could have: *I don't know how much labelling really shifts behaviour change. Years ago I used to work in a fair trade shop and...I was really bought into it, but it was like an identity for a really small number of people, you know, we've had Fairtrade labelling for like a really long time now and that hasn't really impacted how we consume and buy food in any great way.* (D, female, 35-44, interview)

Change the way we eat

Some participants talked about sourcing food differently, such as shopping locally and seasonally. They reported having vegetable boxes from local farms and shopping at markets. One said they had started sourcing fish from a service that catches fish locally with low impact methods. Some participants were growing vegetables in allotments or in the garden.

Although some talked about shopping locally, discussions indicated that the majority sourced their food mainly from supermarkets. Consistent with reservations about current UK farming practices, many were aware of and concerned about the environmental impacts of beef farming.

- *So, obviously, like meat and in particular, red meat - it's the big unsustainable one. Think about how many acres of land is needed and if everyone in the world was like that. What is the true footprint of that kind of diet?* (D, female, 35-44)
- *I'm concerned about animal welfare...and some of the emissions food animals produce or whatever, like methane. I mean, I do eat meat but I certainly do worry because of that.* (R, female, 55-64, interview)

Participants said that a reduction in red meat consumption by the population was necessary to reduce the cost for the environment and several participants had already taken action to cut their meat intake and were vegetarian or vegan or had taken part in “Veganuary”.

- *I don't think we need to go fully vegan, in the country or in the world, but we need to step away from this 'every meal we should have meat'.* (J, female, 25-34, interview)
- *It is a hard thing for me to say, I'm a meat eater but I do realise that you know beef farming affects the climate...My best friend, he's been vegetarian for nearly 40 years. He doesn't...ram it down my throat but I do realise that we're going to have to think about what we do going forward.* (M, male, 65+, interview)
- *I tried veganuary, and did it by buying supermarket products that didn't seem very healthy or tasty, so I'm not sure if I can do it in the long term.* (B, male 25-34, focus group)

One participant who had reduced his meat intake commented on difficulties people face in thinking up meat-free recipes, going back to reliable favourites. People need help to change their diets rather than being demonised for not changing.

Change how much waste is created and what we do with it

Reducing food waste was a solution that participants often articulated based on their existing knowledge as well as when reflecting on the solutions shared during the interviews and focus groups. The majority of participants reported that they were very careful not to waste food: *Food waste we're very good with. We don't leave things in the fridge, don't throw away anything.* (K, female, 25-34, interview)

Overall, participants spoke favourably about food waste redistribution schemes. Several based in Yorkshire highlighted The Real Junk Food Project getting unwanted food to poor people. Several said they volunteered at food banks or waste redistribution charities. Some felt it was dealing with the symptoms rather than the actual problem, that waste should be cut off at the source: *Ideally you don't want food waste to exist in the first place, you know. It's a solution to a problem that shouldn't exist.* D, female, 35-44, interview

When talking about their approaches to avoiding waste, many participants spoke of the need to carefully plan what they eat as well as cooking from scratch rather than relying on ready meals or takeaways. *And I'm a cook as well so you start to learn how to not waste things and reuse things and use up leftovers and stuff. You start to see how easy it is.* B, female, 25-34, interview

Many participants raised concerns that while food waste needed to be reduced, the UK population in general was not equipped with the knowledge and skills to do so. This included planning what you eat, being able to cook from scratch, and being able to turn leftover food into another meal.

- *Planning what you eat, what will go off, freezing food: people don't have that skill set anymore.* S, female, 35-44, interview
- *We need to do a massive amount of education about how you can reuse scraps. I hear from some of the old ladies in church who used to make soup from potato peelings during the war and maybe we need to go back to that because if we don't [stop wasting food] it's going to severely affect the planet that we live in.* A, interview

Thinking beyond individual action, several participants raised the role of supermarkets in creating food waste, managing stock to keep shelves full and catering to desires for an endless choice of products: *I think that food*

manufacturers and retailers need to take a bit more responsibility...do more to stop encouraging people to buy stuff... You can get about 20 different types of hummus, and all that choice ends up with waste. AV, interview

Another participant argued that supermarkets should work with organisations to ensure that any unsold food is redistributed: *We have a Co-op near us and I see them bag up all the food and it goes to waste and I'm against that. They reduce things but quite often they are throwing things.* W, male, 65+, interview

Participants were all supportive of supermarkets selling imperfect produce: *I think it is very important that supermarkets sell imperfect produce. If they don't then the farmers have to find something else to do with it and sometimes I believe it even goes to the landfill. So today, it is scandalous that we're not treating food as a real precious commodity.* A, Bradford, interview

One factor mentioned by several was use-by or sell-by dates, and how their lack of clarity contributed to further waste: *I don't know anything about this, but why do food markets have to throw it away after the sell-by date? Is that legislation again, because if that was changed, that could be very effective.* J, female, 25-34, interview

One participant aligned food waste with obesity with the rationale that eating only what you need could aid weight loss as well as the planet: *I'm overweight and could do with eating less. Part of that solution is only eating what you need and not eating to excess. I went to America when I was younger and people were just greedy. And so that would be part of the solution, to only eat what you need.* W, male, 65+, interview

There was some scepticism over how much of a role reducing food waste could play in addressing food system problems. One participant remarked that it was a small-scale solution for a big problem: *It seems to me to be a somewhat limited option...I wouldn't think it would have a gigantic overall effect. I think it's a bit nipping at the margins to be quite honest.* I, male, 55-64, interview

In the context of food waste, participants also talked a lot about recycling, both in terms of food, e.g. for compost, but also recycling food packaging: *We use a compost bin and it goes on the veg patch. It can make a huge difference if everyone did it, to reduce it by even half.* S, male, 55-64, focus group

Several participants criticised the lack of an effective centralised system for recycling and highlighted poor public understanding on how and why to recycle: *You look at some countries like Germany. They've got a really fantastic recycling system where almost everything is recycled and here, it's so disjointed... rather than a national system that everyone uses and understands.* A, female, 35-44, interview

The role of young people

When discussing solutions to food sustainability issues in the UK and the attitude change required by the general public to live a greener life, young people were often mentioned as key players. The rationale for this was in part that young people are the adults of the future and so what they learn as children and the attitudes they form will influence how they behave and think as adults. So, if they are learning as children the importance of looking after the planet and the steps they can take to do this then they are more likely to look after the planet in future. Participants also spoke of the cascading effect of the young people's learning onto their parents. For example, by teaching young people about sustainable produce and what foods are better or worse for the planet, young people are then likely to influence their parents' shopping habits so that their parents' consumer habits become greener. There was a sense among participants that it takes a long time for ideas to be taken on and integrated into ways of thinking and so the earlier we can do this, the better. This was in line with some of the comments made by participants suggesting that young people's views and young people's actions, e.g., the Extinction Rebellion marches, had made them think more about climate change.

One of our young people started working for a food delivery company...with no plastic...This is a 16 year old and so that conversation was actually fantastic because he was just learning and he was able to feel quite empowered by telling us and we were quite inspired In that way too. E, female, 45-54, interview

Reflections on alternative solutions

This section covers participant responses to the following four solutions shared in the interview: GMO, aquaculture innovations, eating insects, and lab-grown meat.

GMO

GMO was initially responded to with caution by the majority of participants, a caution that seemed to be rooted in the way GMO has previously been represented by the press.

Initially it made me feel negative. I don't know why I think I don't know much about it. I think it's probably just one of those things where it does get some negative press, but that doesn't necessarily mean that it is a negative thing. B, female, 25-34, interview

Reflecting on the origins of UK society's attitudes about GMO, one participant said:

The issue with GM has been from the early days, it being driven by commercial opportunity and exploitation. So it crosses over to the anti-regenerative agriculture space and people have ended up conflating the technology with the political and commercial exploitation. C, male, 65+, interview

Another participant noted the lineage of GMO and how cross-breeding crops and selective breeding of animals is the foundation of many of the foods we eat today: *It can produce more resilient food but modified foods and animals have been the foundation of food produced for humans for 1000s of years.* S, male, 55-64, focus group

For many participants, while they were uncomfortable about GMO as a solution, there was a conscious awareness that they were lacking the necessary up-to-date information to make an informed decision about the value of it as a solution to food sustainability issues: *GMO – bit of controversy. I don't know enough about it. if it is done properly and its safety. – people are scared of change.* W, male, 65+, interview

Of those participants willing to re-think attitudes about GMO, several mentioned watching television programmes where GMO crops had led to higher yields: *I saw a programme about a farmer who made special wheat and everybody was scared but it doubled wheat production – in Canada.* W, male, 65+, interview

Some participants raised concerns about the long-term impacts of GMO, feeling that the use of GMO now would be short-sighted when not enough is known about its long-term effects: *I'm really not into messing with nature...I feel every single thing is connected so that's where the difficulty lies, I think. So, it may seem like a really good idea to be able to produce things quickly, safely and pest free but actually I'd be concerned about the long-term impact.* E, female, 45-54, interview

Although there was a lot of caution, some participants were very open to its use and of consuming GMO produce with a willingness to rethink existing attitudes on the topic. Reflecting on the notion of GMO crops as being potentially unsafe to eat, one participant remarked: *I know some people are very cautious about GM in the whole organic movement... If I was an American, because of their food safety standards I'd be much more concerned about it... but now I feel fairly confident in food regulation in this country that I wouldn't be eating anything dangerous.* D, female, 35-44, interview

Aquaculture innovations

Aquaculture innovations was the solution that generated the least discussion. There was a sense from the majority of participants that this solution sounded good. However, very few participants reported having been familiar with

it before the research. The brief overview of the solution during the presentation did not generate questions and the lack of any pre-existing knowledge meant that participants did not share insights into their views, most likely because they did not have enough information nor any time to reflect on this information to form any opinions. One participant raised concerns related to fish farming and that aquaculture could move the damage caused by food production into waters: *I worry as fish farming is an environmental disaster, so we could just be moving problems off the land and into the water if we're not careful.* F, female, 65+, focus group

Eating insects

The suggestion of eating insects provoked a response of disgust among the majority of participants with only two participants saying that they would be open to eating insects. However, responses of revulsion were almost always qualified by the disclaimer that the disgust response was cultural.

- *It's one of the things that I think ironic that I would be a bit iffy about eating a locust but I'm perfectly happy to eat a shrimp. I think it's just a mindset thing.* C, male, 65+, interview
- *Insects. That is not a thing to eat, you know, something that's not a food group.* K, female, 25-34, interview

While many participants did not want to eat insects, many felt that, if it were possible to encourage others to eat insects then this would be a good idea.

- *I think in theory it's a great idea. It's just that psychology, of people struggling with the idea of it. I mean I know I would struggle. I did eat a locust before in Thailand and it was fairly unpleasant, so [it would take] some getting used to, but, you know, I do think in theory we should do more of that.* B, female, 25-34, interview
- *I'm also interested in the insects one because I feel like that's something we don't do and it may be says more about our interpretation of other cultures and maybe things like racism and xenophobia come into it a bit more but it is a really viable solution for a lot of people so maybe it's something we should look into here.* N, female, 18-24, interview

Although many participants took the view that insects are not part of the UK's food culture, one who was happy to eat them made a historical reference to this practice: *I'd eat locusts, depending what it was, I wouldn't eat a beetle. People have been eating locusts for a long time. John the Baptist lived in the desert and only ate locusts and honey.* W, male, 65+, interview

One participant raised a point about our lack of understanding of insect sentience, comparing the practice to the eating of animals: *We know too little about the sentience of insects. For years, we thought animals didn't feel pain or have emotions. We keep realising smaller animals do have emotions. I've bred insects for years and have some evidence that they have emotions.* F, female, 65+, focus group

One participant did talk about the potential of creating products from insects comparable to Quorn pieces (mycoprotein) and soya sausages. This might be a way of using the protein from insects but in a way that is more palatable than directly eating insects.

Lab-grown meat

The majority of participants expressed cautious curiosity about lab-grown meat: *Some of the solutions were new to me like lab-grown meat. I haven't come across it before and that's interesting because I can't imagine it.* B, female, 25-34, interview

As with GMO, there were challenges by some participants over the safety of the product: *So many instances of things like drugs that cure a problem that people have but then has horrible long term side effects.* G, male, 65+, interview

Some participants raised questions about the energy intensiveness of creating the product and therefore whether the benefits to the planet were outweighed by the costs: *I think that's a fantastic solution but obviously thinking about the water intake and other environmental things you have to put into it as well. How would it compare in terms of environmental impact in terms of the energy you need to put into it? Does it offset it?* N, female, 18-24, interview

One participant remarked on the cost, stating that: *As it progresses it can get cheaper to produce as time goes on. Computers were expensive at first, but they got cheaper.* W, male, 65+, interview

When asked to consider alternative sources of protein, many participants felt they would rather not have meat at all than eat lab-grown meat or insects: *You know and the lab-grown meat I'm really suspicious about. I would rather cook some tasty vegetarian meals than have something that is pretending to be meat and has been artificially produced.* O, male, 55-64, interview

Some participants said that rather than introducing alternative meat products, people should just eat less meat and try different styles of food.

The role of corporations and government

In addition to talking about changes that they and members of the general public could make, there was mixed acknowledgement of the importance of big business and government in addressing climate change. Some participants commented that changes needed to take place at big business and government level: *I think some of the major retailers could do a lot more and because it's not the, you know, it's not the little delis or little sort of food co-ops that we need to influence as a big major supermarket where 98% of people get their food.* H, female, 55-64, interview

With reference to supermarkets, one participant also raised the potential for supermarkets to food production, influence consumer behaviour to be more planet friendly and that our consumer habits can force change.

- *Supermarkets have power. For example, Waitrose put on a promotion for Panza toilet paper [bamboo] pointing out what is wrong with standard toilet paper... [they] put a good price on it and they wanted to introduce people to it. Because they are a big shop, they have a lot of potential power.* E, female, 45-54, interview
- *Something that hasn't been mentioned is avoiding supermarkets, because of the way they pay farmers, and it encourages monocultures. I have a delivery from an organic food supplier.* F, female, 65+, focus group

Several participants spoke about the UK government pledge to be carbon neutral by 2030 but there was no mention of how the UK government intended to fulfil this pledge. The only other reference to specific UK government policy was to a trade deal that appeared inconsistent with the aims of reducing emissions: *New trade deal with Australia bringing cheaper beef and lamb at the expense of doing it with the EU which is right next door to us. With climate change we shouldn't be eating this at all.* G, male, 65+, interview

Other participants mentioned the need for policies to support reduction of carbon emissions and improving food security, but these were vague and did not indicate any confidence that these policy changes would actually come about: *I'm guessing there are much bigger things that can be done in terms of agriculture and in terms of governmental decisions about all the air miles of food and the way the food is produced but yeah, I'm no expert in any of that.* B, female, 25-34, interview

Many participants touched on the need for government policy change, such as the "Sugar Tax", rather than relying on individual action for real difference to be made: *You can think of things that you do on an individual level which obviously can then be prioritized by governments to get everybody doing them.* B, female, 25-34, interview

Despite the awareness that government action was necessary, only one participant spoke about law and government as if it were something they might have any influence over or way of engaging with.

I've always felt that if you're going to try to do something, you have to become part of a campaign that actually stands the chance of gathering some momentum... I think yes, you can take a personal stance and I respect that, but I think there's more value in campaigning and that actually has a chance to change something. E, female, 45-54, interview

Overall, while participants would say that the government needed to create policies for change, government action was not framed as something that the general public had any control over with no reflection of the government as democratic and working for the people.

6.3.2 Teachers

Teachers were asked which, out of the nine shared with them, young people needed to know about. Notably, teachers emphasised what young people would be most likely to engage with. (See the section below for more about factors that engage young people, or challenges to engagement.)

High-tech greenhouses

High-tech greenhouses and other alternative farming methods were identified as important but there were mixed perspectives on whether they were a solution that students would engage with. Some teachers felt that high-tech greenhouses were not relatable for young people as, because they do not ever see or hear about them, they do not see them as reflecting their own lives in any way. In contrast, one Science teacher emphasised the links with computing because of links to drone technology and monitoring. This teacher also made links between GMO and what young people were learning at school indicating that their learning from school could be consolidated by what they learn at the museum.

Regenerative agriculture

Two teachers expressed that regenerative agriculture was something important for young people to learn about and that this should be covered in the museum. One of these teachers stated that this topic should be covered with the focus on the production of crops and not rearing of animals. Another teacher expressed that while regenerative agriculture seemed like an obvious solution, there was a tension between reducing climate change while trying to feed a growing population (a point also made by adults).

Aquaculture innovations

As with adults interviewed, aquaculture innovations received little mention in teachers' discussion about what young people need to learn about and its relevance to them. (Note that, by contrast, family and school focus groups favoured this solution.)

Eco labels

Ecolabels were a popular choice among teachers when discussing what students need to learn about, not only in how to read them but also in why they matter: *Eco labels are definitely worth promoting as young people tend to respond to symbols/symbolism and they can be encouraged to take on ethical sources of food.* (H)

Schemes to end food waste

All but one of the teachers interviewed identified food waste as a solution that young people need to learn about. There was a consensus that food waste was something straightforward and relatable that their actions could have a direct effect on, for example, by reducing waste in the home: *Ending the food waste, they could definitely participate actively. They could look at food waste at home or contact local businesses to see what their food waste is and perhaps they could help me distribute it in some way.* (K)

Eating insects

While eating insects received several mentions in suggestions of what museums might include it received little coverage in terms of what young people needed to learn about. There was a sense that it would engage students as it is unusual. One teacher expressed that by introducing the concept to people while young there is an opportunity to embed the idea and change future behaviours.

I think we are quite picky about what we eat in this country...If we talked about eating insects to children now over the years, it might just become a bit more normal rather than being such a weird gross thing. I think the more those sorts of things are talked about, the less gross they seem the more exposure to it. (K)

Lab-grown meat

Lab-grown meat received little coverage from teachers in their reflections on what young people needed to learn about with the exception of one teacher who felt that it might be hard to market to young people. It was, however, raised as something that young people might be able to sample when visiting a museum.

Community Supported Agriculture

Several teachers raised community-supported agriculture as being a relatable and important solution for young people to learn about by interpreting it in terms of fair trade:

- *Fairtrade is also well worth promoting as it allows individual consumers to make a positive choice.* (H)
- *Community supported agriculture - why Fairtrade and other initiatives are important for fair development.* (W)

Community supported farms were also highlighted as a concept that young people could relate to: *I think given that so many of our students have family in other countries that would be really engaging for them.* (O)

GMO

One teacher highlighted the importance of learning about GMO: *GM seems to be a growth (sorry about the pun) industry and one which young people are often lacking in knowledge about. It is controversial in many respects but may provide answers to food sustainability issues if problems such as cross contamination can be addressed.* (H)

As highlighted above, one Science teacher felt that young people's grounding in biology from school would facilitate them in engaging with the concept of GMO as a solution and make links with their lives at home: *They do a lot about genetic modification in biology...so you could link to that quite easily, and it gives a bit of context as to why would we want to modify food. It gives them some context that ties into their everyday life.* (K)

Veganism and cattle farming

In addition to the solutions shared with teachers, a topic that came up in a number of interviews was veganism and the link between beef farming and climate change. Teachers are conscious of the careful balance required when engaging young people in topical issues due to their emotive nature.

An increasingly popular choice for the free choice debate in the previous A Level syllabus for all languages (Pearson /Edexcel) was 'I am for veganism'. This indicated a growing interest amongst young people with this concept. As an examiner, I was often impressed by their knowledge about the subject and their reasons for advocating their belief. (D)

One teacher expressed that students should be taught about the cost of eating meat to their health and the environment: *Ultimately that consuming 'meat' is not only detrimental to their health but also to the environment, using vast quantities of: space, water and chemicals and producing harmful greenhouse gases contributing to global warming and climate change...If everyone ate a plant-based diet this could be a reality and everyone's needs would be met.* (W)

Teachers highlighted the importance of helping students to make healthy changes and reflect on their diets: *My interest in food is that it keeps me well when I'm eating the right things and I'm concerned that my students are eating the right things as well... you should see what they're eating.* (O)

While the issue of reducing or eliminating meat consumption was felt to be important, one teacher raised caution about how this issue was presented to young people: *A few of them are vegans...perhaps the impact of eating too much meat on the food chain on sustainability in our land. It wouldn't capture all of them but there is a group that would definitely be able to engage as long as there were not traumatising images of animals.* (O)

6.3.3 Secondary students

6.3.3.1 Younger students

Their own suggestions

They suggested ideas such as: *saving food at home; restaurants to stop wasting food; try to stop climate change; look after the environment; stop using plastic bags; make cows stop eating food that makes them release methane.*

This shows that they fully grasped the general concept of looking after the environment. A few were able to mention more specific solutions, although at this stage nobody mentioned solutions such as eating more plants or avoiding food that destroys rainforests.

Views on our suggested solutions

Their ranking of solutions were:

- Top-ranked: high-tech vertical farms, regenerative farming, greener aquaculture
- Middle: some were keen on food waste schemes and ecolabels
- Lowest-ranked: the least popular, although fascinating, were insects and lab grown meat.

They went wild with disgust at the suggestion of eating insects. They asked how you might cook them to make them nice: *Are you telling me that people genuinely choose to eat those insects with their skins still on rather than a bag of crisps?* It was explained that 2 billion people already eat insects but this was hard to grasp.

There was a huge amount of interest (and distaste) in lab grown meat. It raised many questions such as: *Is this really better for the environment?; How much of this is actually meat?; Where do they get the cells from?; Is it taken from child animals?; Are animals harmed?* It was the most philosophical discussion of the whole session. Debate raged between three boys about whether humans need animal protein or not. One insisted that humans would go extinct if they didn't eat meat.

Actions they might take now

When asked what they might consider doing themselves now, they were curious about what was involved in being a vegetarian or vegan. They weren't empowered or knowledgeable enough to make changes for themselves but wanted to know more: *Can you still eat honey if you're a vegan?*

6.3.3.2 Older students

Solutions they know about or practice

Ethical and animal welfare considerations are most important:

- *I don't buy meat myself but if I go out to eat I try to find out where they are sourcing it first.* (L, non-binary)

- *I saw the videos of how much damage [meat] does to the environment and the animals so it put me off. Being vegetarian was the immediate option [of what I could do].* (E, female)

One already makes an effort to reduce food waste, as part of her family's habit of using leftovers creatively and eating produce just beyond its sell-by date. *All the talk about food security, but there is enough food to feed everybody.* (A, female)

Another also talked of solutions practiced by their family, such as buying local, fairtrade and seasonal foods. As with all other audiences, they focused on solutions at a domestic level rather than at a level of advocacy or citizenship.

Views on suggested solutions

This group strongly favoured regenerative agriculture, community-supported farms, and schemes to end food waste, with greener aquaculture also of interest. They were unsure about the other solutions, raising plenty of challenges, especially to high tech greenhouses, eating insects and GMO foods. They were the most negative about lab-grown meat.

Compared to adults and families, these young people are the most questioning about technological solutions. Some because they are somewhat informed about the pros and cons, others because they don't feel informed enough to judge and want to learn more. They helped each other, sharing their knowledge and battling ideas between them in a sociable way.

- *I'm not sure about regenerative farming because it would take up more space, fields that aren't in use and are just left to grow.* (L, non-binary)
- *If the greenhouses are high tech a lot of energy will be used which will make the carbon footprint quite high* (W, male)

When one wanted to know more: *I'm not sure about community-supported farms.* (A, female). Another helped explain; *I understand it as giving back to the people, having the ability to grow your own food and make your own choices, teaching people to produce food to a scale that is efficient* (F, male).

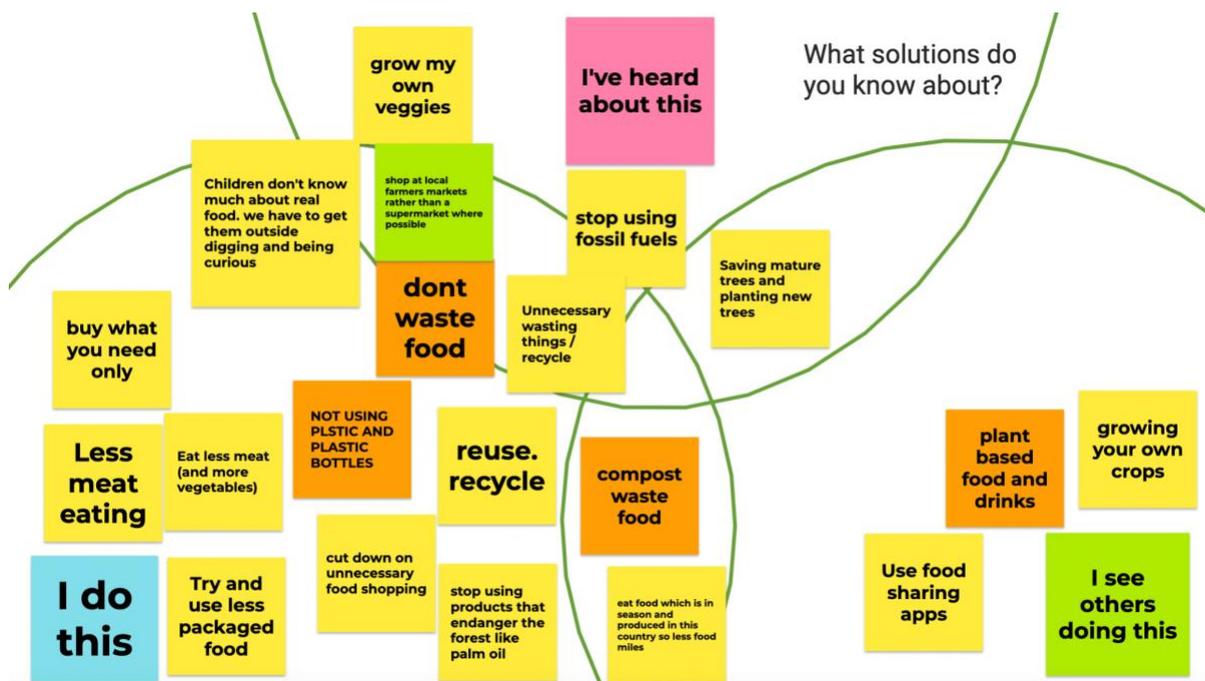
Two have tried eating insects, showing some adventurousness. *I get it sounds gross but you can use them to make protein powder and put it in your veggie curry and know you are getting protein* (A, female). One (E, female) suggested that if advertisers explained insects were already in your food colouring, it could help people get over the stigma, and another said *insects sometimes feed off faecal matter which would put people off for life so it's not going to catch on* (J, male.)

Like the younger secondary students, this group wanted to discuss the solutions at length, finding them stimulating. For example, they discussed GMO foods, exploring the pros and cons and drawing on existing knowledge about Greenpeace campaigns and from the media.

Actions they might take now

They talked about avoiding food waste, thinking more about their food choices, buying local, eating less meat and trying to eat an insect-based meal.

6.3.4 Families



Solutions they already know about and practice

All families described ways they make efforts to be less harmful in their practices, for example, searching out locally grown food or reducing food waste. However, only a few individuals avoided meat and dairy products or referred to a plant-based diet. Some referred to other actions to tackle the climate crisis, beyond food practices.

Views on the suggested solutions

There was near universal support for regenerative farming, schemes to end food waste, and greener aquaculture, and community-supported farming. They asked neutral questions about these solutions because they were new to most. These solutions appealed because they also ticked boxes of social justice, important to this audience: *The food waste solutions are amazing. If you aren't going to use it to give it to someone who will. I help out a lot with food projects, going to Pret to pick up unused food, but an app or seamless system would help.* (E, parent, London)

A few had doubts about how they would help urgently enough on a global scale: *Regenerative farming was in practice some years ago but it was stopped, as it was expensive, as it takes more time as the soil has to be replenished with crops that bring less money.* (W, parent, London)

High tech greenhouses, GMO foods and eco-labels were the next popular solutions, in that order, with eco-labels raising the most questions.

- *I like the greenhouses because even just eating one more vegetable every day will still protect the climate more.* (O, child, London)
- *Eco-labels really struck me as it would help to make a decision.* (A, parent, London)
- *I wasn't sure about eco-labels as with the dolphin-friendly tuna you couldn't tell if they were telling the truth.* (T, child, London)
- *I'm a bit unsure about the eco-labels because maybe companies will use them to greenwash.* (K, parent, London)

Eating insects and Lab-grown Meat were the least favoured, although some wanted to know more about them, or to taste them.

- *We didn't like lab grown meat, it feels artificial.* (J, parent, London)
- *Lab-grown meat sounds interesting, and I'd like to visit the lab and try it.* (K, child, London)
- *I come from a culture that eats insects, even though I don't eat them as I find them gross, so that's an easier sell for me. It's easier for some people to adapt to that.* (I, parent, London)
- *The insects, it does sound like a great idea but...my son said, don't they spread diseases?* (A, parent, London).

Her children said they had tried crickets, ants and mealworms on a camp: *we usually have scorpions but because of Brexit we had to have crickets instead.*

One parent suggested that if animals can be treated well, and used to improve soil, we can still eat meat in moderation: *I just don't like alternatives to meat, I never like the taste of them. I like to associate my meat with animals roaming on green hills, not grown in a lab.* (I, parent, London)

Actions they might take now

Several talked about getting involved in community projects:

- *We all live busy lives and especially during Covid, we've retreated. I don't join with people enough to discuss what we can do. There's a lot of us versus them, blaming others. We have to understand it as a collective and take action with others.* (G, parent, London)
- *Joining up with projects in the community that are already happening. Near us there are allotments. It's small things, and if you all do small things together it will make a change. It's wanting to make the difference, knowing that it's not always easy.* (L, parent, Yorkshire)
- *I want to help a food charity raise money, so I can help local people in need. I don't have the bandwidth to do more but I can support those projects.* (I, parent, London)

Some feel that the Earth crisis is so severe, we need radical imagination:

When I saw the headlines about the Amazon reaching a tipping point, I looked at our Victorian houses and thought we could turn the fronts of our houses into vertical greenhouses. (G, parent, London)

Some children echoed this, calling for complete changes of habit: *Don't buy food with plastic. Animals can die if they get their heads stuck in those rings.* (O, child, London)

6.4 What engages audiences?

6.4.1 Independent adults

6.4.1.1 Sources of information

Inspiring schemes and initiatives

When discussing sources of learning, some participants spoke of schemes and initiatives they had actively participated in. One participant had taken part in the Concern Worldwide Ration Challenge, a week in which: *...we ate the diet that refugees live on in a refugee camp. It was mainly rice and chickpeas. I was never hungry.* O, male, 55-64

Through taking part in the challenge the participant learned about cooking from scratch, for example, by making simple flatbreads from flour and water, as well as gaining experience of what it was like to live on a low waste, mainly plant-based diet.

A scheme that was mentioned by several participants was the Real Junk Food Project, a food waste redistribution scheme (see section 1.2.2). Participants who volunteered for the scheme had seen for themselves how much food is wasted and were passionate about the need for everybody to stop wasting food.

...so I joined one of his [Adam Smith, of The Real Junk Food Project] apps and I do that. So, go and pick up stuff around the area and so just little things like that, you know. If everybody was doing that rather than just a handful of people, then you reduce the amount of food waste. B, female, 25-34

A further example of learning through action was through involvement in the Green Impact Scheme, a scheme designed to support environmentally and socially sustainable practice within organisations. Working in an estates and facilities role within a university, one participant who had been involved in the scheme described how different departments within the university put forward teams that try to make the department more green and implement actions within the department with the aid of training and support. Reflecting on her engagement with the scheme, the participant commented:

[it] does make you consider things a bit more when you're sort of doing research and encouraging others to live slightly more sustainably through that programme. You just find that you look things up a little bit more, you learn a little bit more.

In these instances, participants had not just learned about these initiatives, but had been involved in these initiatives and movements in some way so they had learned through action.

Television programmes and documentaries

Documentaries and television programmes were identified by the majority of participants as sources of information and learning about food and the planet. Several participants mentioned *Seaspiracy*, a Netflix documentary about the fishing industry emphasising the cost of fishing to the oceans and the planet and older participants in the focus groups spoke about *The Animals* as a powerful documentary that had a lasting effect on them in the 1980's. Participants also reported watching documentaries with a more specific focus. For example, one participant had recently watched a programme on the vulture population in India and had learned how, due to use of cattle medicine poisonous to the vultures, vultures feeding off cattle carcasses had died and vulture numbers were in huge decline.

In addition to watching topical programmes with the explicit focus on learning about climate change issues, a number of participants reported watching interest programmes which did not directly cover, but sometimes crossed into environmental or food sustainability issues. For instance, one participant said they regularly watched *BBC Click*, a series showcasing new developments in technology within new media and the internet. Although primarily a technology programme, through watching this programme the participant had learned about high-tech greenhouses. Similarly, several participants reported watching *Countryfile*, a television series about nature and rural issues. One participant reported learning from *Countryfile* about a reduction in the numbers of specific types of birds, while another had learned about how some farmers were leaving the edges of their fields untouched for wildlife and drainage. Again, the focus of the programme was not solely on climate change and sustainability but, learning about climate change occurred because of its crossover with nature and rural issues.

In addition to watching programmes through television and through the streaming service Netflix, identified by several participants as a good source of documentaries, some participants also mentioned watching videos on the online video sharing and social media platform, YouTube. For example, one participant described following a number of cooking channels on YouTube and learning about climate issues through this interest in cooking. *I used to watch a YouTube Cooking Channel called Bon Appetit and they have a chef who is very much into kind of natural things, lots of fermentation and wild things. And so I saw this series where he goes out to visit lots of business people and...a farmer [who] did all those regenerative farming methods. I guess that's one of the places [where I find out about food sustainability and climate issues] because I love cooking so I enjoy watching, not just cooking videos but things around food as well.* L, male, 35-44

Also on the topic of cooking, one participant reported listening to The Food Programme on Radio Four which often included coverage of the impact of what we eat on the planet. Another participant reported watching a celebrity dinner party programme where diners strived to select the items from the menu that were the least environmentally harming.

It was quite well done and it did make you learn things and since then I found myself looking at, you know, the packets of food a lot more than I used to and seeing where things have come from. B, female, 25-34

In sum, while some participants did watch programmes that directly addressed topical issues, in many cases, the route to learning about food sustainability and climate issues was not directly through an interest in those issues. Instead, participants were exposed to information about food sustainability issues as a by-product of their interests and hobbies.

The BBC

Many participants stated that they learned some things about climate change and food sustainability issues through the news although this was usually mentioned alongside a range of other sources such as documentaries. The term 'the news' was framed as synonymous with the public broadcasting service, the BBC. Participants expressed mixed opinions regarding the news as a source of information about climate change and food sustainability issues. One participant reported there was too much news coverage about climate change and that this saturation made them not want to engage at all. Conversely, others commented on how climate coverage in mainstream news was light and infrequent, and that it could only be found in specialist sections on the BBC news site.

- *I notice stuff when it sort of bubbles up in the news occasionally, and I do pay attention when there's that.* D, female, 35-44
- *...but it doesn't come up in news articles or anything like that. If you look at the BBC news page, there are environment sections and people talking on podcasts but it is not like mainstream.* J, female, 25-34

Notably, if content about climate change and related issues is presented in separate sections of the BBC news site rather than as headline news then people visiting the BBC will only be exposed to climate change information if they seek it out. Consequently, those people who may want to avoid engaging with topical issues because of their fears about the size and complexity of the climate crisis would be able to read the main headlines without exposure to climate related content. The additional motivation and action required to access climate change content is unlikely to be undertaken by those who are already uncomfortable about the topics being covered. There is a risk that if the BBC are not presenting climate change and food sustainability issues as mainstream news then people might perceive that these issues are not that urgent. Combined with the lack of government restrictions for big business or policies for the public to help address climate change issues (see section XX), a lack of mainstream coverage of climate change could send the message that the climate crisis is not that serious and that immediate and significant action is not required at present.

Social media and newspapers

Although some participants reported encountering information about climate change and food sustainability issues through social media, most commonly Twitter and Facebook, this was typically described as information they came across by chance rather than because they were actively seeking information about climate issues through these channels.

Well, you know, you definitely see things that come up on social media and the news on the internet and stuff like that. R, female, 55-64

One participant did report finding out about climate related issues via targeted advertising on social media.

I do find out about things on Instagram and Facebook and I do know that it's through their targeted advertising because I've been online looking at something like local veg box delivery and so they know I'm into recycling or farm shops or whatever that topic maybe.. A, female, 35-44

In this instance, the use of targeted advertising was viewed as useful to the participant, facilitating them to live a greener lifestyle. However, wide use of targeted advertising means that individuals whose search history does not indicate an interest in climate concerns will not be exposed to content, through advertising, that would help them learn about these issues.

The low use of social media as a source of information might reflect the older age group of the sample interviewed.

The online written content most frequently referred to by participants as a source of information was newspaper sites, in particular, The Guardian (see section XX on perceived credibility of sources).

Books

Some participants identified books as a source of information about climate change.

There are few books you can buy. I saw one in Iceland [supermarket] about 'Buying Green', and on how to recycle...I picked a few up from second hand book shops. W, male, 65+

Two participants said they had read *Wilding: The return of nature to a British farm* by Isabella Tree. The book tells the story of a rewilding project in the UK and was heavily promoted by The Guardian.

Fiction also featured, with one participant citing Harry Harrison's 'Make Room! Make Room!', later filmed as 'Soylent Green', a book that engaged them with food sustainability when it was published in the 1970's.

Other sources of information

Another source of information and learning identified by participants was campaigning literature received through their subscription to a charity with two participants saying that they subscribed to Greenpeace. In addition, one participant reported subscribing to the New Scientist magazine which includes content on climate change. A further participant reported attending a public lecture on social degradation and having read academic books and papers on climate change as a researcher in the area.

Perceived credibility of sources

When participants discussed sources of information and learning about climate change and food sustainability, some concerns were raised about the credibility of information.

Well, we all use social media, all of us, even I use it...So you get one or two things off there but there is a caveat for that...fact check everything. I try and read the right material. I don't read the Mail. I don't read The Sun or the Daily Mirror and I don't read anything that's trying to sell me something. I read the Guardian because hopefully they're trying to give you a balanced picture but even they have some agenda. So you've still got to check to make sure that what people are telling you is right. M, male, 65+

One participant reported not using the internet to search for information about climate change and sustainability, instead preferring to learn about these issues from books. This perhaps suggests a feeling that the internet is not a reliable source.

The challenge of accessing credible information and being confident in the trustworthiness of that information may underlie the preference for mainstream documentaries and television programs as a key source of information. Interestingly, none of the participants appeared to question the position of the BBC on climate change and sustainability, framing the BBC as a neutral source of news. While the BBC website does state a commitment to being impartial in their outputs, this is qualified by the phrase 'due impartiality' which has a looser definition than full impartiality (<https://www.bbc.co.uk/editorialguidelines/guidelines/impartiality/>).

6.4.1.2 How do audiences like to learn about these issues in a museum?

Stories

Adults were very keen on the idea of educating through stories.

Food brings people together

Although not often explicitly connected to how participants like to be engaged with food sustainability issues, many participants talked about the importance of eating in their lives in terms of connecting with others.

Tonight I've got my three children and grandchildren and the bottom is 13, but my most happy times are when we're together as a family, all of us. And we're all eating and we can all sit down and chat and share and it's absolutely brilliant. And I think that's what brings families together, food and things like that. M, male, 65+

Our relationship with food

There was a sense that people had lost their connection with food and lost the connection with where their food comes from. Participants highlighted the value a museum could bring in encouraging people to stop and reflect on their – and UK society's – relationship with food. Several participants suggested telling the whole story of how a particular item of food made it onto your plate.

Get people thinking about our everyday engagements with food...our food is so packaged and processed...if you understood how much land it took to produce this object in front of you or something, like something that shows the scale of things will be really interesting. D, female, 35-44

One participant suggested that the story of the journey of food to our plates could be broken down in stages and at each stage the museum visitor would be able to see the alternative actions or processes that could be taken and how these are better or worse for the planet. This would allow people to see how a number of small changes at different points in the story could, together, make a difference to the impact of food on the planet.

So you would allow people to kind of see, okay, this is what happens now. But what if I chose this option and then it would show you how to get it from the farm down the road, grown sustainably not covered in plastic, blah blah, and they see it is possible that these little small changes add up to one big change. A, female, 35-44

Similarly, another participant suggested a sort of installation where the visitor was the scientist and by playing this role, they could look at food differently.

I can imagine, you know, people going in, you know, come in and be a scientist, put on a white coat and actually go in and look at this, and look at a piece of meat, and then start to think about where did it come from? And did you realize you can make it in a lab? And here is an example. E, female, 45-54

Other stories included hearing the voices of those involved in the production of food and who might face risks to bring us the foods we take for granted. Talking about the role of child labour in the production of chocolate one participant described: *Seeing the journey of food, like you're holding the cocoa beans and the children in the Ivory Coast showing, for example, how cocoa becomes chocolate, why it would be such hard work for children to do that, or, you know, why it's hard work for adults to do as well.* (R, female, 55-64)

Learning from the past

Several participants spoke about the need to step back and look at the wider picture of how we live now and how things have changed over time.

- *Is it only about the future of food? It should include the past.* (F, female 65+, focus group)
- *I think it would potentially be interesting to look backwards through history as well. Where we came from and where we're going to. Because the other thing that you have to do is align it with the reality of the growth in population. And, therefore, what's got to be supported?* (C, male, 65+)

Several participants suggested telling the story of how our relationship with food and our eating habits have changed over time: *It would be good to show the food we lived on 70 or 80 years ago. We were supposed to have been healthier than than ever in history, and how food has changed in periods since then. And link that to how human health has changed, and if there is any correlation between the change in the planet.* F, female 65+, focus group

One participant suggested an interactive map to convey the timeline of how and when different foods originally came from different countries.

Learning from other cultures

As well as looking to the past, one participant suggested drawing on stories and ways of living from across the globe so we could learn from other countries and communities where the relationship with the land is more balanced.

- *I think we're probably eating more meat than we ever have because in the past, we had such a reliance on the environment around us and we worked with the environment instead of against it. Can we think about communities elsewhere in the world, tribes that maybe hunt animals but because they work with the land around and they do it in a very sustainable way? How are they connected with fruit and vegetables locally and bringing that back to the UK?* (N, female, 18-24)
- *I'd like to hear stories about indigenous people, for example Native Americans and nomadic Scandinavians who would use what was there but move on and let the natural world regenerate. We're so fixed into an urban society so people need to be inspired to not regard the countryside or natural world as something for humans to exploit.* (B, male, 25-34, focus group)

Making the issues feel relevant and close

Consistent with the sense of food sustainability issues feeling like something distant, participants talked about the need for a UK angle on food sustainability illustrating its relevance to the UK context.

There needs to be discussion around how it will impact the UK, and all like scarcity and that sort of stuff, because it is sad to say, but people only really care about themselves. A, female, 35-44

Participants often mentioned the need for the museum to speak to young people which would include making it clear to young people how climate change and food sustainability are relevant to them

Education to young people especially is needed. Things that apply to them personally, not just far away, so macro and micro. G, male, 65+

The need for a UK focus was highlighted by another participant who emphasised the current lack of UK focus in documentaries and other sources of information available to the public.

[You] don't see that many documentaries or things that are local to the UK. A lot of the time it's very Americanized. For example, in Scotland we have mountain ranges that we keep sheep on that we would not be able to have farm land on. Does that mean it's sustainable? Or does it not? I think it would be interesting to bring the animal agriculture debate closer to home, and more local and comparing it to food miles. N, female, 18-24

As well as making clear how issues relate to the UK, some participants raised the need to make people care about the issues and in order to do this, connect with them emotionally. For example, one participant suggested telling a story beginning with a beautiful bird, and then telling the story of how that creature's life is being destroyed by climate change and slowly unravel the picture. In this way, a museum could help people see how the current ways of treating the planet are harming something that they care about and that is emotionally relevant to them.

Objects and installations

When discussing the museum's contents, several participants spoke of the potential to include larger pieces, perhaps shocking, that would help make the issues real to visitors. Most commonly mentioned was a small-scale working version of a high-tech greenhouse, because people don't get to see such things to understand how they work.

From a waste angle, one participant suggested an installation to experience walking into a waste disposal centre. Also focusing on waste, another participant suggested a piece of artwork made from a year of one person's wasted food.

Activities

The most commonly mentioned activities related to cooking and eating. Participants suggested running cooking demonstrations where chefs create dishes from planet-friendly ingredients which might include cooking using insects or lab-grown meat. Visitors could have the opportunity to participate in the cooking and then to try the dishes. As well as trying food prepared and/or shared in the museum, participants also suggested selling insects in the café or shop so people had more opportunities to try eating them. One participant suggested bringing in celebrity chefs to help promote the idea of eating insects to visitors who would need a lot of persuading to change their eating habits.

Solutions and hope

Consistent with the feeling that issues of food sustainability and climate change can feel complex and insurmountable, participants expressed that a museum on these topics would need to emphasise solutions and messages of hope.

I think you've got to get the balance right between the misery and the success stories. If it's all, isn't it awful, everybody's living in poverty and it's all horrible. I know that perhaps we feel we ought to be concerned about that but it's actually a bit of a switch off. I think you have to try to get the balance right between, saying that this is a hugely serious problem and trying to put a positive spin on it, on people whose lives have been transformed. I, male, 55-64

Audiences

Because of the national importance of the message, a food museum needs to reach large and diverse audiences: *[The reach of the museum] should be broad, not just London or the bigger cities.* O, male, 55-64

One participant suggested it could have a touring element while another spoke about presenting Late events to attract a different audience than in daytimes. Consistent with the focus in solutions on the importance of educating and engaging young people about food sustainability issues, the majority of participants emphasised the importance of designing the museum so it is attractive and engaging for children.

6.4.2 Teachers

What engages students?

Two factors, relevance and novelty, were raised by teachers as affecting the extent to which young people would engage in topical issues.

Relevance

Teachers tended to classify solutions into those they perceived young people would have an interest in or a connection with versus those they would not. There was a sense that young people needed to be able to see what a solution means for their own lives in order to engage with it.

- *For young people, the solutions that they can engage in will be the ones that seem most relevant to them...where any YP can act, get involved in and partake in...They can see in their own communities...community food projects, whereas something like high-tech greenhouses⁶⁵ or aquaculture innovations, although they are a very important set of cogs in the machine for making change happen, the young people aren't able to be close to these. (S)*
- *It can be made interactive, really relevant to really see what it means for you and your own life in your world rather than something that just feels far away. (O)*

If students can apply learning to their own lives, it will sustain engagement and deepen learning: *Learning in the abstract is fine but students engage better when they are able to explore their own values and attitudes. (H)*

In order to be relatable and relevant, learning around sustainability needs to account for students' different backgrounds: *For young people from the big cities, they often feel like people are not concerned about them...even their teachers...but if any interest is shown to them and their future and where they're going, they will respond to that. (O)*

This point highlights the need for all young people to see themselves represented, not perhaps just their more privileged peers. This also has implications for who is narrating any stories shared in the museum with the need to ensure that the narrator is relatable. As one teacher said: *Also, [it would be good] if stories could be communicated by real people, not politicians or lecturers. (O)*

Connected to the issue of relevance was the question of how immediate or urgent climate change and food sustainability issues appeared to be. As with the analysis of adults, there was a concern from teachers that young people seeing climate as temporally distant will be a barrier to their engagement: *Perhaps the biggest challenge is the slow pace of change...young people need to be able to see results in the short term. (H)*

This barrier might be reduced by giving young people a way of thinking about the future that makes it feel more tangible⁶⁶. One teacher suggested asking the following: *What would you say to your son or daughter 10 or 20 years from now?...What would you like to have? What would you like the world to be like? How would you like health to be? They respond to that brilliantly. (O)*

⁶⁵ In fact these were popular solutions when young people were consulted

⁶⁶ Since our interviews with teachers, there have been a number of extreme weather incidents across the globe and reports of scientists shocked that catastrophic climate impacts have arrived long before models predicted. Perceptions of temporal distance may no longer apply so strongly.

Novelty vs. Importance

There was a sense that young people would more readily engage with novel or unusual ideas due to their shock factor. However these ideas were not necessarily the topics they most needed to learn about: *The solutions that they would be really engaged with aren't necessarily the ones they need to know about. They would be keen to talk about GMO, eating insects, and eco-labels...[But] high-tech greenhouses, aquaculture and regenerative agriculture...I think those topics just wouldn't engage them now.* (O)

However, some teachers thought that the more unfamiliar or controversial concepts such as eating insects or lab grown meat, could be used to harness young people's attention in order to educate them: *I think that it would be a really good place to introduce things like eating bugs, or growing lab-grown meat... Actually, it's weird...you can use that weirdness to hook them in but then educate them at the same time.* (K)

A museum of food to engage students

Overview

Teachers may use exhibitions and programmes differently from adult visitors, but as adults they share preferences and ideas. They were particularly interested in how to empower students to make change, which was echoed somewhat by parents. (Note that young people themselves were more focused on making change directly, rather than seeing museums as agents for social change.)

In alignment with all audiences, teachers' suggested that the museum should be interactive, experiential and hands-on with opportunities to learn about and taste insects and lab-grown meat. Teachers gave emphasis to activities that involved decision making and learning about the consequences of different decisions. By empowering young people to make informed choices and instilling in them the faith that they can make a difference in the world, education, formal and informal, may hold the key to fostering their ability to make change in themselves and others.

Objects and installations

Some teachers saw the museum as an opportunity to showcase those things that were possible in a museum but not in a classroom. An example of this included a high-tech greenhouse installation:

Talking about the sort of futuristic methods and food production, people aren't going to be able to tangibly see that, but they could do at a museum. So, thinking about vertical growing, they could be set up as an installation. This would attract people and show them something they don't usually get to see so it feels real. (S)

Activities and stories

Teachers also suggested that the museum include coverage of new food sources – insects, lab-grown meat - as well as plant-based foods with opportunities to taste these.

As in the adult interviews, teachers also emphasised the importance of the museum being interactive

- *The more interactive it is, the better young people will remember the experience, especially the very young.* (D)
- *Hands on wins every time.* (H)

Teachers demonstrated a passion for equipping young people to cope with a changing world and to make responsible choices and this was reflected in their suggestions for activities: *I am also interested in educating young people about current issues so that they can make informed choices and decisions about their own lives.* G

These include:

- an interactive flow chart where you can press an arrow and see what consequences a particular decision would have, e.g. if I buy X, if I throw this packaging in the bin rather than recycling it.
- a waste sorting activity where young people could create creative business proposals on how it will be used/distributed

Other suggestions of activities included:

- a "supermarket sweep" activity where they could shop for more sustainable/eco-friendly foods
- a Masterchef challenge using environmentally friendly ingredients
- creating cross curricular links such as Economics, food consumption, understanding how consumer choices in the UK have effects in other parts of the world.

Overall, there was a sense that changes in human behaviour could lead to positive change: *One person can't deal with the whole problem, but we can encourage everyone to do a little bit and then with these little chunks you can make a big impact.*S

This was always presented with the qualifier that we *all* need to behave in a way that is conducive to change: *I think that we need to try and educate/encourage a better culture of "accountability" and make people aware that these are all of our issues/problems and we do have the power to address them.* G

Young people as agents of change

Why they can or should have agency

Teachers saw the potential for young people to play an active role in tackling issues of climate change and food sustainability: *In terms of young people as advocates of change, we've seen recently with teenagers getting involved in climate change, you know, you get a young person who is eloquent and can get their message across and people are suddenly interested because it's not just your run-of-the-mill politicians saying the same thing - we are talking about people who are going to be the adults of the future.* (S)

This sense of young people's voice and actions having a role in consciousness raising among the general public was reflected in the adult interviews: *I do think [with] Extinction Rebellion...this was the first time that...people were hearing it.* (J, female, 25-34)

There was a sense that engaging young people in climate change and food sustainability issues was especially important. One reason for this was that young people have a vested interest in the issues – an interest that has been encouraged by young people's climate activism in recent years - and a vested interest in how these issues will impact their future: *Most young people have a real interest in food sustainability and looking after the environment. I think the protests really did sort of spark something in young people, and they definitely have more climate concerns and perhaps my generation did when we were at school. So, I do think they engage quite well with anything related to food or climate.* (K)

There was also a sense that young people might be more flexible in their thinking about climate issues than older people: *Whilst it may be too late to change the minds of older people, I think it is important to educate young people as they are the future going forwards.* (G)

Further, consistent with the adult interviews, teachers spoke about the cascading effect of the young people's learning and action onto their parents. When talking about eco-labels, one teacher said: *It's something that they can identify to say, go food shopping with parents and things they can point out to parents. So, then education is not just being passed on to the children, but also to families as well and it's something they can identify with in their everyday lives.* (K)

Challenges to their agency

There are challenges in young peoples' abilities to judge the credibility of sources. One teacher spoke of ill-informed opinions being a barrier to young people taking action on climate change: *I would say a massive barrier is misinformation and ill-informed opinions due to social media bots etc. Lack of awareness of how to tell the difference between scientific fact and opinion means that there can be a lot of resistance from others and there could be conflict at home/parental influence.* (G)

Also, one teacher commented on how the Covid-19 pandemic has put pressure on young people and that the stress they are under currently threatens the chances and potential for them to take a more active role in issues: *Let's say a class where there were less worries, I think they would be quite happy to get involved in projects that supported community supported farms and ending food waste in particular. However you know, given the past 18 months, some students are struggling and would not be in a place to engage with these issues in this way.* (O)

6.4.3 Secondary students

6.4.3.1 Younger students

How they learn about these issues

Time was too limited to find out how they learned about these issues, and their preferences. Their teacher said that much of their knowledge would come from Geography lessons, which was a strong subject at the school. The students' ideas suggested that young people are strongly influenced by shops, commercial products and food as it is available to them in their environment.

Imagining a museum of food for the future

They came up with a range of ideas that did not limit themselves to a museum per se.

- One group became very excited about forming an alternative brand, VcDonalds, with plant-based food that is cheap and delicious.
- A museum shop would be 'AF Store' - animal-friendly.
- Another wanted to create a beautiful island of food, a kind of paradise showing what was possible.
- Another had many ideas that revolved around food tasting, cooking clubs, a cafe full of food pictures, and a daily sculpture of frozen food.
- Another wanted to create a big edifice made of a giant banana and apples to make fruit more attractive than meat.

When presenting, they talked about wanting to make a direct change, through high street chains or large-scale public installations rather than through museums.

6.4.3.2 Older students

How they learn about these issues

This group referred to messages reaching them via Tik Tok, peer-to-peer conversation, short powerful films and documentaries (e.g. about microplastics, livestock farming and overfishing⁶⁷). They also referred to campaign organisations such as Greenpeace.

⁶⁷ Cowsspiracy and Seaspiracy

One talked about how her habits were strongly influenced by her family but: *Eventually through school and other places, I saw videos...*

Imagining a museum of the future of food

Like the other audiences, they wanted museum experiences to include food tasting (insects) and explanatory visualisations (e.g. freshwater use compared).

However, they had distinctive ideas about effective stories of ordinary people succeeding in challenging environments, or of accessible but scalable actions that people can take (e.g. how to get into community farming), rather than high tech futuristic solutions that require extraordinary resources:

- *It annoys me a lot of the time when the focus is largely on this cool new tech innovation that is going to save us and not on farmers and the people who are actually making the changes.* (L, non-binary, 16-19, focus group)
- *If there were local stories that might be more effective but even if it was somewhere really different then people might still think they are interesting.* (AB, female, 16-19, focus group)

They suggested powerful messages about topics such as microplastics or water usage, and including an element of shock or alarm.

6.4.4 Families

How they learn about these issues

Parents see that informal education such as museums, games and TV have an impact on children, and want its positive impacts to increase. Some parents want to see forms of engagement that build social connection, such as community gardening, as opposed to indoor and screen-based activities.

Some wanted food producers to be more involved in public communication in ways that would force them to be more transparent and ethical: *I'd like an emphasis on companies. Things like palm oil, or feed given to animals, make people inadvertently destroy the environment. The companies need to be more open and involved in explaining how they're producing food, so consumers have more choice.* (K, parent, London)

Children like to learn about things through games, films or visual storytelling:

- *A monkey telling stories about a farmer who lost his farm, in anime style.* (child, London)
- *I like all the game ideas because my mum doesn't like games.* (B, child, Yorkshire)

Imagining a museum of the future of food

Of all the audiences, families (especially children) were the most inspiring in their ideas for museum engagement. They wanted experiences about future impacts and solutions more than about past histories, compared to adults. They suggested adventures, such as daring eating challenges.

A greenhouse that grows food, and they make meals and you can eat it, with information about it while you wait. (M, child, London)

As with all other audiences, their ideas for a museum of future food were about activities more than displays or objects. Some want museums to use very hands-on activities to educate about solutions, such as a greenhouse where visitors can fly drones; a food waste exchange; challenge games with points to spend on the most eco-friendly shopping basket. A parent and child drew a 'Grub bar', a cocktail bar that sold delicious insects as snacks, inside a museum.

Slightly more than the other audiences, both parents and children emphasised the need for more positive messages in communication, not just about solutions but how to support them:

- *We sometimes amplify the bad, so we need to focus on what good looks like.* (I, parent, London)
- *A lot of the time it feels out of people's control, as it feels too big, so they need to tell people the things they can do at home that will make a big difference on a small scale.* (T, child, London)
- *There's a lot of doom and gloom about climate change being out of control, so get to all age groups and present positive messages. Use presenters like those twin doctors, who are accessible.* (A, parent, London)

Others emphasised the value of technology in museums: *It's about educating, getting people to learn where food comes from, the processes, and what alternatives there are. The media has such clout and influence. But, so do galleries, you're captive audiences in a space, and in museums you can learn by having fun, rather than just preaching. Tech is the way people are engaging now so get the message through tech in a fun way.* (D, parent, London)

Technology can enable immersive visualisations that show future potentials, for example, of biodiverse farming, or the impact of different food systems:

- *A big simulation of compounded impacts of industrial farming, and deforestation for meat, showing how it will affect the planet over time.* (D, parent, London)
- *Showing how we can make lots of different choices and end up with an even better scenario.* (A, parent, London)

Both London focus groups generated ideas suitable for urban families. How to manage small-space food production was popular:

- *How to grow food on a tiny balcony space, it's apt for a city. People who don't have gardens need to get actively involved.* (K, parent, London)
- *Museums could do podcasts or instructional videos.* (J, parent, London). Her daughter added; *And they could have kits in the shop so you could take home plants to grow at home.*

A final appeal was made for museums to consider their whole footprint: *Museums sell a lot of rubbish in the shops, little plasticky annoying things. They need an overhaul of what they sell. Improve not just what people come to see but what they take away.* (K, child, explained by parent)

6.5 Talking to professionals

6.5.1 Context of UK food systems and culture

UK culture is very individualistic and people are encouraged to think of themselves as consumers rather than citizens. Food is very commodified and so the strongest messaging about food is through advertising from manufacturers, supermarkets and chain restaurants. Its low ranking on the Food Sustainability Index is in part due to the availability of Ultra Processed Food. 50% of all UK food is Ultra Processed compared to 13% in Italy. But there are signs of growing awareness and change. The National Food Strategy, an independent review to set out a vision and plan for a better food system has made proposals to tackle the 'Junk Food Cycle' and the 'Invisibility of Nature', and the Government has also announced a plan to tackle obesity.

Multiple research projects show that public concern for sustainability in the UK is not matched by behaviours⁶⁸. A caveat to this is that mainstream research rests on assumptions that environmental action is mainly in the hands of

⁶⁸ For example, see 'Attitudes and behaviours towards sustainable food purchasing', DEFRA, 2011 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/137736/defra-stats-foodfarm-food-attitudes-report-110406-execsummary.pdf

consumers, with much research examining psychological barriers to lifestyle change. More recently, [critical approaches](#) identify that consumer change depends on social, legal and political systemic change, and that consumer change is only part of the story.

The forms of public engagement that seem most effective include powerful broadcast stories such as the Attenborough Effect with Blue Planet, and placing messages in the places where choices are made. The UK public do respond when planet-kind choices are made clear and easy for them. For example, Christina Potter of Oxford's LEAP project analysed 56 international studies on the effectiveness of ecolabels - food labels on ecological footprint. Regardless of an ecolabel's message or format, participants were more likely to choose the product with an ecolabel in 79% of experiments.⁶⁹

We talked to 15 UK-based professionals in public engagement and food sustainability. See appendix for names and affiliations. Ten took part in two focus groups, and five shared their views in writing.

6.5.2 Key findings

Profound lack of food system knowledge

Many of the professionals were certain that there was a profound lack of knowledge in the UK public about food, farming and food systems. The public who responded to our survey were museum audiences and interested in food sustainability. The higher they rated their concern, the more issues they showed knowledge and concern about. These professionals work with wider demographics, and therefore were talking more about the general population in terms of their knowledge.

Rene Meijer, CEO of Food Works Sheffield feels that: *the commodification of food is a major issue...Most people lack the skills, knowledge and confidence to source and understand their ingredients and make them into a balanced diet.* Similarly, Stephen Foulger wanted to challenge: *the stale, disingenuous rhetoric that supermarkets are 'just giving consumers what they want'.*

Clare Brass said: *In my work, I've noticed that people don't realise that food is the biggest and most important way they can address their environmental footprint. People don't understand anything about soil. The extent of understanding about their shopping basket is how much plastic there is.*

Referring to food campaigners, local authorities and farmers coming together in Fork to Farm Dialogues, Duncan Williamson said that: *People don't talk to each other and assumptions are made...and [in the Dialogues] we've found that the assumptions are nearly all wrong.*

- *I think many people don't actually know an awful lot about how food production, processing and transportation impacts the planet.* Stephen Foulger
- *Part of the National Food Strategy youth consultation we did, the young people said nobody ever told us that food impacts the environment.* (Florence Pardoe, Food Foundation)

This lack of awareness in young people lies in gaps in the education system, for example, the separation of geography from food science and health education.

Everyone knows something about food so it's a good starting point

⁶⁹ <https://theconversation.com/food-and-drink-products-with-pro-environment-ecolabels-are-more-appealing-to-shoppers-new-research-157260> and <https://www.leap.ox.ac.uk/home#/?>

We are all food consumers, so it is not an entirely abstract subject. Learning can be constructed from our personal experiences, habits and cultural knowledge. Stephen Foulger made the important point that food is a way to broaden audiences for museums, as well as to engage people with sustainability issues: *I'm interested in reaching audiences with low science capital and little engagement with museums and critical media. The universality but specific and deep cultural resonances of food make it a great way to interest more people in science, technology, critical thinking, culture and museums.*

Food engagement can play on both disgust and delight, and it is important not to demonise food choices (such as insects) that might be imagined as disgusting. Ollie Hunter exclaimed that “it’s ultimately all about flavour”, that people’s food habits can change if they can taste and see the potential for deliciousness.

So, food sustainability is a field with many gaps in public understanding, but its relevance to people’s lives and future thriving is a route to growing Science Capital, Cultural Capital and environmental action.

The UK public needs to know of the complexities AND easy actions

Our interviewees were aware of the need for international collaboration on this complex issue, and the importance of public education. For example, the UN’s Food Systems Summit in September 2021 aims to raise awareness and elevate public discussion about how reforming our food systems can help us all to achieve the SDGs by implementing reforms that are good for people and the planet.

Ollie Hunter talked of three revolutions that the public need to be involved in: a revolution in perceptions of food for human and planet health; a decentralised, soil-based growing revolution; and a revolution in logistics for shortening the supply chain.

Duncan talked of three problems that people need to be engaged in overcoming: antagonistic tribalism between food camps; failure to see the urgency of climate breakdown; water misuse and future impacts of drought on soil.

Florence listed problems: *“ecosystem functions, pollinators, soil health, pesticides and chemical use, and also climate change and extreme weather causing crop losses fluctuating food prices,”* but went on to say that these are non-tangible and hard for people to know how to act on them in their daily lives. In contrast, a fact such as that 70% of UK food waste happens in households is concrete and empowering.

Food is culture, and culture is a rich and deep way to engage people

Food is not nutrients. It's a vast range of relational processes holding together microbiome, soil, agriculture, family, ceremony, and communication. Nora Bateson, International Bateson Institute⁷⁰

The professionals were aware of the spectrum of solutions from personal domestic choices and the big levers that can only be pulled at a political or legal level. Between these two ends of the spectrum lie solutions that bring communities and sectors together, and that harness Culture to create shifts in culture.

Maddie and Cherry (Custom Food Lab) see the role of culture to overcome *“reductive and linear narratives around food systems”* by hands-on activities *“seeing the world as an abundant food source, connecting bodies to the earth through food...[and] commoning practices”*.

⁷⁰ Facebook post, July 9th 2021

Steve Slack suggested we can “*look to culture and heritage for ideas*” and learn from the past: *We’ve lived healthier and sustainable lives. We’ve eaten and disposed of food close to us. Diets have not always been healthier, or enough to eat, in the past.*

Duncan told us that the English breakfast was only invented in the 1920s. *“People didn’t used to eat 3 meals a day. Let’s look into the national traditions and myths behind them to show that food traditions have always changed.”* In Rita’s dance performances ‘As If Trying Not to Own the Earth’, she pairs up with food artisans, teaching them how to dance and the artisans teaching her their craft, providing insight into what is challenging and easy, and what is ancient or innovative, about those practices.

Cultural programming can draw together the personal, political and scientific aspects of this issue. It can overcome arguments between the effectiveness of either domestic or system change, and help people understand both “*what difference each of us can make in our own lives, as well as the systemic changes, and what they can do together for a just transition*” (Steve Slack).

Rene at Food Works Sheffield referred to projects that model “behavioural solutions that address the underlying issues, not technical solutions that mask them”. Practical experience of cooking and growing food together naturally trigger conversations about food waste and nutritional security.

Human rights and cultural history are important as part of the scientific story:

- *Museums have a responsibility...they don’t always take a view or take action on the structural circumstances that determine those stories. They need to talk about access to resources, structural inequalities in terms of distribution and consumption, and ways to reduce harm in the food cycle. In the UK we shouldn’t be too naive, and should address the links between colonial past and legacies of food inequality.* (Domenico Sergi, Museum of London)
- *In the UK we have an unjust social system that is propped up by that redistribution of waste, you’ve got to look at sustainability across the whole system, so that we’re not just looking at production processes and distribution. You have to look at making sure that people aren’t priced out of more sustainable food.* (Ben Fletcher, Bradford Council)

Part of this human-centred approach is being open to all perspectives and needs, including those influenced by or involved in the non-sustainable food system: *I think museums must also engage with the dissenting voice, and be inclusive. I think of my father who was brought up with and worked with meat in a slaughterhouse... We’re aware with the ocean conservation exhibition that the local community have based their livelihood on fishing so we can’t berate people about what is central to their lives.* (Steve Slack)

Practical and sensory experiences work best

These interviewees had deep and wide knowledge of the food system, but shared the views of our public audiences that the very best ways to learn about food sustainability are practical and sensory. The complexities of food and ecological systems can only be explored by making connections, whether these are through conversations, clever interactives, technology, outdoor experiences, or getting hands on (and ‘tongues-on’) food.

- *I think the best way to learn is highly interactive - although everyone is different and learns in different ways - but it is very evident when I host tours for School. I take classes around my parents’ farm to learn about the holistic nature of it and organic farming, and then afterwards we head back to the pub to eat and cook the food.* (Ollie Hunter, Sustainable Food Revolution)
- *We had a food space at We The Curious...visitors could experience food, play with it, and we did sessions like Insect Sushi. You need a communicator there that makes things fun and exciting, their passion and knowledge coming through.* (Florence Pardoe, Food Foundation)

Christian Reynolds wants to see culture and media helping the public: *crack the top 10 planet-friendly recipes, or turning their fridge down*. Rita Marcalo makes performances about the processes of growing and making sustainable food, to demonstrate what can be achieved by anyone.

A museum of future food would activate people

The planetary emergency requires rethinking what museums and science centres can do, to shift from exhibiting things to activating people. *Yes, there is a mission of a museum to educate and empower. But I'm interested in what other verbs a museum of this nature might do. It could agitate, or provoke or inspire. It could encourage or enable.* (Steve Slack)

Overt and practical experiences are seen as essential to activate people. Florence described an idea for a 'Willy Wonka style machine' that illustrates the complexities of the food system with levers to alter variables such as water, soil health or equal distribution. Several were complimentary about the V&A's exhibition 'On The Plate', for example, that it started at the end of a food consumption cycle (toilets!) and ended with food tasting. Christian Reynolds described how he was profoundly affected by an experience at Cornell's Botanic Gardens: *They had tents up that raised the median temperature by two degrees so you could see what they could grow in there, feel the temperature, smell the impact of a change in climate.*

Interviewees suggested museums could normalise a plant-based diet by presenting it positively and modelling it through its catering and activities. In Ollie Hunter's imagined museum: *We won't have waste bins for food... it'll either be eaten, redistributed or fed back into compost or wormeries. We'll source most of our food within 30 miles from where we live, improving communities and local supply chains. We'll head into a 90% plant based diet, with a lot of focus on preserving techniques, including a lot of fermentation.*

This rethinking of their role could include a museum being more like a participatory research lab, with community groups creating content, or participant-visitors being in controlled experiments about their food choices. Such participatory experiences could explore the psychology of food marketing: *It would be interesting if you could map out that psychology in really blatant ways, so that people are more aware of that. Imagine if there was a room in a museum that could make it explicit for people how they are being manipulated and how your brain and body responds.* (Ben Fletcher, Bradford Council)

This rethinking could also apply to the location of museums. Clare suggested that exhibitions could happen in places such as factory farms or supermarkets, not only in museums, so that ethics or desirable behaviour change are very overt. Paige's Better World Museum is in Virtual Reality, for example with a Mannalab for people to explore plants and future food.

A museum of food would not be a museum, it would be a living place, where different cultures come together to explore relationships to place. (Madeleine Collie and Cherry Truluck, Custom Food Lab)

7. Resources to engage public in food sustainability

Resources gathered in preparation for this research

- 400 articles or links on food sustainability, <https://pin.it/4oLm0Dv>
- See appendix 2 in this document; the food sustainability contexts of Brazil, India and UK written in preparation for this research.

Shared by UK professionals consulted

- National Food Strategy <https://www.nationalfoodstrategy.org>
- Long list of organisations interested in food system issues consulted in the National Food Strategy <https://www.nationalfoodstrategy.org/who-we-have-met-2020/>
- The Food Foundation use surprising and inventive ideas to catalyse and deliver fundamental change in the food system by building and synthesising strong evidence, shaping powerful coalitions, harnessing citizens' voices and driving progress with impactful communications. <https://foodfoundation.org.uk/>
- The Youth Consultation carried out by the Food Foundation for the National Food Strategy <https://www.nationalfoodstrategy.org/the-report/>
- Sustain, a powerful alliance of organisations and communities working together for a better system of food, farming and fishing, and cultivating the movement for change. <https://www.sustainweb.org/projectsandcampaigns/>
- '30 food' is Ollie Baker's project for a sustainable food revolution. He runs the Wheatsheaf restaurant, has published a book, runs education activities and has a website <https://www.30food.co.uk/>
- Food Citizenship Framework, shared by Rene Meier, <https://foodcitizenship.info/>
- [Custom Food Lab](http://www.customfoodlab.com/) includes projects such as Locavore Food Growing and Food Art Research Network. Amongst others, they also shared these projects as good examples: <https://viviansansour.com/>; <https://colaboratorykitchen.com/>; <http://bakudapan.com>
- Fork to Farm Dialogues <https://www.fork2farmdialogues.org/> shared by Duncan Williamson.
- [Department 22](https://www.department22.com/), a circular economy innovation agency, whose projects include Bulkify <https://www.bulkify.co/>
- Intangible Cultural Heritage (INTACH): Resources on culturally sensitive means of engagement, including around heritage of food and agriculture <http://intangibleheritage.intach.org/about/>
- [Mammamiaa](http://www.mammamiaa.com/), a project by John Thackara exploring the possibilities of 'social food' for sustainable innovation.
- Meat the Future is an exhibition at Oxford's Museum of Natural History. It is a culmination of the public engagement strand of LEAP, a University of Oxford enquiry into Livestock, Environment and People. <https://oumnh.ox.ac.uk/meat-the-future>
- Christian Reynolds has published a number of papers on food sustainability policy and ways to engage citizens and cultural agencies. E.g. [Citizen Science and Food: A Review](#), Food Standards Agency, March 2020.

Shared by Brazil professionals consulted

- The [Campanha Permanente Contra os Agrotóxicos e Pela Vida](#) (Permanent Campaign Against Pesticides and for Life), shares information on the risks that pesticides represent, and from there, take measures to curb their use in Brazil.
- [Embrapa](#) (Brazilian Agricultural Research Corporation) seeks to develop technologies and knowledge on Brazilian agriculture and livestock.
- The [Prato Do Mundo](#) 'Food for Tomorrow - Feeding 10 Billion', was a temporary exhibition at the Museum of Tomorrow in 2019. It asked 'how will we feed 10 billion people while ensuring diversified food production, respect for the environment and nutritional quality?'
- [Cooperafloresta](#) is an association of agroforestry farmers created by farmers from quilombos - settlements originally founded by AfroBrazilians who escaped slavery. It runs the [Projeto Agroflorestar](#) (Agroforestry Project).
- With partner communities from the Amazon and the Atlantic Forest region of southern Bahia, [AMMA](#) produces chocolates with organic & biodynamic cocoa in areas of agroforestry cultivation.
- The NGO [Banco de Alimentos](#) (Food Bank) helps people in situations of food insecurity by combating food waste, and donate nutritious meals to more than 23, 000 a day.
- The national network of food banks [Bancos de Alimento Mesa Brasil Sesc](#) serves people who are socially and nutritionally vulnerable.
- Aware of the high rate of fruit and vegetable waste due to its appearance, [Fruta Imperfeita](#) (Imperfect Fruit) delivers 'ugly' products from small rural producers.
- Since 2010, the [Maré de Sabores](#) (Maré of Flavours) project has held gastronomy training workshops for the Maré community in Rio de Janeiro, promoting healthy eating based on organic and sustainable food.
- Using gastronomy as a tool for social transformation and combating waste, [Gastromotiva](#) offers training for future entrepreneurs, kitchen assistants and chefs. Many students mobilize their communities, generating local opportunities and activities to combat hunger.
- Inaugurated by the Rio de Janeiro Municipal Department for the Environment in 2006, the [Hortas Cariocas](#) (Gardens of Rio) Program, present in 49 communities in Rio de Janeiro, serves as a model for promoting socio-economic development and creating jobs in low-income regions. One of these, the [community garden in Manguinhos](#) harvests 2 tons of pesticide-free food per month in what was a space where crack users would gather.
- Since 2015 the project [Horta Inteligente](#) (Smart Garden) in Morro da Providência-RJ, carries out group activities for planting and agro-ecological management. In 2019 revitalised a public area on top of the João Ricardo tunnel which was a dumping ground for waste and a focus of disease. Now it has a community agroforestry system with several varieties of food.
- [Projeto Jovem Eco Social](#) (Eco-Social Youth Project) is a partnership between Niterói City Council in Rio de Janeiro, and Firjan SENAI SESI. It carries out environmental education and agroforestry planting with 400 young residents from 11 communities.
- The [Serra da Misericórdia Integration Centre](#) is a non-profit association dedicated to promoting nutritional food sovereignty in urban areas and is based on the precepts of agroecology. Located in Penha in Rio, large degraded areas are being reforested..
- [Instituto Horta Girassol](#) is located on five thousand square metres of public land and is now the largest urban garden in the Federal District.
- In order to value, encourage and make family farming viable, the non-profit organisation [CSA BRASIL](#) began operating in 2011. Today there are 400 participating families that support farmers in the transition to ecological production models.
- The [Small Farmers Movement \(MPA\)](#) is a national initiative, made up of local networks of rural families. Its objective is to produce healthy food for rural and urban people, thus guaranteeing food sovereignty as a right for people and countries.

- [Bucket Revolution](#) is a community project for managing organic waste and urban agriculture in Florianópolis, coordinated by the NGO [CEPAGRO](#) with local youth.
- [Fazenda Urbana](#) in Rio de Janeiro conducts indoor farming without pesticides, making use of containers or warehouses, transforming unproductive spaces and buildings into productive areas within the city.
- [Raizis](#): this company sells food from small organic producers directly to restaurants and to the end consumer. Currently, produce comes from 824 farming families.

Shared by India professionals consulted

- Dr. Shweta Khandelwal from the Public Health Foundation of India (PHFI) shared the HLPE Report on *Nutrition and food systems*. <http://www.fao.org/3/i7846e/i7846e.pdf>
- The Daily Dump is a project started by Poonam Bir Kasturi in 2006 that provides products and resources around the waste ecosystem, management and composting for interested individuals and organisations. It is a model for public participation in sustainability initiatives. <https://www.dailydump.org>
- Two exhibitions mentioned by Dr. Jahnvi Phalkey that were organised at the Science Gallery Bengaluru.
 - *Phytopia* – This was an online exhibition that took place in August 2020 and explored plant life as a source of air, food and sustainability. <https://bengaluru.sciencegallery.com/phytopia/archive>
 - *Edible Elements Workshop* – This was a physical workshop that took place in Bengaluru, India and explored the relationship between science and food as part of the exhibition, Elements, in October 2019. <https://bengaluru.sciencegallery.com/elements/programmes/edible-elements>
- The workshop was led by Chef Elizabeth, co-founder of *Edible Issues*, a collective that fosters thought on Indian Food Systems. <https://edibleissues.in>
- The Triple Bottom Line Framework and other ideas of John Elkington were suggested by Food Industry consultant, Mr. Niranjan Khatri as having guided his early interests in sustainability. <https://sustain.wisconsin.edu/sustainability/triple-bottom-line/>
- The Global Alliance for Improved Nutrition (GAIN) was mentioned by Ms. Aarti Srivastava, Consultant, IQVIA INDIA as a good model for international cooperation in improving nutrition and food systems. <https://www.gainhealth.org>
- An Integrated Farming Systems Model was suggested by Dr. Ashok Kumar Singh as developed by the Indian Council of Agricultural Research (ICAR). <https://icar.org.in/sites/default/files/BulletinIFS.pdf>