FOOD FUTURES
PANEL

OPM GROUP

Trade-offs in future food systems – consumer perspectives

A GFS Food Futures panel project

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Contents

Executive summary

Background to the project

The Global Food Security (GFS) programme brings together the UK's major public funders of research into food security. A central part of the programme is to understand and respond to public views on global food security challenges and potential solutions. To help meet this aim, the GFS programme has commissioned a panel of 600 members of the public to take part in engagement activities, including deliberative and online activities exploring different aspects of food security research. The GFS programme will be using the findings to inform the direction of publicly funded food security research in the UK. The panel is co-funded by the Sciencewise[1] programme.

This project 'Trade-offs in future food systems – consumer perspectives' (called here, Sustainable Intensification, or SI for short) was commissioned in late 2015 with two aims:

- To discuss with public panel members the potential breadth of trade-offs across the ever burgeoning pressures on the food system. Building on their recent interaction on relevant debates regarding food systems, innovation, insect protein and through their online activities.
- To bring in the voice of consumers into the sustainable intensification discussion to balance the industry-focused investment.

We clarified the scope of the project with the topic lead and specialists to break the aims down into four research areas:

- Sustainable intensification as an approach to agriculture
- Trade-offs associated with sustainable intensification
- Actors and influences on sustainable intensification
- Consumer choice and sustainable intensification

The sustainable intensification project combined three different approaches to engage participants with the topic: in-depth one-to-one interviews, an online survey and two discussion groups (one online and one face-to-face held in London). We used specialist input at several points, primarily during the scoping stage and at the discussion groups.

[1] Sciencewise is the UK's national centre for public dialogue in policy making involving science and emerging technology issues

Key findings

Perceptions of Sustainable Intensification

Rising global population coupled with depleting natural resources means that the world is facing a potential crisis in terms of food security. Addressing this challenge will require interdisciplinary solutions and no one approach will be sufficient on its own.

In this project, we presented public panel participants with three approaches to achieving food security and asked them to discuss all three in comparative terms. We were clear throughout that no one approach alone would be sufficient, but wanted to understand how participants viewed sustainable intensification in relation to other possible contributors to global food security. The three approaches were:

- Increasing production through sustainable means (sustainable intensification)
- Reducing waste
- Changing diets.

Participants tended to support the concept of **sustainable intensification** but were worried about some of its potential implications. Prominent areas of potential concern were animal welfare, health risks and costs of new technologies. It is important to note that the project presented participants with a wide range of potential trade-offs, and the issues by which participants were most concerned (e.g. animal welfare or impacts on areas of the UK valued for tourism) are not necessarily those most likely to occur.

A small proportion of participants explicitly rejected the use of sustainable intensification because of environmental concerns or because they considered that the UK should focus on reducing food waste rather than producing more food.

Even though many participants were positive about the use of sustainable intensification, it was not most people's preferred approach to address the food security challenge. For most participants the priority for addressing the food security challenge was **reducing food waste**. This finding is consistent with other public panel activities where food waste formed the focus of many discussions and even when specialists explicitly pointed out that food waste alone is not sufficient to achieve food security, participants still felt it should be prioritised above increasing production.

Outputs from interviews with participants and specialists suggested that views differed on the need for **intensification**, whether sustainable or not: there was greater consensus about the potential and need for increasing production in developing nations where agriculture was perceived to be less efficient and food scarcity more widespread. There was greater disagreement, from both specialists and participants, about the need to increase food production in the UK and other developed nations.

The differences in participants' views could be partially explained by their perception of the urgency of the food security challenge. Very few (3%) of 97 survey participants thought that

food security was not much of an issue in the world today, but around one third gave this answer when asked about the UK.

Changing diets was the second most preferred approach to addressing food security for the UK and third for the world. Participants argued that switching to less meat intensive diets and crops that required fewer inputs (e.g. fertilisers, pesticides, water) would enable our current resources to last longer and could potentially deliver health benefits to consumers. In later discussions however, some participants were sceptical about the feasibility of such approaches, indicating that they would struggle to reduce their own meat consumption.

Trade-offs

In the survey, we asked participants to prioritise one of four statements which generalise the potential trade-offs identified through scoping research: environmental, economic, societal and consumer. The four options presented in the questionnaire were:

- Producing food more sustainably, in ways that protect the climate, biodiversity and other resources
- Producing food in ways that support the economy and farmers
- Producing and distributing food in ways that are equitable for all involved
- Plentiful and affordable food supply for the UK consumer

The first option, a proxy for environmental sustainability was assigned the highest priority by around two thirds of the survey respondents, while each of the other options was chosen by around one in ten.

Despite this when asked in the interviews and discussion groups participants were overall reluctant to prioritise environmental sustainability when it was posed against economic, societal or animal welfare interests. There are a number of possible explanations for this discrepancy: ranging from the way in which participants interpreted questions about what is 'important' for society and what they as individuals ought to do, to an effect of the differing methodologies.

In line with findings from other public panel projects, **animal welfare** was consistently identified as a red line issue and something participants were unwilling to compromise on.

Many participants also felt that the **financial interests of the farmers,** particularly in the UK, should be protected, often expressing their disquiet at the imbalance of power that exists between supermarkets and farmers. Related to this, participants thought that farmers should use environmentally friendly technology but should not be expected to bear its purchasing cost alone. These comments were in the context of discussions, which tended to regard farmers as traditional, working at a small scale in a difficult economic context. Participants tended not to be aware of the role of larger agri-businesses until introduced to them by specialists.

With regards to **changes in diets** towards less resource-intensive foods, the majority of participants stated that they would be happy to consider this. However, their reasons often focused on supporting locally grown produce and eating in season as contributors to a healthier lifestyle rather than benefiting the environment. Participants tended to view local and seasonal produce as having lower environmental impacts than imported produce, but this was not the primary motivator for choosing it. Some participants expressed concerns about the limited variety of produce that would be available strictly seasonally in the UK given the country's climate, others felt less choice would be acceptable and even desirable.

Participants were prepared to **pay more** for free-range and high quality food but were less certain about products that benefited the environment, often noting that the environmental aspect is less visible to the consumer. Some participants stated that they were aware that their purchasing decisions might have ethical and environmental consequences but that their main priorities remained affordability and convenience.

One scenario suggested by specialists for sustainable intensification was that of changing land use: this could mean using land currently prioritised for other purposes for agriculture (e.g. national parks), or intensifying production in current agricultural areas (e.g. larger crop farms). **Changing land use** for agriculture, even where this would mean increased environmental impacts, was on balance more supported than **intensifying production in existing agricultural areas**. Recurring concerns across comments on both options were the increased risk of flooding and the impact on wildlife with a strong emphasis on bees. Participants were particularly concerned that expanding agricultural in the UK would affect rural areas, which are valued for tourism.

Participants were open to the idea of using **new types of technology** in agriculture but expressed mixed views about the use of **scientifically modified crops**[2]. Whereas participants recognised the need for building an efficient and resilient food system, they had concerns about the long-term safety implications of the modified crops. Some also felt uneasy about consuming food they thought would not be natural.

Responsibility

Participants were asked to discuss four main actors' level of responsibility for ensuring that food is produced sustainably: farmers, government, supermarkets and consumers. During the discussions, some participants (particularly in the discussion sessions where a representative of an agricultural company was present) identified a fifth actor - agri-businesses.

[2] We used the term scientifically modified crops deliberately following discussion with the topic leads and steering group members. It was felt that the term 'genetically modified' failed to encompass the potential for selective breeding techniques to contribute new varieties. 'Scientifically modified' was intended to encompass all possible mechanisms by which a crop variety might be developed.

Farmers have been consistently regarded by participants as the actor with the least influence in the food system, and the most deserving of public sympathy. We specifically use the term farms because of the perception participants had of food producers as predominantly individual farmers and not large scale commercial enterprises, about which they were more sceptical.

The role imagined for **government** tended to be largely one of oversight: enforcing standards via regulation and legislation, and monitoring their implementation. Some participants also called for greater government-led regulation of supermarkets to ensure lower levels of waste and more equitable relationships with food producers.

While participants often felt that **supermarkets** were responsible for problems in the food system, such as food waste and limits to farmers' income, there were few suggestions about how sustainable intensification might remedy this.

The majority of participants were receptive to business (where they differentiated large commercial enterprises like supermarkets, or agri-business from small-scale producers) as an important actor in sustainable intensification but some were sceptical of the willingness of large commercial enterprises to act in the public interest.

Participants, particularly in the discussion groups, were prepared to consider a situation in which they would be happy to have less choice as consumers. They felt that the burden on consumers to decide between ranges of products with different sustainability credentials could be too much, and saw restricting choice as a way to shift the burden to institutions like governments. They felt that government was better equipped to evaluate the many factors relevant to sustainability than **consumers**, and should remove the least sustainable options (although they were rarely specific about a mechanism for this). This tendency contrasts somewhat with a consistent finding throughout the public panel that participants feel empowered by understanding more about the food supply chain: there is a tension between how participants view themselves (more informed, able to make better choices) and the wider public (less informed, need intervention to prevent poor choices).

About this report

This report consists of four chapters:

- Chapter 1 gives the background to the Sustainable Intensification project, and explains how the project was carried out.
- Chapter 2 deals with participant views on Sustainable Intensification as an approach, their positive and negative associations and how important they felt it was in relation to other potential approaches to global food security.
- Chapter 3 deals with the potential trade-offs of SI, taking them in turn and exploring what participants felt was acceptable, should be prioritised or not.
- Chapter 4 deals with actors and responsibility, including the role of the consumer. It addresses how participants felt responsibility for SI should and would fall, and gives more depth about the trade-offs participants were willing to make as consumers, how empowered they feel and what choices they make.

Chapter 1: About the project

A note about terminology

We use the following terminology in this report:

- When we talk about the complete public panel programme we refer to the "**public panel**".
- "**Topic**" describes the main content focus of the project – in this case, sustainable intensification. Topics are specifically policy directed.
- "**Topic lead**" is the representative of the GFS partner organisation that suggested the topic. One way to describe the topic lead is as the person asking the question which the project explores.
- "**Project**" describes the implementation of a topic, using a method or methods.
- "**Method**" describes the approaches used to implement a project, for example, survey, blog, online forum discussion or workshop.
- "**Specialist**" describes people with specific knowledge and/or expertise who have contributed to the project, without also holding a formal role (e.g., on the Food Futures/GFS public panel Steering Group, Project Management Team or as an employee of one of the GFS partner organisations).
- There were three different methods used in this project, when we are talking specifically about views expressed in interviews we refer to "**interviewees**", when we are talking only about views expressed in the survey we refer to "**survey respondents**" and when we are talking only about views expressed in the discussion groups we refer to "**discussion participants**". We use the more general "**participant**" when what we report is not specific to one data source.

Quotations from participants' submissions online and from the workshops appear throughout the text and have not been changed other than corrections to punctuation for readability.

1.1. About the Food Futures panel

The Global Food Security (GFS) programme brings together the UK's major public funders of research into food security. A central part of the programme is to understand and respond to public views on global food security challenges and potential solutions. To help meet this aim, the GFS programme commissioned a panel of 600 members of the public to take part in engagement activities, including deliberative and online activities exploring different aspects of food security research. The GFS programme will be using the findings of the public panel to

inform the future direction of publicly funded food security-related research in the UK. The panel is co-funded by the Sciencewise[3] programme.

The Food Futures public panel is designed to enable both online and face-to-face engagement. The panel is managed through a software portal, which can host a range of different digital materials and activities. The panel is closed, with members recruited to a quota and all content is password protected, ensuring privacy for participants and enabling effective control and management of the sample. The panel is clustered in six locations around the UK, allowing for a diverse sample and providing opportunities for face to face activities.[4]

The panel consists of 600 participants, quota sampled to be broadly representative of the UK population. The sample does not perfectly represent the UK: ethnicity is representative of local areas, and there is a slight bias towards female participants, middle age groups and more educated participants. Participants are incentivised to take part in some of the panel activities, with the value of the incentive tailored to the specific method or topic. Not all activities are incentivised – for example, ongoing engagement that is not part of a project on a specific policy topic tends not to be incentivised.

1.1.1. Sciencewise Guiding Principles

The delivery of the public panel was guided by the Sciencewise quality framework and designed to align with Sciencewise Guiding Principles (both available online here). Both principles and quality framework aim to ensure that public dialogue is fair, effective and credible: whilst we used approaches other than public dialogue in the public panel, we sought throughout to retain this focus, and ensure fair, effective and credible engagement. You can read about learning from the public panel in the independent evaluator's report which can be found on the Global Food Security website, here.

1.2. About the Sustainable Intensification project

This project, 'Trade-offs in future food systems – consumer perspectives' (for brevity we refer to the project as Sustainable Intensification, or just SI) was commissioned late in 2015 with two aims:

- To discuss with public panel members the potential breadth of trade-offs across the ever burgeoning pressures on the food system. Building on their recent interaction on

[3] Sciencewise is funded by the Department for Business, Innovation & Skills (BIS). Sciencewise aims to improve policy making involving science and emerging technology across Government by increasing the effectiveness with which public dialogue is used, and encouraging its wider use where appropriate. It provides a wide range of information, advice, guidance and support services aimed at policy makers and all the different stakeholders involved in science and technology policy making, including the public. Sciencewise also provides co-funding to Government departments and agencies to develop and commission public dialogue activities. www.sciencewise-erc.org.uk

[4] Locations are: Belfast, Cardiff, Dundee, Harrogate, London, Plymouth.

relevant debates regarding food systems, innovation, insect protein and through their online activities.

- To bring in the voice of consumers into the sustainable intensification discussion to balance the industry-focused investment

From these overall aims, we explored the definition of sustainable intensification, which was the central topic of the project. We looked at existing research on sustainable intensification and held a series of discussions with Defra, the topic lead, and other specialists from GFS and its partner, the Biotechnology and Biological Sciences Research Council (BBSRC) to develop a series of more specific research questions. It became clear from these discussions that there is no single definition of sustainable intensification shared by these specialists and it was difficult to agree a description and examples that we could use in this project. This means that some of the scenarios we used represent views that not all the specialists we spoke to thought were likely to occur. Our in designing the project activities was to explore a wide range of potential scenarios. For the purposes of the project, we agreed to present participants with a single definition, but made it explicit that there remains some debate about that definition. We phrased this as:

Sustainable intensification is a difficult approach to define and specialists are still debating exactly what it means. One definition used recently is: sustainably increasing the production of food, combined with improved resource use efficiency and better environmental outcomes.

A second challenge to defining the scope of the project was the debate among specialists about whether to frame sustainable intensification as inevitable, and the debate as having moved from 'whether' to develop SI to discussing 'how'. Given the lack of consensus among specialists about this question we chose to present the more cautious position and not present sustainable intensification as a policy which is beyond question. However, we recognise that this may have influenced the ways in which participants discussed the topic, and is a framing which may be disputed by some specialists.

From this definition, and the initial aims of the project, we developed four research areas:

- **Sustainable intensification as an approach to agriculture**
    - Meeting the food needs of a growing population is a challenge. One approach that has been proposed is sustainable intensification. What are participants' views on sustainable intensification as a response to food security challenges? Does it address the challenges they see as being of the highest priority?
- **Trade-offs associated with sustainable intensification**
    - What trade-offs do participants believe are acceptable, desirable or inevitable in relation to sustainable intensification? Who do participants believe should determine which trade-offs are acceptable?

- **Actors and influences on sustainable intensification**
    - How do participants understand the food supply chain (relevant to sustainable intensification) and who has influence on it?
- **Consumer choice and sustainable intensification**
    - Do participants' feel their preferences are reflected in their food choices? Do they see consumer choice as an appropriate way to bring about change?

Steering Group Members
Riaz Bhunnoo, GFS
Tim Benton, GFS
Caroline Drummond, LEAF
Lucy Foster, Defra
Tara Garnett, University of Oxford
Fraser Henderson, Sciencewise
Peter Jackson, University of Sheffield
Roland Jackson, Sciencewise
Huw Jones, Rothamsted Research
Hannah King, NERC
Suzannah Lansdell, Sciencewise
Jennie Macdiarmid, University of Aberdeen
Alison Mohr, University of Nottingham
Kieron Stanley, Defra
Geoff Tansey, Food Systems Academy
Jon Woolven, IGD

1.3. Involving specialists

As noted, we used a range of approaches to engagement in the Food Futures programme, but were guided throughout by the Sciencewise principles. These emphasise the importance of two-way conversations between publics and 'specialists', with expertise being brought into the room (real or virtual). Specialists act as participants, joining the discussions and helping participants to engage with the content at hand, and hearing and learning from participants. This project involved a number of specialists from within the GFS programme, including the Steering Group (see list on the left for membership) and others recruited specifically for their expertise in the topic area of sustainable intensification.

The aims of the sustainable intensification topic were proposed by DEFRA, one of the GFS partners, and research questions were developed iteratively with the Defra topic lead and representatives of other GFS partners including BBSRC. We interviewed 12 specialists at this stage, chosen to ensure that we had considered a broad spectrum of views. This was particularly important given the political and academic debate about sustainable intensification: we wanted to give the participants a full and balanced picture of all sides of the argument.

We also drew on specialist input when developing stimulus materials and invited several specialists to take part in discussion groups with the panel participants[5]. We involved specialists and stakeholders from a broad range of backgrounds, and with a range of views on the topic, in the development of the project including academics, third sector representatives and industry. Table 1 provides a list of specialists involved and the role they played.

Table 1. Specialist involvement in the sustainable intensification project

Specialist[6]	Involvement
John Hall, West Sussex Growers Association	Scoping interview
Mike Wray, Fera Science Ltd	Scoping interview
Tim Williams, Farming Futures, University of Aberystwyth	Scoping interview, face to face and online events
Sam Durham, National Farmers Union (NFU)	Scoping interview, face to face and online events
Tara Garnett, Food Climate Research Network, University of Oxford	Scoping interview
John Crawford, Rothamsted Research	Scoping interview
Richard Tiffin, Reading University	Scoping interview
Caroline Drummond, LEAF	Scoping interview
Andrew Burgess, Produce World	Scoping Interview
Dave Hughes, Syngenta	Scoping interview, face to face and online events
Patrick Mulvaney, Food Ethics Council	Scoping (by email)
Evangelia Kougioumoutzi, Global Food Security Programme	Face to face event

1.4. Methodology

The sustainable intensification project combined three different phases to engage participants in the topic – you can see them in figure 1 below. The three phases covered similar topics and participants were invited to take part in all three phases.

[6] NB: Two of the specialists (Tara Garnett and Richard Tiffin) were also scheduled to attend the discussions with specialists, but were each unable to make it on the day.

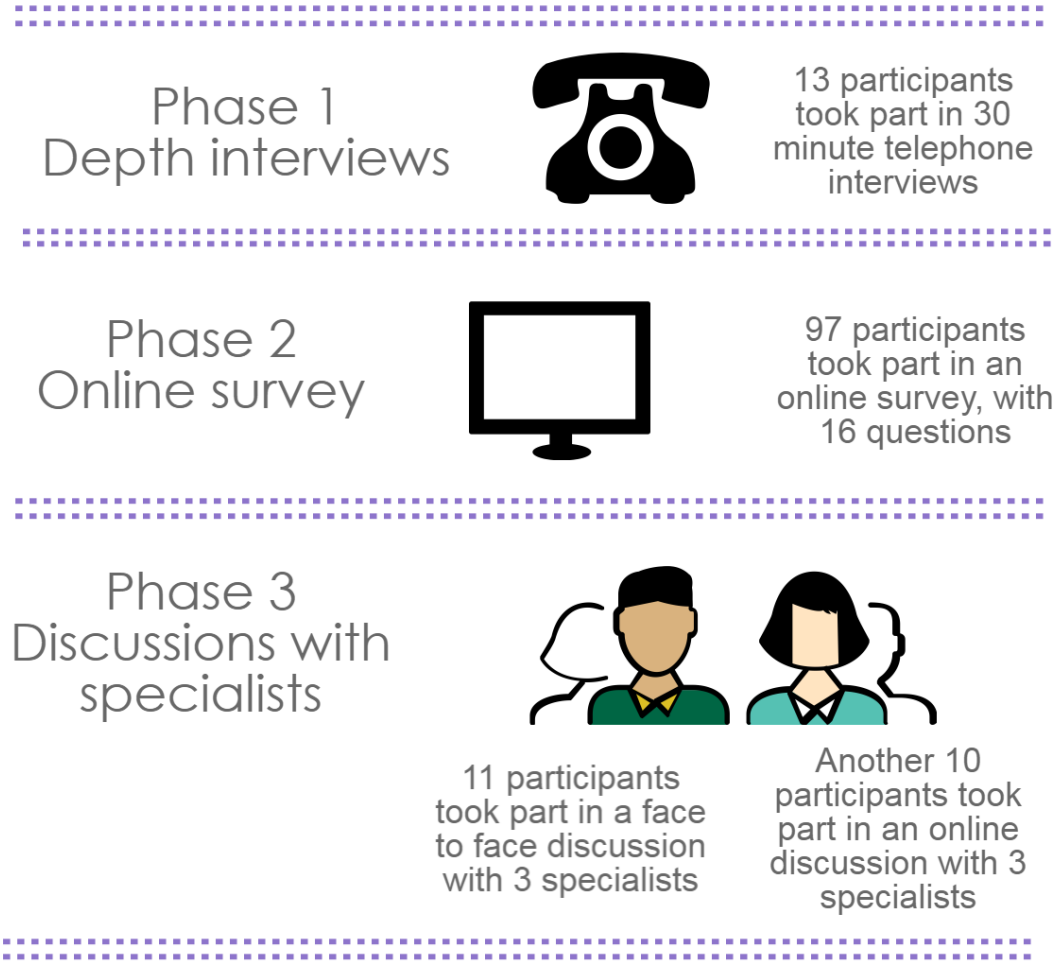


Figure 1 SI project phases

Each phase of the project was designed to focus on one or more of the research questions. In Table 2 below, we show how the three project phases map against the research questions, with darker shades showing which questions were prioritised at each phase.

Table 2 Project phases and objectives

Objectives / Phase	Views on SI as an approach to agriculture	Trade-offs associated with SI	Actors and influence on SI	Consumer choice and SI
Depth interviews				
Questionnaire				
Specialist Q&A				

Briefing note

For each phase of the project participants were given the same briefing note, to ensure they had access to the definition of sustainable intensification shown earlier in this chapter, and some examples. The briefing note is included in appendix B, and summarised in Table 4:

Table 3 Briefing note contents

Setting out the challenge	Why global food security is an issue.
Possible approaches	SI as one approach, alongside changing diets and reducing waste
An introduction to SI	Definition as above, provided as 'one' definition rather than 'the' definition.
Potential benefits of SI	Examples of how changing crops, changing farming practices and changing land use could lead to SI
Challenges of SI	Using the same examples (crops, farming practices, land use) we discussed the potential trade-offs in SI
Why we are asking the panel about SI	A statement to put the project in context

Depth interviews

We recognised from the outset that sustainable intensification is a complex topic and the potential trade-offs associated with it add to this complexity. To help us get some in-depth perspectives on the issues at the start of the project we carried out 13 telephone interviews with participants. Each interview took 30 minutes and a semi-structured topic guide was used, but interviewers adapted the questions to accommodate the interviewee's level of knowledge and interest. Interviewees were therefore not always asked each question. However, across all the interviews, all of the sections of the topic guide were covered.

Online survey

To collect a wider set of data, we carried out an online survey with 97 panel members. The survey consisted of 16 questions, following approximately the same structure as the interviews but using different examples to explore a wider range of trade-offs. We developed the questions after the interviews, using the initial findings to help us refine the questions. The survey is included in full in appendix B and summarised below in Table 4.

Table 4 Survey structure

Q1	Have you heard of SI? If so, where and what do you take it to mean? If no, what are your first impressions based on the briefing?
Q2, Q3	Repeat of questions from the panel baseline survey asking participants for their views on how much of an issue global food security is in the UK, and around the world.
Q4, Q5, Q6, Q7	Three questions asking participants about their priorities for addressing global food security: changing diets, reducing waste and increasing production. The questions asked which they thought was a priority in the UK, in the developing world, and in each case asked for a reason.
Q8	Asked participants to think about their priorities for food production, broadly the options were environmental sustainability, economic sustainability, equity of distribution and the interests of UK consumers.
Q9, Q10, Q11, Q12, Q13, Q14	We then asked participants six questions about potential trade-offs involved in intensifying production. For each trade-off we asked an open question (what do you think of this example, should it be implemented). The six examples were: • Growing crop varieties/types which are more suited to the environment, with the trade-off that consumers would find their diets forced to change as a result. • Growing scientifically developed crop varieties with reduced resource requirements, with the trade-off of accepting novel varieties that could be genetically modified. • Producing livestock more efficiently in order to reduce environmental impacts, with the trade-off of lower animal welfare standards. • Intensifying food production in areas of current low productivity, with the trade-off that areas we might value for their appearance could be altered. • Intensifying food production in areas with the highest potential production in order to spare other areas, with the trade-off that impacts associated with intensive farming (flooding, biodiversity, appearance of the landscape) would be affected in those areas. • Increasing food production using agricultural technology like satellite monitoring to reduce inputs, with the trade-off of higher costs.
Q15, Q16	The final two questions asked participants again what factors they saw as priorities in food production (environmental sustainability, economic sustainability, equity of distribution and the interests of UK consumers) and if their views had changed since starting the survey, why.

Discussions with specialists

To add to the individual data collected in interviews and the survey we ran two discussion groups with participants and specialists, one online and one face-to-face. We chose to run the same session in two formats to explore whether participants expressed different views online and in person: you can read more about how the panel trialled innovative methods in the learning report[7]. These sessions were designed to cover the same questions, and to help us understand how participants' views might develop as they debated the issues with other participants and specialists. Each of the two sessions lasted 90 minutes and involved three or four specialists from a range of backgrounds and ten or eleven panel members. We asked all participants in the discussions to complete the online survey in advance, to allow participants to start the discussions with some information and views about the topic, helping us to maximise the short sessions.

The sessions started with a reminder about the definition of sustainable intensification under discussion, and provided highlights of the survey to encourage participants to build on the earlier phase. Specialists were asked to give a two/three minute introduction to their perspective on sustainable intensification, including the main opportunities and challenges they saw. Participants were encouraged to put questions to the specialists, with the facilitator moderating to encourage debate rather than simple question and answer. This was followed by a longer session (around one hour, at two tables in the face-to-face session), in which participants and specialists engaged in discussions about the potential for SI to be implemented (focusing on the UK), the potential trade-offs and the actors and responsibilities involved, particularly the role of consumers.

1.5. Sampling and recruitment

Across this project, we aimed to engage a small but diverse sample of respondents (you can see the resulting demographics in appendix A). As well as demographics, we included two other factors:

- To determine the extent to which each interviewee considered the environment when choosing which foods to buy, we used their response from the baseline survey (when they first joined the panel) to the question *'What would you say is important to you when deciding what to buy to eat at home?'* as a proxy measure. Those who chose *'Environmental considerations (e.g. from sustainable source, impact on landscape)'* from the multiple choice list, were considered to be people for whom environmental considerations are a priority, whilst those who did not choose this option were not.
- To explore whether participants views differed depending on their participation in other activities on the Food Futures panel we also identified a range of levels of

[7] All reports available on the GFS website at http://foodsecurity.ac.uk/programme/activities/public-panel.html

interaction, including a differentiation between those who had taken part online and in person.

To ensure that the participants taking part in the project represented these groups we invited a group of participants who met this quota, with several further rounds of invites to make up the required numbers. As with other projects across the panel we used rewards to encourage participation.

Table 5 Sampling approach and reward strategy

	Sampling approach	Reward strategy
Interviews	Quota sampling for diversity (invites to a small initial group, those not meeting quota invited to survey instead) 13 participants	Incentive of £20 per participant
Survey	Initial invitations to a sample targeting the least represented groups, followed by an open invitation to all panel members. 97 participants	Incentive of £10 per participant
Discussions with specialists	Initial invitations to a sample targeting the least represented groups, followed by an open invitation to all panel members. 11 participants face to face 10 participants online All discussion group participants were asked to complete the survey before attending.	Incentive of £30 per participant for the face-to-face session and £10 per participant for the online session.

Many of the participants in this project had also taken part in other public panel projects. For example, 56 participants had also taken part in the earlier Food Systems project, and 42 had taken part in the Urban Agriculture project. You can read more about these projects in their reports, available on the GFS website: http://foodsecurity.ac.uk/programme/activities/public-panel.html

1.6. Analysis and reporting

We used a thematic approach to analysis, producing an overarching coding framework, specifying themes and sub-themes. As analysis continued, we modified the framework to

capture emerging themes. Transcripts were read in full and we used Nvivo[8] qualitative data analysis software to support the analysis. This enabled us to interrogate the data further by running queries to explore initial coding rounds in more detail. The final report is designed to meet the Sciencewise "Guidance for Final Dialogue Project Report".

One of the purposes of the Food Futures panel is to test the innovative methodologies offered by an online panel whose members can also be invited to take part in face to face activities. We used a mix of methods for the SI project, which yielded different data types:

- **Interviews:** The output of the interviews was digital recordings and facilitator notes. This comprised some 6.5 hours of recordings. Comments are analysed in the context of the interview as a whole.
- **Online survey:** The 16 survey questions and 97 respondents resulted in a mix of quantitative and qualitative data. The former was analysed to identify using descriptive statistics[9]. Qualitative data was analysed thematically as per the interview notes.
- **Discussion with specialists (face-to-face):** This session was digitally recorded, supplemented with facilitators notes. There was around 30 minutes of whole group discussion, and around 60 minutes where discussion took place at two tables, giving a total of around 150 minutes of recording.
- **Discussion with specialists (online):** This session was hosted via a chat room on the Food Futures platform. The chat file was downloaded and analysed thematically alongside the other qualitative data.

This report is based on a cross-cutting analysis of all the data. Most of the findings draw on several sources and appear consistently across them. Where findings are based on a particular data source this is noted in the text.

Part of the reason for carrying out a face-to-face and online discussion session with specialists was to test whether the same type and quality of discussion was possible. As you will see through this report we have been able to draw equally on both discussions in analysis and reporting. Further discussion of the use of online and face-to-face methods can be found in the learning report on the GFS website.

A cautionary note about this report

It's important to note that even where we have presented data in charts and reported the number or proportion of responses these should not be assumed to represent the views of "the public". They represent the views of the small number of panel members who took part in the project.

[8] NVivo is a qualitative data analysis computer software package designed for use on qualitative unstructured data. http://www.qsrinternational.com/products_nvivo.aspx?

[9] Given the scale of the survey (97 respondents) findings are unlikely to be statistically robust and so are described as indicative only.

It is also important to be cautious about comparing the findings of the survey (shown in the chart above) and the discussion groups (reported on below) because they did not involve the same group of people. Although those taking part in the discussion groups had completed the survey not all of the survey respondents took part in the discussion groups and so did not have access to additional information from specialists. It is possible that these methodological differences account for the difference in views.

Chapter 2: Perceptions of Sustainable Intensification

In this chapter we look at the definition of sustainable intensification we used, participants' views on sustainable intensification and what role they thought it could play in addressing the food security challenge both globally and in the UK. We also explore how the support for sustainable intensification as an approach in maintaining the availability and access to food compares to the two other approaches discussed.[10]

2.1. Framing sustainable intensification

As we explained above sustainable intensification is a much-debated topic and there is no commonly agreed definition among specialists. For the purpose of this project, we needed to come up with a definition that would be both comprehensive and easy to understand for a diverse audience. Following a discussion with the project team and input from a range of the specialists, we agreed the following phrase:

Sustainable intensification is the process of sustainably increasing the production of food, combined with improved resource use efficiency and better environmental outcomes.

To help participants understand the status of sustainable intensification as one of a range of potential approaches which are not mutually exclusively we presented increasing food production alongside changing diets and reducing waste as additional approaches to the food security challenge.

We also presented participants with three different methods through which sustainable intensification could be realised to make the concept more tangible:

- **Changing the crops we grow:** choosing crop varieties which are more efficient, for example switching from water intensive rice crops to drought resistant millet crops.
- **Changing the way we farm:** making use of new technologies in farming, such as using satellite data for land monitoring and targeted application of fertilisers and pesticides.
- **Changing land use:** growing more intensively where the land is most suitable so we could free up other land for conservation purposes.

The three methods evoked different reactions and levels of support – these are discussed in further detail in the relevant sections in Chapter 3.

[10] The two other approaches were reducing waste and changing diets

2.2. Initial views on sustainable intensification

Positive with some caveats

When first introduced to the topic through the briefing note, most interviewees and survey respondents were positive about the idea of sustainable intensification, describing it as "logical" or "obvious" as an efficient way to make better use of current resources and increase local or UK food production. Many, however, qualified their support by emphasising the need to avoid negative consequences to the environment or society.

> ***The idea is top notch but the devil is in the detail. The last part talks about the holistic approach, how it affects the society, the economy and the environment and they are very important issues, you need to take into consideration the intensification and sustainability but also in relation to the other issues – it doesn't work unless you think of it holistically.***
>
> ***Interviewee (Male, 66+, Harrogate)***

Some interviewees and survey respondents also expressed doubts about how sustainable intensification would work in practice given the wide range of aims it is trying to achieve – increasing production while protecting the environment and ensuring farming is profitable. They were sceptical about how realistic this was, and foreshadowed the trade-offs they went on to discuss:

> ***It sounds as if whatever is done to increase production has a negative knock-on effect.***
>
> ***Survey respondent (Female, 66+, Plymouth)***

Other survey respondents simply pointed out that the issue seemed complex, with many potential barriers to measures that they might support in principle. The question of who would lead on and monitor the implementation of sustainable intensification was a recurring one and many interviewees and survey respondents felt that this would determine the success of the approach. The issue of responsibility is explored in further detail in 3.2.7.

Even though most interviewees and survey respondents were positive overall about the concept of sustainable intensification, some aspects of intensification were immediately raised as problems. For example, reductions in animal welfare standards were almost universally identified as a red line participants across the project would not want crossed. The use of fertilisers, pesticides and genetically modified crops evoked mixed views, as did the option of changing land use. All of these are further explored in the relevant subsections of Chapter 3:.

Negative or unsure

A small proportion of interviewees and survey respondents explicitly rejected the use of sustainable intensification because of environmental concerns or because they thought that the UK should focus on reducing food waste rather than producing more food (this is discussed more in section 2.3 below). Finally, a few reported finding the topic too complex and felt that they needed more information before they could express an opinion.

At the close of the online discussion group we asked participants to feedback how they would explain sustainable intensification to the next person they saw, to test the extent to which they had taken on board the definition proposed and whether their initial views had developed. Although this featured only a small number of participants (10), they tended to give broader definitions, more in line with the GFS definition of food security[11].

I would say it is the responsibility we all have to the world's population to ensure we grow enough safe food to ensure that everyone has enough to eat to stay healthy. I would also say it is a massive challenge.

Discussion group participant, online

2.3. Perceptions of the role sustainable intensification could play in addressing the global food security challenge

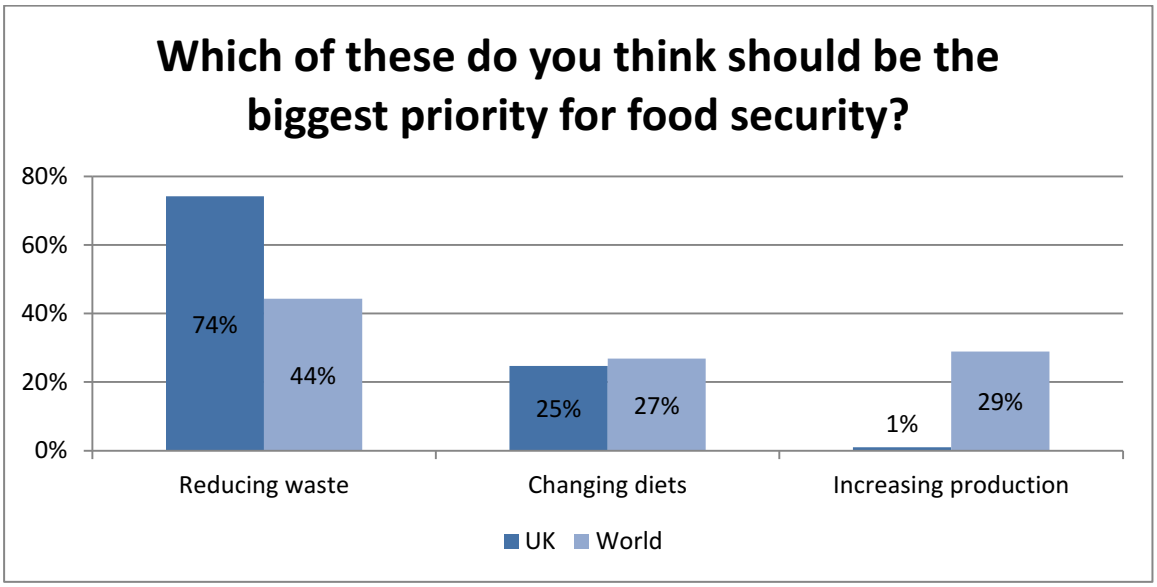
Even though many interviewees and survey respondents were generally positive about the use of sustainable intensification, it was not the preferred approach of most survey respondents to addressing the food security challenge, as explained below.

In the online survey, participants were asked to prioritise one of three approaches (reducing waste, increasing production and changing diets), for the UK and the rest of the world. We explicitly asked which was the **biggest** priority, not implying that any one solution alone could address the issue but asking which should be addressed with the highest priority. Interviews with participants and specialists at the beginning of the project suggested that views differed on the need for intensification, whether sustainable or not: there was greater consensus about the potential and need for increasing production in other nations where agriculture was perceived to be less efficient and food scarcity more widespread. However, there was greater disagreement, from both specialists and participants, about the need to increase food production in the UK and other developed nations.

The results are shown in figure 2 below.

[11] Global Food Security occurs when everyone has access to sufficient, safe, affordable and nutritious food, all of the time and in ways the planet can sustain into the future.

Figure 2 Questions 5 and 6. BASE=97



In the survey, only one of 97 respondents felt that increasing food production should be the biggest priority in the UK, compared with 29% who thought this was the biggest priority globally. This relationship was reversed in relation to reducing waste, which 74% of participants thought should be the priority in the UK, compared with 44% who thought it was a priority in the world. A similar proportion of respondents thought changing diets was a priority both in the UK and in the world. The most commonly expressed view about these differences was that the UK was in a better position than other countries where food was scarce:

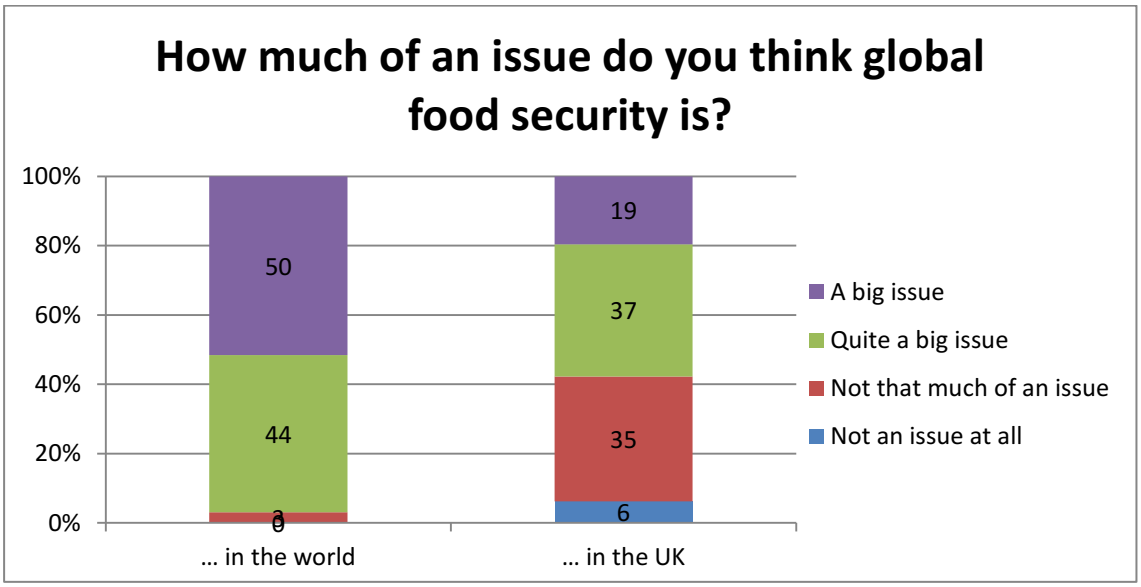
In many third world countries they do not have the luxury of being able to waste food, in such countries increasing productivity is much more important.

Survey respondent (Male, 41-55, London)

The differences in survey respondents' views could be partially explained by their perception of the urgency of the food security challenge. While 67% of respondents thought that food security was a big or quite big issue in the UK, this figure is 97% for the world. This is in line with findings from the Urban Agriculture project[12] where some participants considered the easy access to cheap and plentiful food in the UK as a proof that the country is not threatened by food crisis.

[12] Report available at: http://www.foodsecurity.ac.uk/programme/activities/public-panel.html

Figure 3 Questions 3 and 4. BASE = 97.



The view that **increasing food production** should not be our main priority was dominant among survey respondents and interviewees, often expressed in the context of calls for reducing food waste and educating consumers. Participants across the project tended to feel that we should first address the existing problems of the food system (waste and overreliance on unsustainable diets) before we look for ways to increase production.

I think we need to prioritise what we need to do first, and wastage right now is a problem, that if we cannot manage correctly, there is no point in trying to produce more.

Survey respondent (Male, 26-40, London)

Discussion group participants, on the other hand, were more willing to consider a scenario where various approaches to addressing the food security challenge (including increased production) would take place simultaneously. This difference in attitude is likely to have been prompted by the Q&A session that took place at the beginning of the discussion group sessions where the specialists argued that increased production would be necessary to feed the predicted global population regardless of how successful action on food waste is in the UK[13]. This demonstrates clearly the influence of an explicit statement of a need case for change to the food system: where participants felt that specialists stated definitively that SI was necessary they were more receptive towards it, although this does not undermine their preference for prioritising other approaches. This reflects learning from the Urban Agriculture project, where we found that stating the need case for agriculture in urban environments was essential if participants were to engage fully with the different urban agriculture technologies explored.

[13] Exactly how much, if any, increased production is required to feed the growing global population remains a disputed point among specialists and the GFS partners. The specialists in the workshop specified that UK food waste on its own would not be enough to produce global food security but did not prohibit participants from discussing whether to **prioritise** addressing food waste or increasing production.

Question from participant: ***If we reduce food waste, would we still need to produce more food?***

Answer from specialist: ***The answer is yes, even if there was zero food waste, we would still need to produce more food to feed the world's growing population. Tackling food waste is important – you can't keep investing in producing more food if that food is going in the bin. Reducing food waste needs to remain a priority but it would not solve the problem.***

Discussion group, London

Of those survey respondents who prioritised food production globally in the survey, many referred to developing countries with severe weather problems and/or countries that have already exhausted all other alternatives, including adopting an insect based diet. Some respondents thought that production needed to increase now, to address hunger, while others thought it would need to increase in the future to accommodate future population growth.

Most survey respondents thought that the highest priority for addressing the food security challenge was **reducing food waste,** particularly in the UK. This finding is consistent with other public panel projects[14] where food waste formed the focus of many discussions. The interest in this issue was partially prompted by a popular television programme and other media focus on the topic[15]. There are several possible explanations for the prominence of this issue, and it is likely that all three play a part:

- **Exposure**: food waste has been extensively featured in the media over the nine months of the panel, making it topical and memorable for participants.
- **Agency**: food waste is an issue which participants have some control over, in their own lives, which can be more attractive for discussion than more distant or remote topics. (This was picked up in other public panel projects like innovation too, where participants described food waste as 'the quick win' because it was in their own homes)
- **Emotive**: food waste, particularly when considered in the context of hunger elsewhere is an emotive issue, it raises questions of fairness, of excess and greed, which participants feel strongly about.

Participants in all phases of the sustainable intensification project tended to see the food security challenge as a distribution rather than a shortage problem and felt that by reducing food waste in economically developed countries, there would be enough food to feed everyone on the planet.

Changing diets was the second most frequently prioritised approach for the UK and third for the world. Survey respondents argued that switching to less meat intensive diets and crops that required fewer inputs would enable our current resources to last longer and could potentially deliver health benefits to consumers. Some, however, were sceptical about the

[14] E.g. Food Systems – report available via: http://www.foodsecurity.ac.uk/programme/activities/public-panel.html

[15] Hugh's War on Waste - http://www.bbc.co.uk/programmes/b06nzl5q

feasibility of such approaches, indicating that they would struggle to reduce their own meat consumption. There were mixed views from survey respondents about whether changing diets applied equally to other countries. Some felt that societies in developing countries already have resource efficient diets so they did not see the need for further changes, others thought any change needed to be global.

Chapter 3: Trade-offs

As the sustainable intensification project progressed, we asked participants to consider a number of possible trade-offs. In this chapter we look at their responses to these, through survey responses and in discussion of case study materials used in the workshop.

What are trade-offs?

A trade-off is a situation where you can't have everything: there may be several possible benefits, or impacts, and no one solution that works well for them all. For sustainable intensification the challenge is to provide more food without harming the environment, the economy or society.

3.1. Trade-offs in principle

One of the questions we wanted to explore in this project was whether people's general views about the importance of difference aspects of sustainability were consistent with their responses to particular examples. To illustrate: if we believe that in principle the environment should be protected, does this principle still hold when the consequence of protecting the environment is higher costs for consumers.

To test this we asked online survey respondents to prioritise four principles for the food system:

Producing food more sustainably, in ways that protect the climate, biodiversity and other resources (i.e. the environment)
Producing food in ways that support the economy and farmers (i.e. the economy)
Producing and distributing food in ways that are equitable for all involved (i.e. society and fairness)
Plentiful and affordable food supply for the UK consumer (i.e. individual interests)

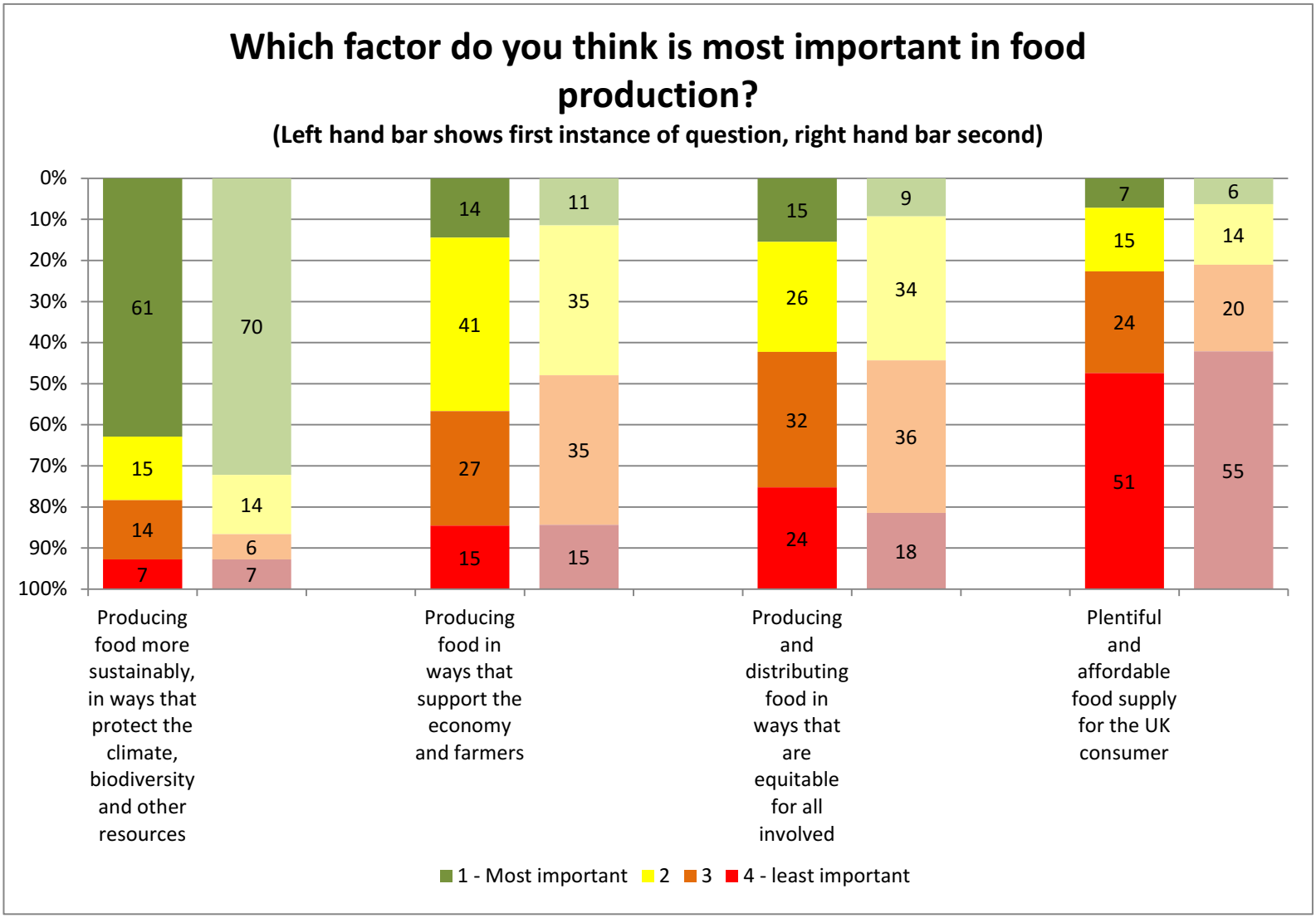
These principles were distilled from some of the trade-offs that specialists had identified during the scoping interviews: there will, of course, be many others relevant to discussions of sustainable intensification and they are not mutually exclusive. However, given that the focus of the topic was trade-offs, we wanted to understand whether participants tended to prioritise a particular principle.

To help us understand more about how people's views about sustainable intensification might change when they learned more about it we asked the same question again after the survey

respondents had answered six questions about possible trade-offs related to particular examples of SI.

Figure 4 below shows how survey respondents prioritised each of the four principles, with green bars indicating the highest priority of four and red the lowest. The two bars represent the two times during the survey that respondents addressed the question, once before and once after they had considered examples of trade-offs. As the chart shows, environmental sustainability was given the highest priority by between 60% and 70% of respondents each time, while the other three factors were chosen between 5% and 10% of the time. Plentiful and affordable food supply for the UK consumer was given the lowest priority by over half of survey respondents each time.

Figure 4 Base = 97. Shows both instances of question.

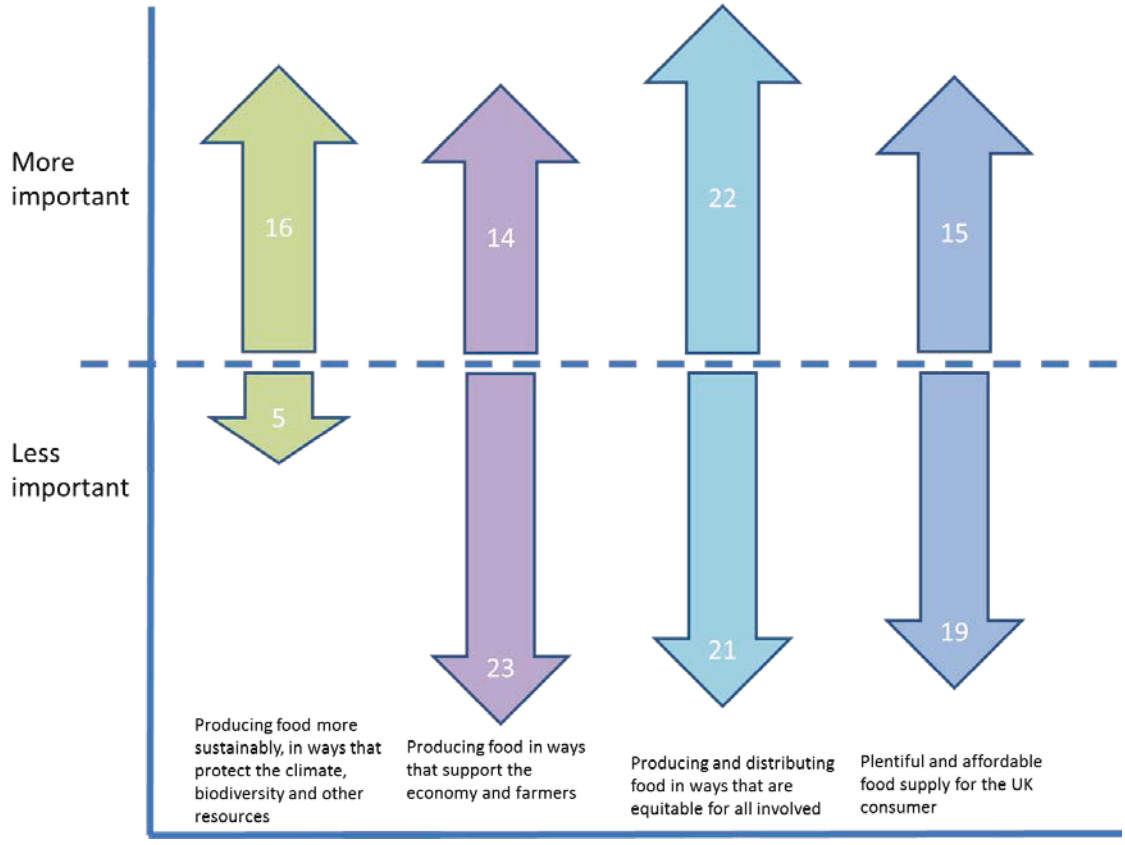


3.1.1. Changing views

Most survey respondents did not change their views on how important each factor was after considering the examples. Slightly more respondents prioritised environmental sustainability, while slightly fewer prioritised the economy and farmers. Figure 4 above shows the changing scores: the left hand bar in each bar is the first response and the right hand bar is the second.

While all four scores changed slightly, when we look at how individuals changed their views we see that not everyone changed their views in the same direction. To explore how survey respondents views changed figure 5 below shows how many participants changed their scores for each item, with positive movements above the line and negative movements below. Environmental sustainability was ranked as more important after considering the trade-offs by 16 respondents, and less important by five. In contrast, more respondents ranked economic

Figure 5 Direction of change between instances of question. BASE = 97. Does not show respondents whose views did not change.



sustainability less important after considering the trade-offs (23 to 14). There was no clear trend for the other two items, with roughly equal numbers of participants recording increased and decreased importance for equitable food production and UK food supply.

When we asked participants to explain why, if at all, their views had changed, there was a range of comments, although it should be noted that the majority of participants did not change their responses. Not all those whose views changed commented, and there was some inconsistency between the scores participants gave to the closed question and their comments, suggesting that at least some participants did not recall their first answer.

For those who gave higher scores to environmental sustainability, they reported feeling that the examples had prompted them to think about the need to manage resources, or new possible approaches. One described having "a clearer idea of what I find acceptable and not" suggesting that the examples given under the trade-off questions had prompted them to consider their own red-lines. One respondent specifically mentioned that their initial priority had been on equity and fairness but they had realised they actually placed a higher priority on the environment and sustainability.

Those who reported higher importance of economic sustainability tended to mention 'farmers' specifically rather than the wider economy or agri-business (as offered in the question text "support the economy and farmers"), in line with other findings about the sympathy towards individual farmers that is consistent in discussions on production. For example:

> ***Yes, I think farmers need an incentive to try new ideas and they need to make a living too.***
>
> ***Survey respondent (Male, 41-55, London)***

The most common reflection by participants on how their views had changed was that they felt they were more informed, (even 'enlightened' in one case), and that they were more conscious of their own choices. Some linked this to an increased sense of responsibility:

> ***I've changed to supporting the farmers and economy before plentiful and cheap food because I consider that those needs should be met more importantly.***
>
> ***Survey respondent (Female, 41-55, London)***

There were also several comments from respondents who felt that completing the survey had reinforced their feelings about the importance of addressing food waste, one of the most common themes of discussion across the public panel, regardless of the initial topic.

3.2. Specific trade-offs

While this data seems to show a clear preference amongst survey respondents to prioritise environmental sustainability over the interests of UK consumers, this wasn't as clear in other phases of the project. When participants were asked to consider specific examples of trade-offs that could benefit the environment they were less positive than the survey data would suggest. Each of the sections below deals with a specific trade-off that sustainable intensification could prompt, we used a range of scenarios in the interviews and survey, and some were discussed further in the discussion groups. Each section below deals with a particular trade-off, and specifies what scenarios were proposed and in which sessions they were discussed.

A note about comparing data

It is important to be cautious about comparing the findings of the survey (shown in the chart above) and the discussion groups (reported on below) because they did not involve the same group of people. Although those taking part in the discussion groups had completed the survey not all of the survey respondents took part in the discussion groups and so did not have

access to additional information from specialists. It is possible that these methodological differences account for differences in views.

3.2.1. Animal welfare and productivity

Note: While this was one of the range of scenarios identified in the scoping research, some GFS partners feel strongly that sustainable intensification should not be assumed to involve reduced welfare conditions for animals. Despite being presented as one of a wide range of scenarios, it was considered particularly important by participant who tended to assume that intensification would inevitably result in reduced animal welfare.

Figure 6 Animal welfare and productivity

Many participants across the project felt strongly about and were not willing to compromise on animal welfare. When faced with a choice of changing animals' living conditions to realise environmental benefits, survey respondents tended to assume that any changes would be negative, and to argue strongly for preserving (or even improving) current standards of animal welfare. There was a widely shared view that people have a moral obligation towards animals and should not treat them just as a source of meat. Animals' wellbeing was also thought to contribute to the quality of products with some survey respondents (and later discussion participants) arguing that free-range meat and eggs taste better than non-free range varieties.

In the interviews and discussion groups, when participants were asked to consider scenarios where their choice would lead to increase in the price of animal products, they tended to say that they would rather pay more or reduce their meat consumption overall, rather than agree on lower animal welfare standards.

Animals should come first, even if that means having less meat. If this increases the price of meat, then so be it, we should be prepared to pay more for it. I only buy free range eggs, you can taste the difference.

Interviewee (Female, 26-40, Harrogate)

One interviewee even suggested that genetic modification could be explored which would allow us to increase animals' productivity without having to compromise on their living conditions.

Free range was one of the most regularly cited examples of labelling relating to animal welfare, and one where participants felt that consumers were willing to accept a higher price as a trade-off for better production practices. When probed on this in the discussion group one table of participants agreed that while free-range had become a "normal" choice, this had really taken off when prices became comparable. As shown in the exchange below, participants felt that knowing something was more sustainable (or ethical) was not in and of itself enough of a reason to change buying behaviour.

Participant A: … you might also buy something virtuous for the feel good factor, and pay a bit more for that.

Participant B: But do you think the regular Joe on the street thinks that?

Participant C: Well for free ranges eggs now the prices are the same people buy them.

Participant A: Sustainability is like an album that's not very good, you have to listen to it a hundred times before it's good.

Discussion group, London

One participant in the online discussion group felt that there was a discrepancy between people's words and actions, adding that consumers would always go for to the lower price tag.

Most people don't want to make changes if it means paying more. Take eggs as an example. 85% -90% of eggs on sale in the supermarket are caged hen eggs. Animal welfare is way down the list of people's choices, whatever they may say.

Discussion group, online

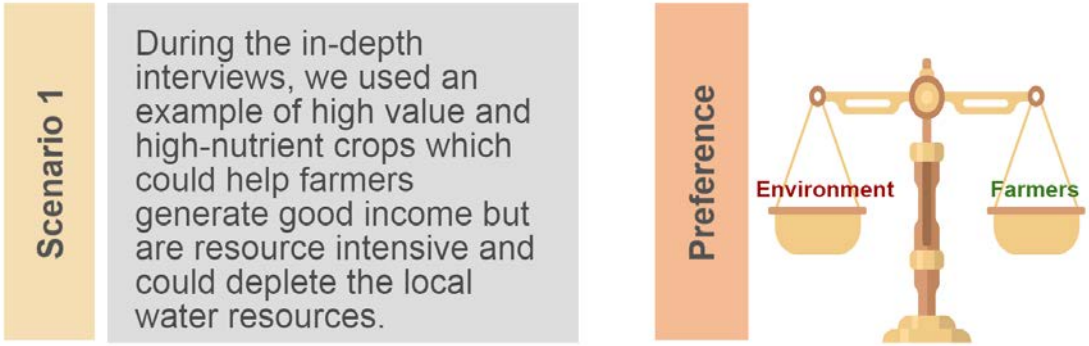
At the other end of the spectrum, was a small minority of interviewees and survey respondents who believed that the current standards in the UK were unrealistically high and there was scope for relaxing them. Some argued that people' needs should come first and the only reason we rear livestock is to get food.

Some interviewees and survey respondents were willing to explore changes to the animal welfare standards as long as minimum standards were met for animals and would not result in increased risk of diseases. For example, one participant, influenced by the Urban Agriculture dialogue, suggested that urban areas could be used for raising animals, thereby releasing some of the agricultural land currently occupied by livestock.

3.2.2. Economic costs and environmental costs

Scenario 1: Farmers' economic gains at the expense of the environment

Figure 7 Farmers' economic gains at the expense of the environment



Many interviewees were reluctant to take a side on this trade-off, arguing that this was a complex situation which could not be reduced to an 'either /or' answer. These views often stemmed from a widely shared concern about farmers' current financial situation, which many described as difficult. Some pointed out that if farmers were not making a profit, they would be unwilling to grow crops that might be essential to consumers but offer a low return on their investment. The same point was re-iterated by one of the specialists at the London discussion group:

> ***Imagine a technology that prevented nitrogen fertiliser from oxidising in the soil and releasing oxides of nitrogen greenhouses gases in the air. If we had a technology that would stop that, that would add value, right but who would pay for it? The farmer wouldn't because the farmer would not benefit from doing this, other than the greater good. So that is unlikely to be a commercial success even if the technology adds value.***
>
> ***Specialist, discussion group, London***

Interviewees responding to this were concerned that without support from government farmers would be forced to bear the costs of taking actions whose benefits accrued to society as a whole (a concern that was repeated in the discussion groups).

> ***I do not expect the farmer to think of anything else other than how to manage their own land but the Government, on another hand, should be looking after our health and environment.***
>
> ***Interviewee (Male, 18-25, Cardiff)***

Many interviewees suggested solutions to reduce water use whilst allowing the farmer to continue growing crops which enabled them to make a good living. These included changing the way water was managed (e.g. artesian wells), or switching to more water efficient crops. Some also suggested that we should reduce the number of cattle herds.

Interviewees felt that truly sustainable food production could only be achieved if the socio-economic needs of farmers were also taken into account and it would be unreasonable to expect farmers to put the needs of the environment before their own. Reflecting on the

interdependence between farmers' activities and the environment, some interviewees argued that farmers have a strong connection with their land and would not consciously harm the environment.

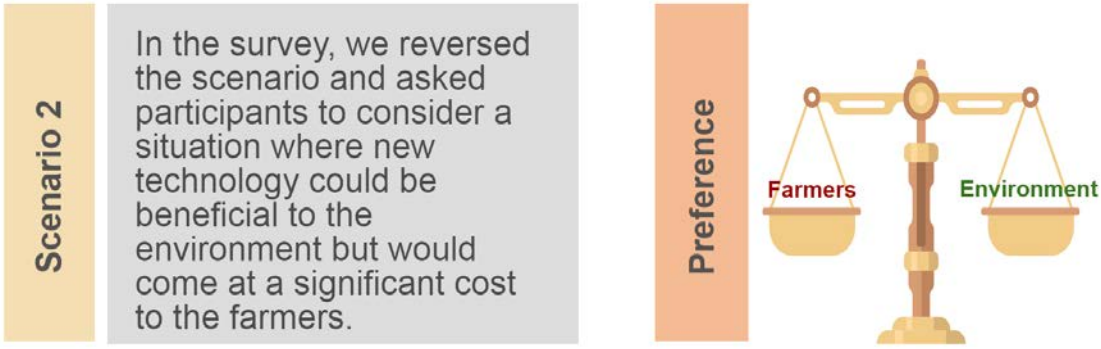
> ***Farmers who have been doing this for generations, they know that they have to look after the land, because otherwise they will not have a land to grow on. Generally, maybe except for the use of pesticides, I believe that farmers do look after the land. Sometimes they use pesticides that are more harmful to the environment because they are cheaper but that is because they are not getting enough money for their produce in the first place.***
>
> ***Interviewee (Female, 26-40, Belfast)***

Interviewees tended to think that if farmers were asked to go beyond and above their current levels of environmental responsibility, they should receive financial help and guidance. One interviewee, however, clarified that subsidies could also have unintended consequences such as distorting the market.

A few interviewees found it difficult to engage with the outlined scenario arguing that they could not imagine a situation where the UK would experience water shortages and that flooding was of more concern to them. Others were worried about shortages as water is finite resource and requires careful management.

Scenario 2: Environmental benefits at farmers' cost (survey)

Figure 8 Environmental benefits at farmers' cost (survey)



Views on the second scenario (changes to farming practices that could reduce environmental impacts at a cost to farmers) were slightly more mixed.

There was a strongly expressed preference for the use of more technology in farming but not necessarily for environmental reasons – instead survey respondents focused on the socio-economic benefits such as increased productivity, safer produce (due to minimised use of pesticides) and reduction in food waste. Participants found the idea of achieving more with less appealing as this could save resources without the need for consumers to make significant sacrifices.

In line with findings from previous public panel projects[16], survey respondents favoured technology seen as efficient and modern.

When talking with the specialists in the discussion groups some participants argued that costs should not be a deterrent, as they would decrease over time. However, many echoed concerns expressed by interviewees and argued that the cost of the new technology should not be borne by the farmers. Instead, they called for the technology to be subsidised or provided for free. One discussion participant suggested taxing retailers and using the profits for research and development.

As in the interviews, participants in the discussion groups raised concerns about possible negative consequences of subsidies.

> ***I do agree with helping the farmers but I don't want to go back to the years where they were given grants for leaving fields fallow or they were paid grants for other things which they were able to take advantage of. In those days you never saw a poor farmer. But the grant system was open to abuse.***
>
> ***Discussion group, online***

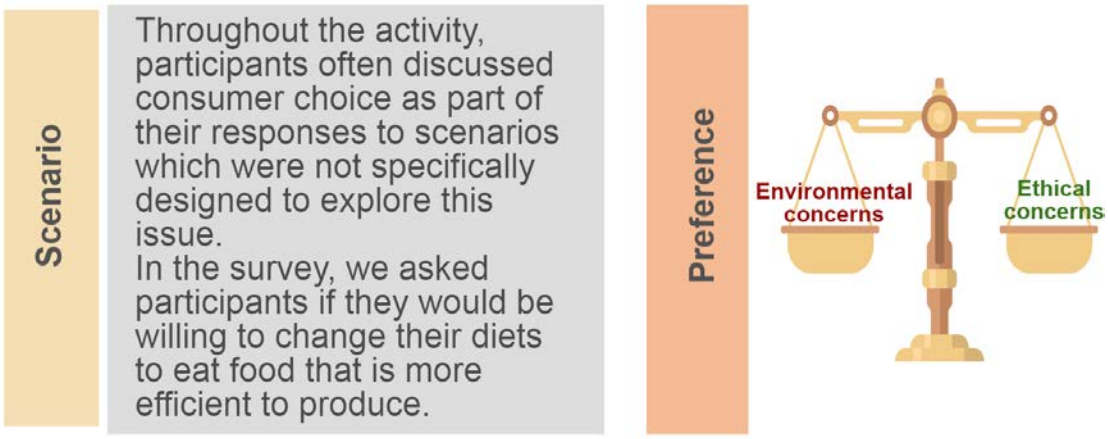
Some participants were reluctant to make a decision noting that the pros and cons need to be carefully considered and new technology should only be used in areas where it could really make a difference. There was also concern that farmers in developing countries would be unable to afford such an expensive solution and that efforts should be directed towards developing something cheaper. Some participants stressed the importance of education, arguing that technological improvements alone would be insufficient.

> ***There's better ways of increasing immediate yield from a farm than this method. Equipment and education for example could increase yield from 40% to 70%, whereas this tech may only increase 40% to 50%. It's a more expensive method possibly without same increased gains.***
>
> ***Survey respondent (Male, 26-40, Belfast)***

[16] See the Urban Agriculture report available here: http://www.foodsecurity.ac.uk/programme/activities/public-panel.html

3.2.3. Consumer choice shaped by ethics

Figure 9 Consumer choice shaped by ethics



What we mean by ethics and environment

Participants across the project tended to prioritise "ethical" issues over "environmental" when considering trade-offs. Neither of these words is easy to define, but people often talked about the rights of animals or people without explicitly calling them 'ethics'. In contrast, participants tended not to talk about the environment as an issue of right and wrong, or to have such strong views on the need to protect it, despite the high proportion of respondents selecting environmental sustainability as a priority in the survey.

During the project, it emerged that consumers were more willing to pay higher price for ethical rather than environmental reasons. Concerns about animal welfare and farmers' financial position were identified as strong drivers that could influence consumer choice. Some participants discussed this in the context of quality of outputs, noting that consumers would be more likely to pay more for something they felt would offer them a better experience such as improved taste or more generic statements like 'better quality'. There was a perception among discussion group participants that environmental credentials alone would not be enough to motivate behaviour change at the expense of price.

It depends on the taste – for example organic eggs taste better, so that's why people are willing to pay more them.

Discussion group, London

When asked if they would consider paying more for products that would be more environmentally friendly, some discussion group participants pointed out that because the

environment is a less tangible and more complex dimension of the food system, consumers would have to be educated first in order to start making such choice.

3.2.4. Consumer choice shaped by environmental considerations

Figure 10 Consumer choice shaped by environmental considerations

Changing people's diets was widely accepted among survey respondents, with most commenting on the potential for more seasonal diets. Participants identified waste reduction and resilient, healthier and environmentally friendly diet amongst the benefits. Many of the comments exhibited a bucolic and nostalgic view of agriculture – seasonality was seen as connecting consumers to nature and recreating habits people were accustomed to as children.

I still remember a time when this happened. It seems a perfectly acceptable way to farm and the delight when the crops are in season is something I cherish!

Survey respondent (Female, 56-65, Dundee)

Participants in one of the discussion groups noticed this perception, debating with the specialist at their table whether views of 'traditional' agriculture were realistic. The tendency to view historic practices as more environmentally sustainable were challenged, but our experience with the panel as a whole is that this perception is a common one, and difficult to shift.

People like to talk about how things were in the past. The fact is there were only 2 billion people in 1920, there are 7.25 now and there would be 11 billion by the end of the century; we are facing unprecedented challenges. We can't go back to technical solutions that were effective 80 years ago and expect them to work.

Specialist, discussion group, London

A significant minority of discussion group participants were happy to consider changing their diets but only if they could get produce that was of sufficient variety and quality and at affordable price. Some participants admitted that they would struggle with reducing their own meat consumption.

To be honest when it comes to eating meat then probably not, I am open to ideas but cannot imagine my diet to not include meat which in my household is almost a staple requirement.

Discussion group, online

The majority of survey comments on seasonality tended to link it to locally produced food, but a few participants looked at the issue from a global perspective. One was concerned how increased reliance on local produce would impact on the countries the UK currently imports from, while other respondents asked if seasonal produce should be home grown or imported.

The few participants in the survey and discussion groups who objected strongly to changing their diets described the approach as going backwards and added that the availability of advanced technology (including genetic modification) could help us overcome the environmental limitations without having to alter our eating habits.

This would not work in the UK as people would see it as going backward. I would not want to restrict the range of food available in my local supermarket.

Survey respondent (Male, 41-55, London)

3.2.5. Consumer choice shaped by price

Some participants said that in their households, price and convenience were the most important factors when shopping for food. Related to this, some participants noted that paying attention to such a wide range of issue (ethical, socio-economic, environmental) could be overwhelming and time consuming.

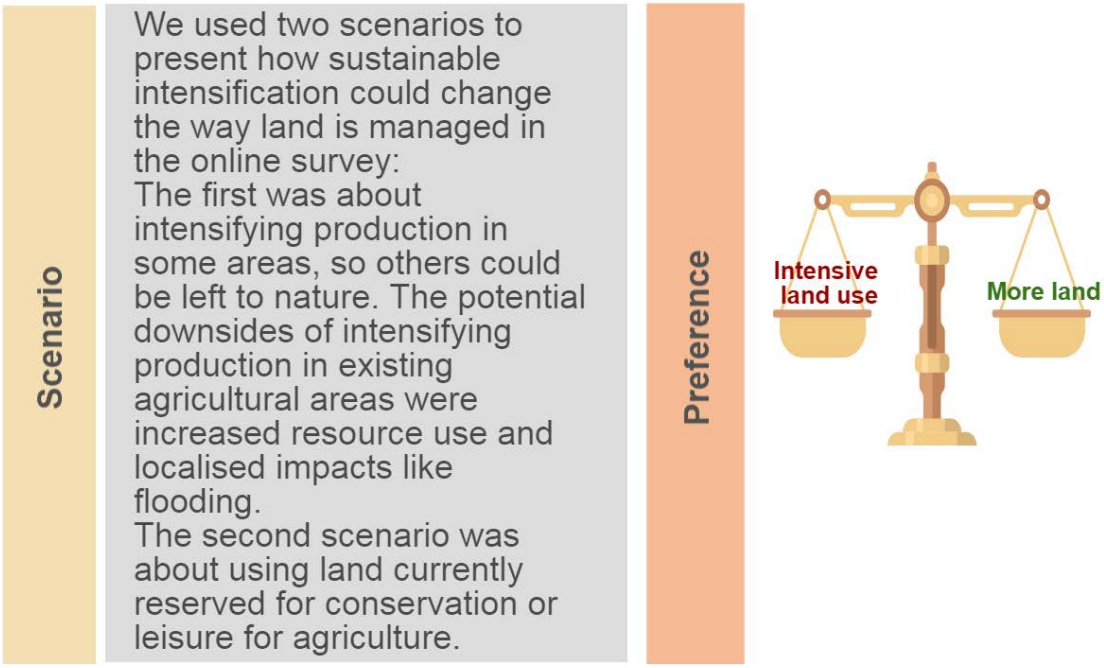
Sometimes you feel a bit overwhelmed by all the impacts you have to think about: is the farmer getting paid enough, was the land it was grown on claimed for rainforest, is the animal happy?

Discussion group, London

Some participants argued that consumers would always be motivated by price and the only way buying decisions could be influenced is by limiting choice - either through increased prices or reduced variety of produce in supermarkets. This is further explored in Chapter 4.

3.2.6. Land use

Figure 11 Land use



These methods evoked mixed views among survey respondents, with the option of using more land (even if, as in the UK, that land had to be acquired by limiting the availability of land use for other purposes, such as environmentally protected areas) being on balance more popular than intensive land use. A common theme across the negative comments on both was respondents' belief that changes to land use should be treated as last resort and we should first ensure that we are using our current resources efficiently. A recurring concern was that any changes could increase the flooding risk – something participants felt strongly about –one of the discussion group participants suggested that the risk of flooding had made the land use sound much more risky than other impacts, suggesting that flooding is particularly emotive. Survey respondents and interviewees suggested a range of alternatives to increasing the amount of land used for farming or intensifying production on existing land. These included - reducing food waste, utilising GM technology, and adopting vertical farming

Arguments specific to each of the methods are presented below.

Intensive land use

Those who supported intensifying land use felt that it would be an efficient way to increase production without having to disturb land currently unused for agriculture spaces. Many, expressed concerns about how this might impact on flood risks and wildlife, particularly bees. Related to the latter, some survey respondents referred to the use of precision agriculture as a potential solution (see section 3.5). This is a good example of how as the project progressed and participants were exposed to more information, they started to identify links between the different methods.

I do not like this idea - we are already aware of the dramatic decline in bees, without which the majority of crops would never be pollinated. We should be doing everything we can to protect this insect because without it, we would be in big trouble. If however the intensively farmed areas had areas set aside with crops/hedges for bees/birds etc. and used the targeted approach with fertilizer as discussed earlier, this may be a solution.

Survey respondent (Female, 41-55, Cardiff)

Other suggested ways to mitigate the potential negative consequences including close monitoring and intensifying production only in areas where the impact would be minimum.

One interviewee added that efficiencies could be achieved by looking into the type of produce that would be farmed – for example, replacing livestock with crops or switching from high-maintenance breeds to low-maintenance breeds.

More land use

NB: This scenario was intended to help participants consider the trade-off between agricultural and other land uses, such as preserving land for environmental reasons, or for recreation. It was not presented as a solution to the global food security challenge , given the limited (if any) potential for land to be converted to agricultural use.

This method received overall a good level of support from survey respondents, with some saying that securing access to food is more important than preserving aesthetics.

Land is there to be farmed I'd rather eat than have a nice view

Survey respondent (Male, 41-55, Cardiff)

Some participants argued that they would prefer that land in the UK currently allocated to other purposes (e.g. recreational use, or conservation land) is used for agriculture rather than relying on imported food or GM crops. While this may not provide a real alternative to achieving global food security, it does tell us people prioritise what they perceive as 'natural' approaches to farming – which might mean transfer of land use – over approaches that they see as risky, such as genetic modification or reliance on imports.

During the discussion groups, we asked participants if the survey findings surprised them. One participant stated that the housing shortage the country was currently facing had changed people's perceptions and had prompted them to see land as a commodity that could and should be traded.

Not all participants were open to the idea of increasing the amount of land used for agriculture. One major concern was that the landscape is both a tourist attraction and a recreational space: participants felt that changing it would have adverse socio-economic consequences.

The way our countryside looks is important to us all but it is also an attraction. Out tourist industry which brings money into the country needs the countryside to keep looking beautiful.

Discussion group, online

The question of aesthetics evoked mixed views – while some participants thought that agricultural activities would damage the look of the countryside, others argued that beauty is subjective and were happier with change.

Provided there are not rows and rows of greenhouses and solar panels, what could be nicer than looking at field after field of fresh crops swaying in the wind?

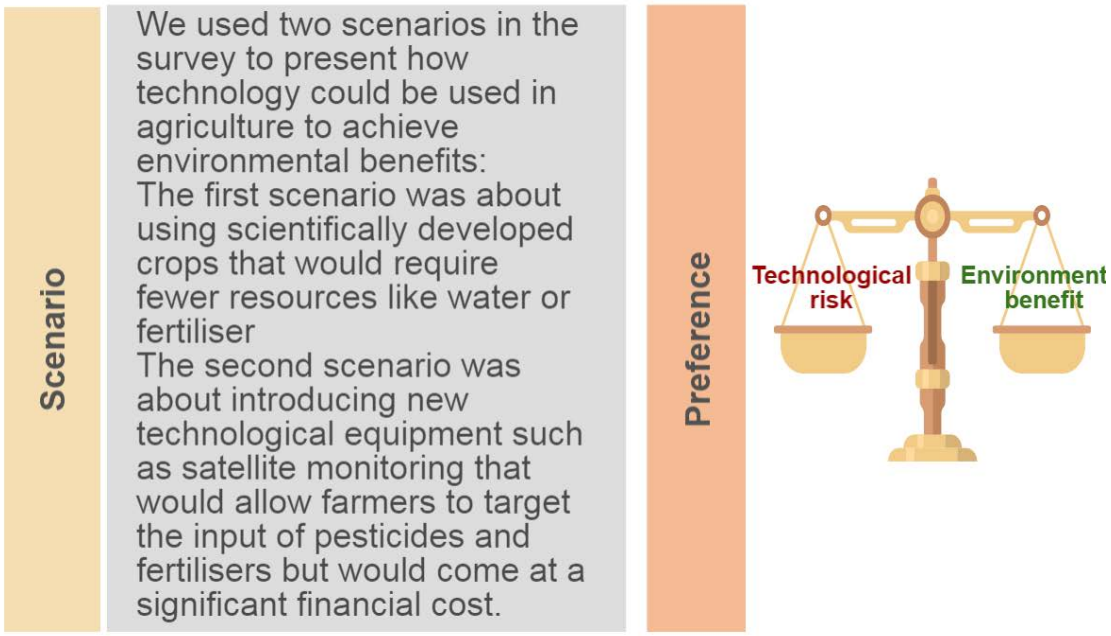
Survey respondent (Female, 41-55, Cardiff)

Some participants, while supportive of the concept of expanding farmland, suggested that this should not necessarily take place in areas of natural beauty – instead they suggested using urban spaces or wasteland in developing countries.

In contrast to the Urban Agricultural project, very few participants identified a conflict between the need to increase farmland and the need for housing. This could be due to participants' tendency not to think of the land as one entity but in terms of its geographical location - city land and countryside land.

3.2.7. Technological risk and environmental benefit

Figure 12 Technological risk and environmental benefit



When speaking in general terms, participants across the project were open to the idea of using more technology in agriculture, on the assumption that their concerns were addressed and sufficient mitigation measures were put in place. Of those who stated their support for technological solutions, many stressed their contribution to food productivity in addition to the environment, indicating once again that participants were looking at the food security issue from numerous angles.

I thought the document was going to be about GM, and I think that's something to be explored. Definitely something we need to have a debate about. I know that a lot of people have the knee jerk reaction of saying no to genetically modified. Obviously organic and

natural and as pure as possible is good, but we can't keep doing it, look at the flooding in this country, global environmental change

Interviewee (Male, 41-55, London)

Of the two scenarios posed, new technological approaches like precision agriculture were more popular with survey respondents and discussion group participants. In some cases, precision agriculture was strongly endorsed as method that should be adopted by farmers. Remaining concerns were mostly about how farmers would manage the costs of introducing new technology (see section 4.1.1 for more on the role of farmers).

This is exactly the approach that farmers should be taking - just identifying exactly what is needed where. Your doctor would not prescribe iron tablets for you if you were not anaemic, so why blanket fertilise your crops if it's not required. There is a massive use of fertilizer in agriculture, which does run off into waterways and should be minimised. Obviously there will be more costs involved, however this should be borne in part by the EU to encourage farmers to use this approach.

Survey respondent (Female, 41-55, Cardiff)

In contrast, the topic of new crop varieties was a divisive one. In the online survey we used the phrase 'scientifically developed crops' to include both conventional breeding and genetic approaches, but this was commonly interpreted by respondents as a euphemism for genetic modification. In the discussion groups participants talked in some depth with specialists about new crop techniques, both conventional and genetic.

Participants' technological concerns can be clustered in three broad categories: safety; naturalness and commerce.

- **Safety:** this was the most common theme with many survey respondents and discussion group participants expressing a degree of anxiety about the long-term effects and our perceived inability to anticipate all potential consequences, to both the environment and human health. While many participants expressed concerns about safety, there was also some recognition that as more information had become available these concerns might be less justified.

I don't know. I feel uncomfortable about this. Are we talking GM crops? The world is constantly changing and science is developing at a rapid rate. Part of me feels we should use these new resources to help us but part of me is afraid of the consequences both to ourselves and our environment.

Survey respondent (Female, 26-40, Harrogate)

To some participants, experimenting with something they believed to be fundamentally new required a leap of trust in the food system and its actors. Many stressed that if the new technology has been sufficiently tested and officially approved by the government, they may consider using it.

Not sure yet, about GM crops because I'm not sure it's been tested. I trust the government so if they put a circle with a tick in to say their inspectors had done something and it had passed and it had fit with their criteria then I would be happy with that

Interviewee (Male, 41-55, Harrogate)

However, other participants argued that even if the technology was thought to be safe, the same could be said of chemicals like DDT in the past and were unsure how they could be confident that there was no risk.

- **Naturalness:** related to the above outlined safety concerns, some participants noted that using man-made inputs would never be as good as relying on natural resources. The question of naturalness was picked up by a few respondents, mainly in the context of their longing for what they saw as "traditional" agriculture.

[in response to a question about new generation of pesticides] We need to use our natural resources more. Natural sunlight can be harnessed better and rainwater collected and used.

Discussion group, online

Others, even though open to the idea of combining science and farming, stressed that we should first focus on more natural approaches such as changing our diets and reducing waste.

Some respondents also worried that overreliance on scientifically developed crops may result in losses of native varieties which we may not be able to recover.

- **Commerce:** As discussed in section 3.2, one of the biggest concerns about introducing new technological equipment was around its cost and the financial implications to the farmers. The question of funding was also raised in relation to development of scientific crops. Some participants, particularly in the discussion groups where they had the chance to engage with an industry representative, were worried that big multinational companies, which have large research and development budgets, would come to dominate the agricultural sector through scientific patents, thereby affecting smaller producers.

Chapter 4: Who is responsible for ensuring that food is produced sustainably

This chapter discusses participants' views on sustainable intensification as a system change that could affect, and be affected by, the various actors in the food system. We consider the way in which participants understand the food system in relation to sustainable intensification, and the distribution of responsibilities and benefits amongst different actors. We also report on how participants saw their own responsibility as consumers, and to what extent they believe their food preferences can, through food choices, affect the food system.

4.1. Role of governments, farmers, scientists and businesses

Actors in the food system

In an earlier project with the public panel (Food Systems[17]) we discussed extensively the differential roles and responsibilities of the different actors in the food system. In reporting on that project we proposed a model of the food system based on how participants discussed actors, which we found was less structured around the supply chain and more around the perceived influence of the different actors. This is shown below in figure 13.

Figure 13 Perception of actors in the food system

[17] All reports available on the GFS website at http://foodsecurity.ac.uk/programme/activities/public-panel.html

When discussing SI with participants, in the interviews and discussion sessions, we found that participants used the same broad conceptual model. The distinction between farmers and other food businesses persisted and producers were assumed to be small scale, traditional, and with less of a commercial focus than other actors.

My mental map of farming in the UK is still smallholdings all over the place, family farms.

Discussion group, London

4.1.1. The role of farmers

Farmers have been consistently regarded by participants in panel activities including food systems and innovation as the actor with the least influence in the food system, and the most deserving of public sympathy. Even on the most emotive of topics, food waste, participants tend to assume that farmers are innocent of wasting food, at least relative to other actors, perhaps based on recent media coverage of the topic. However, this view is based on a perception of farmers as predominantly individual and small-scale producers, working directly on the land in a traditional way. Participants rarely thought of food producers as major commercial enterprises, unless prompted.

Participants in discussion groups and interviews saw farmers as trapped by low prices, and a few participants connected this directly with unsustainable practices. A few participants mentioned pesticide use as a concern.

They can't produce less because they'll lose out, but they're harming the land in the long term.

Interviewee (Male, 26-40, Cardiff)

The more common perception was that farmers have a stewardship role in relation to the land they farm and the food they produce, with participants assuming that farmers would act in the interests of environmental sustainability wherever possible.

Generally, maybe except for the use of pesticides, I believe that farmers do look after the land.

Interviewee (Female, 26-40, Belfast)

When we talked to specialists about sustainable intensification at the beginning of the project several of them identified 'resilience' as an important part of the discussion. Some specialists felt SI should include a shift from producing maximum yields in good years and suffering in bad years, to more consistent yields that might not peak as high. They felt that this was particularly difficult in the UK because farmers who are faced with low prices will always try to maximise the yield in any year, and find it hard to invest for the longer term. This complex issue was not featured in the survey due to the difficulty of explaining it fully in the format but it was mentioned in the face-to-face discussion group.

You get 27 times the return on investment in agriculture, but it takes 14 years to get the return, and farming is very conservative, so people aren't investing, those barriers need to be broken down.

Definition:
Resilience is the ability of something to recover from shocks. In the food system, this might mean farmers growing crops that are more resistant to extreme weather, or a supply chain that keeps the shelves full despite a strike.

Specialist, discussion group, London

Participants recognised this challenge, and felt it was important that farmers were supported to overcome it, which would benefit both them and the UK food system in the long term. Government was the only actor seen as having both the motivation and power to implement this change, despite the feeling that supermarkets (as controllers of the supply chain) bore more responsibility for the economic difficulties that farmers face now. Some participants suggested that farmers be supported financially, others wanted to see regulation, and a few suggested alternatives like farming co-operatives to give groups of farmers more power.

There must be a trade-off on that [crop rotation], if they farm it for five years, and they grow what they need to grow, are the government going to help the farmers to compensate for the off years.

Interviewee (Female, 55-65, Plymouth)

The most important thing for participants in the discussion groups was that farmers shouldn't bear the cost of making changes to the food system alone.

4.1.2. The role of governments

Participants often ascribed responsibility to the 'government' without being specific, and in some cases it was clear that participants were unsure about what bodies already exist and what their remit is. One or two suggested the need for a separate body with responsibility for food, to ensure that farmers were practicing sustainable agriculture, and support those who are not operating efficiently and sustainably now.

[Facilitator] Who do you think has responsibility for making sure that food production is sustainable?
[Participant A] There should be a Government department set up for it.
[Facilitator mentions DEFRA]
[Participant] DEFRA, what's their involvement? There should be a separate organisation to control food; something's going to have to be done anyway.

Interviewee (Male, 56-65, London)

The role imagined for government tended to be largely one of oversight: enforcing standards for environmental sustainability. Participants were less clear about how such standards should be determined.

Government should be responsible for setting standards, companies and farmers adhere to. They need to strictly regulate and monitor it because otherwise who is going to keep control of it?

Interviewee (Female, 56-65, Belfast)

Others were sceptical about the potential for government to intervene: suggesting either that the "political will" for change to the food system was absent, or arguing more directly that "Politicians are scared of big business" (online discussion group). It seemed that participants had mixed feelings about how much they thought government **should** intervene in the food system and how much they **would, or could.** There was greater consensus about the role of

governments in controlling supermarkets, with several respondents, particularly in the online discussion, arguing for greater regulation of supermarkets to enforce more responsible behaviour and more equitable relationships with food producers.

I would be happy for the government to help farmers by restricting the supermarkets from pressing the suppliers too hard for unrealistic deals.

Discussion group, online

The potential costs of government intervening weren't always obvious to people, but in the discussion sessions the specialists were able to help participants in thinking about how taxes might be impacted by new policies. As identified earlier in the Food Systems project participants were often wary about the introduction of measures that could affect how much tax they pay personally. Participants were supportive of changes that didn't increase costs, particularly when they discussed with the specialists the amount of public money currently spent in this area. Participants felt that government could use existing policy tools and regulations to introduce sustainability.

I think there is a role for policy, like the Common Agricultural Policy. I think the public would think 'not my taxes, they'll increase!', but people don't know that we're already subsidising it.

Discussion group, London

There was some debate in interviews and discussion sessions about the role of inter and intra-national bodies in governing food systems. For example, some participants argued that the system used to determine fish quotas should be adapted for agriculture to overcome the challenge of individual interests. Participants spoke relatively little about the EU, perhaps because at the time of the field work (February 2016) the UK referendum on leaving the EU had just been announced and the issue was seen as too controversial. Alternately, it may have been a lack of knowledge about the role of the EU in agricultural policy.

4.1.3. The role of businesses

Supermarkets

Participants saw supermarkets as the primary business or commercial interest in the food system. Many were surprised to learn from specialists about the extent to which supermarkets control the supply chain. . Participants saw supermarkets as particularly responsible for food waste, and for creating the economic conditions which prevented farmers from investing in sustainability.

I think we should pay a proper price for our fresh food. The farmer takes all the risk. The farmers are out in all weathers. They should have the lion share of the profits not the shareholders of supermarkets.

Discussion group, online

While participants often felt that supermarkets were responsible for problems in the food system, such as food waste and limits to farmers' income, there were few suggestions about

how sustainable intensification might remedy this. Participants tended to mention government regulation as a driver of supermarket behaviour. Others were keen for supermarkets to take action themselves, and through the course of the discussion groups participants tended to move towards a view of the problems as systemic and requiring concessions from all actors, not just supermarkets.

Everyone plays a role – it can't be just the government on their own, for example supermarkets can buy more from local small farmers to help them sustain their business.

Interview (Female, 26-40, Dundee)

Agri-businesses, research and science

Participants on the panel tended to have less knowledge about the role of agricultural businesses like agri-tech firms, which are less visible than other players in the food systems. Agri-tech firms were viewed negatively by a minority of participants: for example in the London discussion group, one participant asked the specialist (a representative of an agri-tech company) whether they were associated with Monsanto, and was reassured to hear that the specialist was not. This sub-group of participants tended to be sceptical about the motivations of commercial enterprises, and questioned whether they would make genuine moves towards sustainability:

I think it's because everything is profit-driven there will be problems about how we fund these things [more sustainable practices], multi-nationals won't, why would they, they want to make a profit.

Discussion group, London

The majority of participants were receptive to business as an important actor in sustainable intensification. Participants more often spoke about research in the abstract, without considering who would be carrying it out, or who would benefit beyond general terms like 'scientists'.

I have a lot of sympathy for farmers but it almost feels like the future of agriculture won't be in the hands of farmers, it would be in the hands of scientists.

Discussion group, London

In one group the specialists were asked about current research funding and participants were pleasantly surprised to hear about the extent of government support for innovation in this area, through research programmes and funding.

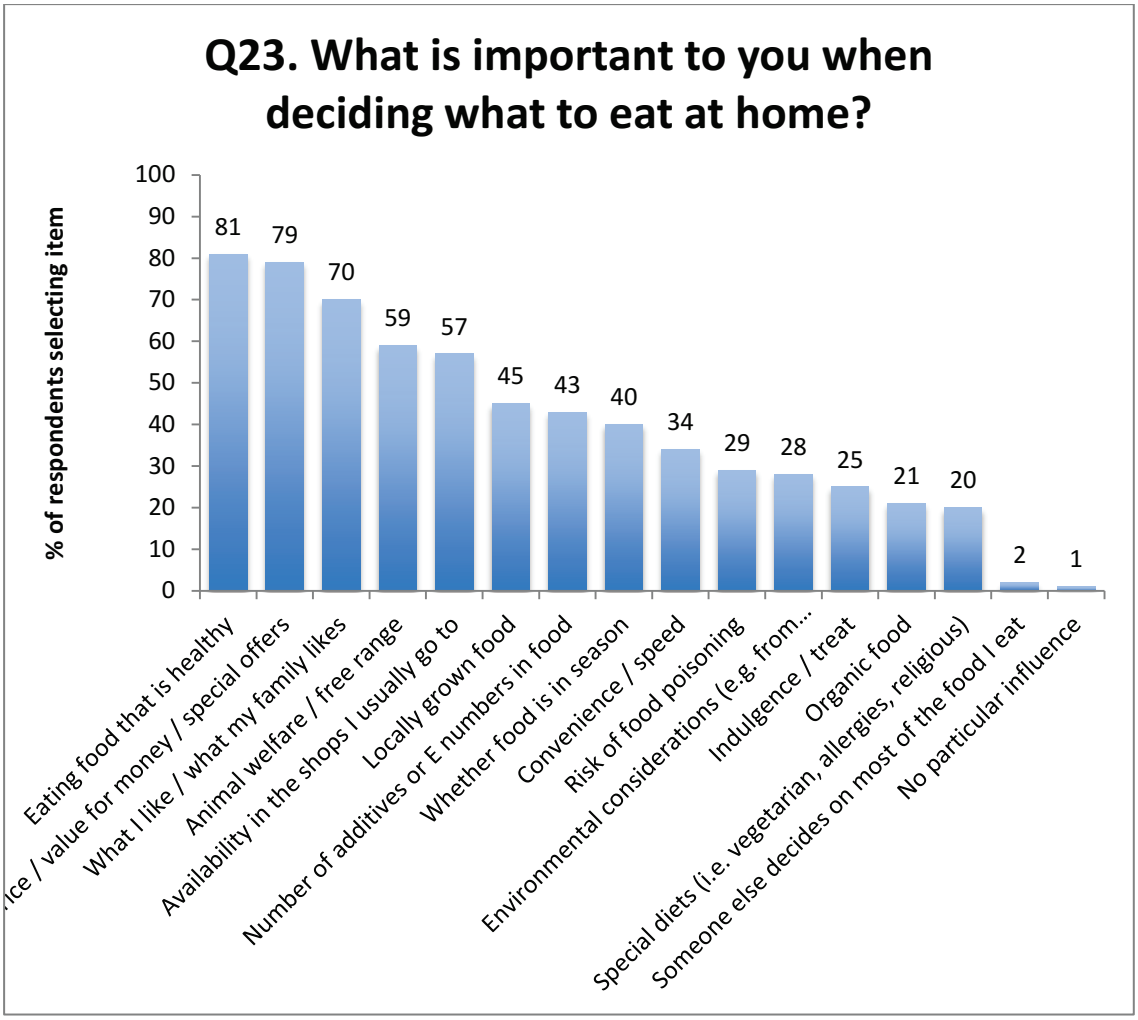
4.2. Role of consumers

One of the aims of this project was to explore the extent to which participants feel their preferences are currently reflected in their food choices, and whether consumer choice is seen as an appropriate way to bring about change in the food system.

Consumer preference and choice

To provide context to this question, figure 7 shows an extract from the baseline survey carried out at the beginning of the public panel. In response to the question of what factors participants considered when deciding what to eat, we found that health, price and what food people like were the most commonly cited factors. Environmental considerations were cited by a minority of participants. We invited participants with a range of views, including those who did prioritise environmental factors, to take part in the sustainable intensification survey. However, there was no significant difference between participants' responses to the survey based on this factor.

Figure 14 Extract from baseline survey. Base=489.



Most participants did not think that that the potential benefits of sustainable intensification (environmental, economic and societal sustainability) played a significant role in shaping consumer preferences.

> ***I think the average consumer would not care about the benefits to the environment or the farmers.***
>
> ***Discussion group, London***

When probed on this, participants tended to start from the assumption that a lack of information or education was the barrier to consumers forming preferences based on sustainability. However with further discussion (for example, when participants were asked if they felt the amount information they have already would motivate them) some felt that too much information could also be a barrier:

> ***No, if you buy a bag of apples, do you know if they were grown sustainably, was seasonal, how it was grown. If you read all of that, you'd be forever shopping.***
>
> ***Discussion group, London***

Others compared the challenge of influencing consumer behaviour on sustainability with health campaigns. They felt that if individuals were not willing to act in their own interests they would be even less likely to act on abstract goals like sustainability.

> ***It will take a lot for the public to change their habits. I mean with all the information out about alcohol, it doesn't seem that people are drinking much less. The same applies to food.***
>
> ***Discussion group, online***

One of the research questions in this project was "do participants' feel their preferences are reflected in their food choices?" There are two aspects to this, if someone prefers sustainably produced foods, are they *able* to buy them and secondly *do* they actually buy them.

In this sample, most people did not have a preference for environmental sustainability, unless prompted extensively and even then, aspects such as price, taste, health and ethics took priority over sustainable production. So there was no gap between their preferences and either what was available to buy or what they chose to buy.

However, what this also shows is that from the perspective of sustainable intensification most people don't currently know enough to form meaningful preferences, and so sustainability is not affecting their buying behaviour. Unless people have enough information to form preferences the potential for consumers to drive environmental sustainability is limited.

Consumer choice and power

As in other activities (particularly Food Systems), participants - and particularly those in the discussion groups - were prepared to consider reduced consumer choice in order to increase the sustainability of the food system. They felt that the burden on consumers to decide between ranges of products with different sustainability credentials could be too much, and saw restricting choice as a way to shift the burden from them to institutions like governments. They felt that government was better equipped to evaluate the many factors relevant to sustainability than consumers, and should remove the least sustainable options (although they were rarely specific about a mechanism for this).

A minority of participants (anecdotally, most often male) advocated a reduction in choice where they felt that consumer behaviour was unlikely to change, and the benefits were significant enough, as in this exchange about reducing meat consumption for environmental reasons:

A: To be honest when it comes to eating meat then probably not, I am open to ideas but cannot imagine my diet to not include meat which in my household is almost a staple requirement

B: [Participant A], you summed it up. People don't want to change their diets, or pay more for what they eat. Enforcement on consumers is necessary

C: Agree with [participant B] drastic but take away some of the choice, we are all like spoilt kids at times

Discussion group, online

Not all participants agreed with limiting consumer choices and those who did were not explicit about the mechanisms they would like to see in place to bring about this change. There was more agreement on imposing restrictions on other actors, particularly supermarkets. The primary reason for this is that commercial actors are seen as better able than individuals to absorb increased costs, or more culpable for the current challenges.

This tendency contrasts somewhat with a consistent finding throughout the public panel that participants feel empowered by understanding more about the food supply chain. Food waste is perhaps the clearest example, with participants increasingly feeling that food waste at the production stage is driven by retailer requirements, which in turn are driven by consumer preferences. However this example also illustrates that participants sometimes feel their preferences are misrepresented by the supermarkets: they were unanimous in rejecting the idea that the shape of vegetable forms an important element in their food purchasing decisions. In some cases there seems to be a tension between how participants view themselves (more informed, able to make better choices) and how they view the wider public (less informed, need intervention to prevent poor choices).

Appendix A: Demographics

The table below shows the total number and proportion of participants against the sampling criteria.

*<>10% of target		13 Interview	11 London	10 Online	97 Survey	13 Interview	11 London	10 Online	97 Survey	TARGET
Gender	Male	6	6	6	44	46%	55%	60%	45%	50%
	Female	7	5	4	53	54%	45%	40%	55%	50%
Age	18-25	2	0	1	10	15%	0%	10%	10%	17%
	26-40	3	5	3	37	23%	45%	30%	38%	25%
	41-55	2	5	3	34	15%	45%	30%	35%	25%
	56-65	4	1	1	9	31%	9%	10%	9%	17%
	66+	2	0	2	7	15%	0%	20%	7%	17%
Ethnicity	Non-white	2	3	2	9	15%	27%	20%	9%	12%
	White	11	8	8	88	85%	73%	80%	91%	88%
Education	BTEC Higher / Level 4+, HND, Degree, Masters, PhDor similar / higher	5	5	5	48	38%	45%	50%	49%	37%
	AS/A Levels, BTEC National / Level 3 or similar	4	4	3	27	31%	36%	30%	28%	18%
	GCSEs Grade A*-C, BTEC Level 2	2	1	2	14	15%	9%	20%	14%	17%
	GCSEs Grade D-G or similar, BTEC Level 1	0	0	0	1	0%	0%	0%	1%	13%
	None	0	0	0	3	0%	0%	0%	3%	10%
	Other qualifications including apprenticeships	2	1	0	4	15%	9%	0%	4%	7%
Prioritised environmental issues at baseline	Yes	5	5	6	32	38%	45%	60%	33%	30%
	No	8	6	4	58	62%	55%	40%	60%	70%
Participation to date	Workshop	3	8	5	31	23%	73%	50%	32%	30%
	Online	8	3	4	43	62%	27%	40%	44%	30%
	None	2	0	1	23	15%	0%	10%	24%	30%

Demographic correlations

We tested all closed questions in the online survey against demographics to determine whether there were any significant trends in the responses. We identified two significant correlations for ethnicity within a 95% confidence interval (i.e. relationships expected to occur by chance less than 5% of the time). Participants who identified as a group other than white were more likely to have heard of Sustainable Intensification. They were also less likely to

prioritise “Producing food more sustainably, in ways that protect the climate, biodiversity and other resources” than participants identifying as white, although again this effect was found only in the repetition of the item at Q16, and not in the first instance at Q9. In contrast participants in an ethnicity category other than white were more likely to prioritise “plentiful and affordable food supply for the UK consumer”, again in the second iteration only. While these findings were statistically significant in our views the small sample size makes them of limited value, and anecdotally we believe it is likely that participation in previous sessions may be a confounding variable in this case.

Appendix B: Dialogue materials

Briefing note

NB: The same briefing note was used in advance of the telephone interviews, online survey and workshop to ensure all participants had been provided with the same basic information about the topic.

Figure 15 - screenshot from introductory video

Video:

As well as providing a text copy of the briefing note we produced a simple video which read out the same text, accompanied by animations. You can watch the video version via the following link:

https://www.youtube.com/watch?v=IsAIPJPtTZw

Text version:

The challenge

Food security is one of this century's most important global challenges. By 2050 – given current trends - the world will need to produce significantly more food in order to feed its predicted 9 billion people. At the same time diets are changing around the world, climate change is altering the environment in which food is produced, and land and water are becoming more scarce. The challenge is for the food system to produce more food whilst sustaining the environment, preserving natural resources and biodiversity and supporting the livelihoods of farmers and rural populations around the world.

Potential solutions

There are many potential solutions to the challenge of food security, and most food researchers agree that no one solution will be sufficient. We can think of the possible solutions in terms of three themes:

Managing demand

At the moment, the world produces enough food to feed the current population. But as many as a billion people are chronically hungry at the same time as a billion people are over nourished and millions are suffering health problems related to obesity. Managing demand means changing the type and amount of food that is required to feed the population.

- For example we know that producing a certain amount of calories from meat takes more resources than producing the same amount of calories from food crops. So reducing demand for animal products could lead to a more efficient food system in some ways.

Making better use of current food production

Not all of the food that is currently produced ends up being eaten, either because it is wasted before it can be eaten, or because it does not reach the people who need it.

- For example a large proportion of food is wasted in the food chain because poor storage means it is spoiled. Improving the way in which food is stored and distributed could reduce waste.

Increasing food production

If demand continues as it is we will need to produce more food in the future. But some methods of food production can have negative impacts on the environment, which in turn reduces the capacity of the planet to produce food. Increasing food production needs to take these impacts into account and be done in ways which are sustainable. Increasing food production could involve:

- Finding more space for food production, for example through converting forests to agriculture. However, this comes at significant environmental costs. Other ways of using "new space" such as urban agriculture, are unlikely to produce enough. Thus, as a first approximation, if we are to grow significantly more food it should be on the land we already use.
- Changing the way in which food is produced to increase the amount of food that can be produced with the same inputs (land, fertiliser, energy) without harming the environment. This is referred to as sustainable intensification and is the topic for this project.

What is sustainable intensification?

Sustainable intensification is a difficult approach to define and specialists are still debating exactly what it means. One definition used recently is : sustainably increasing the production of food, combined with improved resource use efficiency and better environmental outcomes.

There are different ways in which production can be increased:

- **Changing the crops we grow:** One way to increase food production is to choose crop varieties which are more efficient. For example a crop whose roots absorb water more efficiently could increase the amount of food produced in the same field without requiring more water.
- **Changing the way we farm:** Another approach is to change farming practices to use resources more efficiently. For example targeting fertiliser inputs in each small area of land rather than putting the same amount on across the field. This "precision agriculture" would reduce air and water pollution.
- **Changing land use:** Another way of sustainably intensifying food production is to change where it is grown. For example we could grow more intensively where the land is most

suitable and leave land to nature so that it benefits biodiversity where it is less suited to crop growing. This "smart land use" could apply within a farm or landscape (where should land be left for nature?) or at the country level.

What are the challenges for sustainable intensification?

Sustainable intensification might sound like a perfect solution to feeding the world and protecting the environment but in practice there are important decisions to make. While some people see sustainable intensification as a way to reduce hunger, others question whether it is just a label given to the same old intensive farming, or suggest that it will distract governments and others from problems like food waste and changing diets.

There are also questions about what impacts sustainable intensification might have around the world. The impact may be different in countries like the UK where much of our agriculture is already quite intensive, and in other countries where some of the approaches we use are not as common. For example:

- **Changing the crops we grow**: Sustainable intensification might mean changes to the type of food produced in an area to use crops that have lower impacts. In the UK we might not notice changes to what's sold in our supermarket because much of our food is imported from other countries. But in an area where people have less access to imported food it could affect their everyday diet.
- **Changing the way we farm (a):** A farmer could improve the yield of their crops by changing the way they manage water on an individual farm. This could affect the amount of water running through the public drainage system, or into rivers. If the farmer uses more water this could mean less water for use elsewhere, if they increase drainage it could increase the risk of flooding by speeding up river flow.
- **Changing the way we farm (b):** if a farmer is intensifying to grow more food on their farm, they might need to use more inputs, even if they are increasing efficiency. These inputs could be fertilisers – which can pollute rivers – or pesticides which can affect beneficial insects like bees or butterflies, as well as the birds that feed on them.
- **Changing land use:** If the UK took the approach of concentrating food production in the most suitable land areas this could have a significant effect on those areas of the countryside. Areas that are intensifying could have larger farms and fields, and larger herds of cows. This would have implications both for the appearance of the countryside, and the local economy.

Another challenge for sustainable intensification is to decide what counts as "sustainable". It's easy to think of sustainability as reducing environmental impacts like pollution but when researchers talk about sustainability they are often referring to a much broader picture. Sustainability can include social and economic impacts, like the farming economy, human health impacts, and how well an agricultural system can stand up to shocks like extreme weather or price hikes, as well as whether we are leaving the world in a good state for future generations. When sustainability encompasses all of these aspects it's difficult to find

approaches to food production that works well for all of them. That's where we get trade-offs between the different aspects. Some examples of **trade-offs** are:

- Increasing productivity of livestock farming has often involved more animals in a smaller area. This may reduce the environmental impact (for example by using less land), but reduce animal welfare by housing animals in more cramped conditions. How do we balance the environmental impact with the ethical concern?
- A farmer may be able to grow a high value food crop which guarantees them a good income, and has nutritional benefits for consumers, but requires so much water to grow well that local water sources are depleted. How do we balance the social benefits (health and economy) with the environment?

Why are we asking the panel about sustainable intensification?

The Global Food Security programme, who fund this panel, help influence what public sector research is carried out in the UK, including what types of sustainable intensification should be the main areas of focus. They want to understand your views on this topic to help them set a long term strategy for this research, and that's what we'll be exploring in this project.

Interview discussion guide

All interviews used the same discussion guide, which followed the same approximate structure as the briefing note. Not all questions were covered in each 30 minute interview, and interviewers were instructed to be responsive to participants, following up on areas where participants were particularly responsive.

Research are	Prompt questions
n/a	Thanks for taking part. First we'd like to know whether you had heard of sustainable intensification before we invited you to take part in this interview? If yes, in what context did you come across it? , What did it make you think of? What did you understand it to mean? What associations did it bring to mind? If you first encountered sustainable intensification in the briefing note, what are your first impressions? What does it make you think of? Positive/negative? Associations?
Views on SI as an approach to agriculture	Thinking about the briefing note, what do you think of the food security challenge? Have your views about the importance of food security changed since joining the panel? What do you think of the three approaches to addressing the food security challenge that were described in the briefing note? (Reducing demand, making the most of what we have, producing more food). Which do you think should be the biggest priority? Why? In this country? Why is it particularly suited to the UK? Individually in other countries around the world? A global approach? Which of the approaches do you think is already being used? Here in the UK? Elsewhere in the world? Which, if any, of the approaches do you support in particular? Which, if any, of the approaches do you oppose in particular? If not discussed already prompt participants on cited challenges. How do you think farmers would respond in each situation? Which approach do you think is most important in addressing food security?
Trade-offs associated with SI	The briefing note set out some potential trade-offs or challenges for sustainable intensification. The first example was about animal welfare and productivity: what are your views on this trade-off? • *Increasing productivity of livestock farming has often involved more animals in a smaller area. This may reduce the environmental impact (for example by using less land), but reduce animal welfare by housing animals in more cramped conditions. How do we balance the environmental impact with the ethical concern? (Quote from briefing)* The second example was about the potential conflict between economic and environmental benefits. What are your views on this trade off? • *A farmer may be able to grow a high value food crop which guarantees them a good income, and has nutritional benefits for consumers, but requires so much water to grow well that local water*

	sources are depleted. How do we balance the social benefits (health and economy) with the environment? (Quote from briefing) How much do you think about the environmental, social and economic impacts of your food? Do you think people should consider these impacts?
Actors and influence on SI	One question asked about sustainable intensification is who is responsible for implementing it and who might benefit. Some organisations like Greenpeace think that it is a term mostly used by big business to describe their existing intensive farming practices and not about real changes that benefit farmers. But agricultural businesses like Monsanto argue that by introducing new technology they are enabling farmers to make a better living. This is just one example, and there are many approaches to SI. Who do you think has responsibility for making sure that food production is sustainable? What about ensuring that enough food is produced globally? Is it the role of the individual farmer to manage their own land in the right way to grow as much food as possible, or to reduce environmental impacts, or to make the best living possible? What about the companies who purchase their food or the companies that supply seeds and tools? What about governments?
Consumer choice and SI	Reflecting on some of the trade-offs we've discussed, how would you tell whether the food you choose is produced in a way that you are happy with? Are there any criteria which you would want to be sure were met? How do you know if food is produced, ethically, environmentally sustainable, economically? Are there specific examples you can think of where you know how something is produced? Do you think consumers have a role in changing the way food is produced through their choices? How much influence do you think you have? What could give you more influence? What would influence you to change your behaviour?

Survey

The survey was hosted online and all quantitative questions were compulsory.

	Question	Response format
1	Had you heard of sustainable intensification before taking part in this questionnaire? • If yes: can you tell us where you heard about sustainable intensification and what you understand it to mean? • If no: reflecting on the briefing, what are your first impressions of sustainable intensification?	Y/N Open text Open text
2	Global Food Security occurs when everyone has access to safe, affordable and nutritious food, all of the time and in ways the planet can sustain into the future. How much of an issue do you think food security is in the world today?	A big issue, Quite a big issue, Not that much of an issue, Not an issue at all
3	How much of an issue do you think food security is in the UK today?	A big issue, Quite a big issue, Not that much of an issue, Not an issue at all
4	Sustainable intensification is one approach to address global food security, by increasing the amount of food produced. Which of these three approaches do you think should be the biggest priority **in the UK**? • **Changing diets**: some foods are more resource intensive, like meat, by consuming differently we could increase the food directly available for human consumption. • **Reducing waste**: among consumers and throughout the supply chain we could feed more people with the food we currently produce. • **Increasing production**: we could change the way we produce food to increase production.	Select ONE of three.
5	Why do you think this should be the biggest priority?	Open text
6	And which of the three do you think should be the biggest priority in the **world**? • **Changing diets**: some foods are more resource intensive, like meat, by consuming differently we could increase the food directly available for human consumption. • **Reducing waste**: among consumers and through the supply chain we could	Select ONE of three.

	feed more people with the food we currently produce. • **Increasing production**: we could change the way we produce food to increase production.	
7	Why do you think this should be the biggest priority?	Open text
8	Sustainable intensification aims to produce more while reducing environmental impacts. However, sometimes there will be a choice to make about whether or not to increase production depending on the impacts. The following questions give examples of some of these potential trade-offs. Which of these factors do you think is **most** important in food production? • Producing food more sustainably, in ways that protect the climate, biodiversity and other resources • Producing food in ways that support the economy and farmers • Producing and distributing food in ways that are equitable for all involved • Plentiful and affordable food supply for the UK consumer	Rank from one to four
9	**Changing the crops we grow part 1**. Consumers in the UK can buy most foods all year round. One way of reducing the resources used for the crops we grow and consume is to more closely fit supply and demand with the conditions i.e. growing the crops when the conditions are right. For example, this might mean growing summer fruits for only a few months a year. In some other countries this could mean choosing a crop that better suits the environment, for example switching from water intensive crops like rice to drought resistant crops like millet that are currently less popular. • What do you think of this approach to increasing production? Would you be prepared to change your diet to eat food that is more efficient to produce? Why?	
10	**Changing the crops we grow part 1**. One way of producing food with lower impact is to change the varieties of crops we grow for those that require less resources like water or fertiliser. In the UK this could be scientific development of new varieties and breeding techniques to improve genetic traits to increase productivity. • What do you think of this approach to increasing production? Should we use scientifically developed crop varieties to increase production without changing diets? Why?	Open text
11	**Changing the way we farm.** Producing livestock like cows and chickens for food can be less efficient in converting resources into calories than producing vegetables and crops, particularly when animals are fed on grain, which could be	Open text

	used to feed humans. If livestock are being produced for human consumption, it can be more efficient to farm large numbers of animals in a smaller area. However, this can result in lower animal welfare standards. • What do you think of this approach to increasing production? Should we accept lower animal welfare standards in order to reduce the environmental impacts? Why?	
12	**Changing land use.** One example of areas in the UK that do not produce much food are uplands – areas like the Lake District, Welsh mountains or Northern Irish hills. These areas are often valued for their appearance, and they often have low levels of sheep farming because they are not well suited to growing crops. If we wanted to increase the amount of food produced in the UK we may be able to farm these areas more intensively, but this would change their appearance, and could have negative environmental impacts. • What do you think of this approach to increasing production? Should we use more land, even if it has more impacts? Why?	Open text
13	**Changing land use.** In contrast to the example of uplands, we could focus production in areas that are most suited to agriculture. This could mean more intensive farms (perhaps much larger farms, with fewer hedgerows) in some areas, so that other areas can be left to nature. Another possible consequence would be for water: more water might be used for agriculture, and intensive crops could increase the risk of flooding nearby. Within the intensively farmed areas there could be more pesticide and fertiliser use, with fewer birds, bees and butterflies. • What do you think of this approach to increasing production? Should we use some land more intensively so other land can be preserved, even if it has negative impacts on the areas being farmed? Why?	Open text
14	**Changing the way we farm.** Precision agriculture is one way of increasing production while using less of inputs like fertilisers. Farmers use technology like satellite monitoring to identify exactly where fertilisers are needed. One of the barriers to this approach is the cost of new technology for farmers, and there can be big differences in efficiency between the most and least advanced farms. • What do you think of this approach to increasing production? Should farmers use new technology to increase efficiency? Why?	Open text
15	Thinking about all the examples you've read today, which of these factors do you think is **most** important in food production? • Producing food more sustainably, in ways that protect the climate, biodiversity and other resources	Rank from one to four

	• Producing food in ways that support the economy and farmers • Producing and distributing food in ways that are equitable for all involved • Plentiful and affordable food supply for the UK consumer	
16	Has your view changed, and if so why?	Open text

Discussion group materials

Process plan

This part of the project involves two 90 minutes discussions between specialists and panel members, one each our London offices (1st March) and an online session using the online chat function on the Food Futures platform (3rd March).

This document sets out each stage of the workshop and forms a discussion guide for facilitators. The questions included in the guide are not used verbatim by facilitators but provide a loose structure for them to follow, whilst also allowing them to respond to and incorporate participants' views as the discussion continues. Facilitators are briefed on the overall objective of the discussion and what each question is seeking to elicit, which enables them to tailor the questions they do ask appropriately. We will aim to be responsive to the points participants make, and to keep the discussion flowing as naturally as possible.

Process plan: face to face event

Timing	Activity / questions	Facilitator notes
18.00 – 18.30	Specialists and participants arrive.	Reminder to specialists about their role Sandwiches available Participants allocated to tables
18.30 – 18.45	**Introductions** • Lead facilitator introduces the format, aims, ground rules and participants • Reminder of concept of sustainable intensification (as per briefing note) and highlights from survey • Short table discussion session: what struck you from the survey? o Aim here is to encourage participants to reflect on the survey and build on it rather than to go over the same ground o Prompt questions: o What did you agree with? Is there anything that was new/surprising in the questions? Do you agree	Slides with intro Identify who's in the room Slides with definition and highlights from survey (handouts on tables for participants to refer to) TURN ON RECORDERS Specialists at tables at this point, facilitators to guide discussion

Timing	Activity / questions	Facilitator notes
	with the responses?	
18.45 – 19.00	**Specialist introductions**: **how can SI contribute to global food security?** • 3 minutes each to present the main opportunities and challenges they see for sustainable intensification	Back to plenary Encourage participants to make notes on post-its to discuss in next session
19.00 – 19.05	**Table discussions: how can SI contribute to global food security?** What questions do you have for specialists, what are your first impressions of sustainable intensification as an approach to global food security? In the UK? In other countries?	TURN ON RECORDERS Facilitators – collate questions from post-its, prompt participants for more questions
19.05 – 19.20	**Panel session: how can SI contribute to global food security?** Addressing questions from participants	Back in plenary, lead facilitator to chair LF will encourage debate between participants, not just back and forth with specialists

19.20 – 19.50	**Table discussions: how could SI be developed?**
	What would need to change for SI to happen in the UK? What would be the effects? How should the UK negotiate the trade-offs?
	• Two sets of stimulus/prompt materials
	  ○ Actors in the food system, what do they need to do? What is the role of consumers? Are you able to make choices as a consumer that can have an impact?
	  ○ Trade-off cards showing possible trade-offs (e.g. environmental vs ethical, landscape vs productivity as per survey)
	• Aim is to stay with the theme of trade-offs but move to a discussion of the possibilities for the UK, of implementing SI, the roles of different actors, how benefits could accrue.
		TURN ON RECORDERS
		Facilitators to guide, specialists at tables

Timing	Activity / questions	Facilitator notes
19.50 – 20.00	**Thanks and close**: Lead facilitator to wrap up, evaluation forms and incentives	Evaluation forms for all

Process plan: online event

Timing	Activity / questions	Facilitator notes
18.00 – 18.30	Specialists and participants login.	Calls with specialists in advance to ensure they can access chat Facilitators logged in to welcome participants
18.30 – 18.45	**Introductions** • Lead facilitator introduces the format, aims, ground rules and participants • Reminder of concept of sustainable intensification (as per briefing note) and highlights from survey • Short discussion session: what struck you from the survey? ○ Aim here is to encourage participants to reflect on the survey and build on it rather than to go over the same ground ○ Prompt questions: ○ What did you agree with? Is there anything that was new/surprising in the questions? Do you agree with the responses?	Facilitator has pre-prepared intro Video clip with intro and survey highlights in side bar Specialists involved at this point, facilitators to guide discussion with prompt questions
18.45 – 19.00	**Specialist introductions**: **how can SI contribute to global food security?** • 3 minutes each to present the main opportunities and challenges they see for sustainable intensification	Facilitator signals move to next part of discussion Each specialist has text prepared, present it one at a time Encourage participants to think about questions
19.00 – 19.05	**Question gathering: how can SI contribute to global**	Facilitators – ask participants to submit

Timing	Activity / questions	Facilitator notes
	food security? What questions do you have for specialists, what are your first impressions of sustainable intensification as an approach to global food security? In the UK? In other countries?	their questions within the ten-minute time limit. Facilitator will collate and put to specialists one at a time.
19.05 – 19.20	**Panel session: how can SI contribute to global food security?** Addressing questions from participants	Facilitator will present back questions one at a time and direct to particular specialists LF will encourage debate between participants, not just back and forth with specialists

19.20 – 19.50	**Table discussions: how could SI be developed?**
	What would need to change for SI to happen in the UK? What would be the effects? How should the UK negotiate the trade-offs?
	• Two sets of stimulus/prompt materials
	  ○ Actors in the food system, what do they need to do? What is the role of consumers? Are you able to make choices as a consumer that can have an impact?
	  ○ Trade-off cards showing possible trade-offs (e.g. environmental vs ethical, landscape vs productivity as per survey)
	• Aim is to stay with the theme of trade-offs but move to a discussion of the possibilities for the UK, of implementing SI, the roles of different actors, how benefits could accrue.
		Facilitator signals move to next part of discussion
		Facilitators to guide discussion which includes specialists
		Prompt materials in the side bar for participants to click on

19.50 – 20.00	**Thanks and close**: Lead facilitator to wrap up, evaluation forms and incentives	Lead facilitator to close and thank – evaluation by email and incentives as points.