Priority Research Questions for the UK Food System

This UK-Global Food Security (GFS) project determined the **priority research questions for the UK food system with the aim of improving the system's efficiency and effectiveness**[1]. It thereby complemented other studies that have focussed on food production (e.g. agriculture[2]) but not the full food system; such studies may have included some questions on markets and consumption, but framed from a productionist viewpoint. This project involved the wider range of actors engaged in the full suite of food system "a*ctivities*" along the food chain (i.e. producing, processing, packaging, retailing and consuming); and others interested in food security or other socioeconomic and environmental "*outcomes*" of these activities. Emphasis was placed on incorporating a wide range of 'world views' from different stakeholder groups: policy, private sector, non-governmental organisations, advocacy groups and academia.

A total of 456 individuals submitted 820 questions from which 100 were then selected by a process of online voting and a three-stage workshop voting exercise. These 100 final questions were sorted into ten themes and the 'top' question for each theme identified by a further voting exercise, deriving the overall "top 10" questions (below). This step also allowed four different stakeholder groups to select the top 7–8 questions from their perspectives (Tables S1-S4).

The considerable effort made to engage a very wide range of 'post-farm gate' disciplines and stakeholder communities in generating the initial questions was largely successful for 'food system activities', but considerably less successful regarding the 'food security outcomes', which attracted only 18% of initial questions. Of these. questions relating to food affordability, nutrition and food safety all featured highly, but other important topics for food security (e.g. trade, transport, preference and cultural needs) did not emerge to the same extent. Despite this, different stakeholder groups did identify specific research needs on a range of 'post-farm gate' activities and food security outcomes from the questions available in the final 100.

A paper detailing the rationale, process and outcomes of project has been published in *Food Security*[3]; and a brochure highlighting the priority questions by stakeholder group is being prepared with the aim of soliciting public-private funding to address the questions.

---

[1] The project was led by John Ingram (formerly NERC Food Security Leader; now Food Systems Programme Leader, Environmental Change Institute, University of Oxford); Hugh Wright and Bill Sutherland (Cambridge University); and Lucy Foster (Defra Food Science Coordinator).

[2] See, for example, Pretty et al, 2011. The top 100 questions of importance to the future of global agriculture. *International Journal of Agricultural Sustainability*, 8:4, 219-236.

[3] Ingram et al, 2013. Priority research questions for the UK food system. *Food Security* **5**, 617–636.

TOP 10 QUESTIONS ON THE UK FOOD SYSTEM BY SUBJECT CATEGORY

Producing – Environment & Resources
How can the sustainability of UK primary production be improved without expanding our social and environmental footprint overseas?

Producing – Innovation & Context
How can food supply be maintained as the functionality or use of pesticides, anti-microbials, antibiotics and biocides decreases?

Processing
How can the fat, sugar, preservative and salt content of foods be reduced while ensuring that palatability is maintained, waste is minimised, and food remains safe and does not spoil?

Logistics, Packaging & Safety
How will novel, emerging and re-emerging pathogens be prevented, detected and controlled rapidly and accurately to enhance food security?

Retailing
What food information system would allow UK consumers to make an informed choice about each product's impact on different aspects of sustainability (environmental, economic, health and social)?

Affordability & Consumption
Which intervention (or combination of interventions) would be most effective in achieving changes in consumption decisions and which types of intervention (e.g. awareness raising campaigns, choice editing, education, legislation or regulatory) are most appropriate for specific contexts and decisions?

Nutrition
How can nutrition be improved based on understanding of the interactions between genetics, epigenetics, environment and diet?

Waste
How can ways of influencing behaviour be most cost-effectively designed and targeted to reduce food waste in UK homes?

Whole System – Environmental Context
What are the opportunities and risks for UK food supply and primary production in responding to climate change?

Whole System – Policy Context
Where the UK food system has demand for, and command of, resources in other parts of the world, how can associated ethical, political and other impacts be addressed?

Table S1 Top research priorities for the UK food system selected by the **primary production stakeholder group**. Questions are not ranked by importance.

1. How can the sustainability of UK primary production be improved without expanding our social and environmental footprint overseas?
2. How should UK soils be managed for optimum productivity and environmental protection in field vegetable, arable and grassland livestock systems in the long term?
3. Given the UK's geographical imbalance between limited and excess water supplies, how can water resources be better managed to improve water-use efficiency for food production?
4. How can primary food production be sustainably intensified whilst maintaining or enhancing the nutritional value of those food items?
5. What are the barriers to the further development and uptake of precision technologies, smart engineering and automation by producers to enhance the efficiency and sustainability of the food system, and how can they be overcome?
6. How can UK food supply and primary production adapt to more extreme weather events? [a]
7. How can food supply be maintained as the functionality or use of pesticides, anti-microbials, antibiotics and biocides decreases? [a]

[a] Questions selected by academics in addition to those selected by practitioners.

Table S2 Top research priorities for the UK food system selected by the **food industry and retail stakeholder group**. Questions are not ranked by importance.

1. How can the fat, sugar, preservative and salt content of foods be reduced while ensuring that palatability is maintained, waste is minimised, and food remains safe and does not spoil?
2. How can food hygiene and safety be ensured as chemistry and chemical engineering in manufacturing processes (e.g. cold plasma, high pressure processing, non-compressor refrigeration) change to meet future economic, social and environmental drivers?
3. How will novel, emerging and re-emerging pathogens be prevented, detected and controlled rapidly and accurately to enhance food security?
4. How can smart packaging be used to reduce food waste and maintain or enhance food safety?
5. What food information system would allow UK consumers to make an informed choice about each product's impact on different aspects of sustainability (environmental, economic, health and social)?
6. What strategies would overcome the main barriers for UK food manufacturers, retailers and the service sector to incorporate more smallholders and small and medium enterprises in their supply chains? [a]
7. What are the implications for food manufacturing of changes in available raw materials due to climate change? [a]
8. How can buyers and suppliers develop more trustworthy, equitable and collaborative relationships to improve supply chain practices? [a]

[a] Questions selected by academics in addition to those selected by practitioners.

Table S3 Top research priorities for the UK food system selected by the **governmental policy stakeholder group**. Questions are not ranked by importance.

1. Which intervention (or combination of interventions) would be most effective in achieving changes in consumption decisions and which types of intervention (e.g. awareness raising campaigns, choice editing, education, legislation or regulatory) are most appropriate for specific contexts and decisions?
2. Which UK groups (e.g. socioeconomic, regional) are, or are likely to become, food insecure in the near future, and why?
3. What factors influence the allocation of food within UK households, and what are the implications for health?
4. How can UK food supply and primary production adapt to more extreme weather events?
5. What are the opportunities and risks for UK food supply and primary production in responding to climate change?
6. How can mismatches between formal risk assessments and public perception be resolved when assessing the use of different technologies that could improve the efficiency and resilience of the food system? [a]
7. What dietary choices would UK consumers make if their intake of meat and dairy products was reduced, and what impact would this have on health and sustainability? [a]
8. How can the sustainability of UK primary production be improved without expanding our social and environmental footprint overseas? [a]

[a] Questions selected by academics in addition to those selected by practitioners.

Table S4 Top research priorities for the UK food system selected by the **non-governmental organisation and advocacy stakeholder group**. Questions are not ranked by importance.

1. Which intervention (or combination of interventions) would be most effective in achieving changes in consumption decisions and which types of intervention (e.g. awareness raising campaigns, choice editing, education, legislation or regulatory) are most appropriate for specific contexts and decisions?
2. How can food prices or other financial mechanisms account for the environmental and health externalities in food production and consumption?
3. What dietary choices would UK consumers make if their intake of meat and dairy products was reduced, and what impact would this have on health and sustainability?
4. Under which circumstances are the various channels for using food waste (including anaerobic digestion, feeding it to animals, composting, land-spreading etc.) socially, environmentally and economically preferable?
5. How can ways of influencing behaviour be most cost-effectively designed and targeted to reduce food waste in UK homes?
6. How can mismatches between formal risk assessments and public perception be resolved when assessing the use of different technologies that could improve the efficiency and resilience of the food system? [a]
7. How can waste of primary production be minimised by ensuring efficient conversion to secondary products? [a]

[a] Questions selected by academics in addition to those selected by practitioners.