Research Project: Sustainable Food Systems – Technological Transformations in Food Consumption and Production Systems (CPS).

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Background:
Developing more sustainable food consumption and production systems is an important priority for policy-makers and food industry players and stakeholders. The food industry has also experienced in recent decades a surge of potentially transformative technologies in terms of both consumption (e.g. microwaveable meals) and production (e.g. genetically modified foodstuffs). The sustainability impacts of many food-related innovations are often controversial and poorly understood. This core of this project was work funded under the *Sustainable Technologies Programme* and undertaken jointly with Manchester University.

Aims & objectives:
- To produce cases of technological innovation in a range of food products which look at food production, distribution and consumption as a system.
- To identify technologies that are crucial for determining the sustainability of the food consumption and production systems in the studied food products.
- To identify to what extent the key actors promoting technological change recognise the sustainability and system implications of their actions.
- To review alternative strategies for achieving sustainability of the food consumption and production systems, such as organic and local foods.
- To identify what policy issues arise from the analysis of the technological innovations and the strategies of UK and EU policy-making bodies concerning sustainability across the food consumption and production systems.

About the research:
The research was developed through a single project that involved several distinct stages.
A sustainability assessment of the selected food supply chains was conducted in order to evaluate the effects of the food system upon sustainability. The sustainability assessment considered three important dimensions: economic (sustaining economic growth), environmental (minimisation of environmental impacts and protection of the natural environment) and social (improvement of quality of life, provision with employment, provision with healthy and safe foods).
A critical review of the existing food consumption and production strategies was undertaken and followed by the development of case studies of different food products. These cases were developed to illustrate various food consumption and production strategies, and the technologies used throughout different stages in the food consumption and production systems. This involved a farm-to-fork approach including agriculture, processing, distribution and consumption. The case studies focussed on chicken and potatoes (BRASS); peas, yoghurt, salmon and cod (Manchester).
A study of the policy and regulatory issues affecting various food consumption and production strategies and selected food supply chains was completed. The research also involved the development of sustainability indicators, sustainability assessment of the current supply chains of the selected food products and further scenario building concerning food consumption and production strategies such as local, global, conventional and organic supplies. Data for the research project was collected through interviews with key actors in the relevant food supply chains and via analysis of secondary data sources such as market reports, statistical reports and other literature. Moreover, data from the Office of National Statistics was collected and analysed for the purpose of conducting a sustainability assessment of the food system. This also allowed the project to develop more widely to consider issues of developing sustainability indicators for food systems more generally rather than simply the supply chains of the case studies under consideration. To try to

more accurately determine the sustainability performance of food supply chains, the research tested the potential indicators against food supply chain experts' opinions about which factors contribute the most to sustainability. Using the Analytic Hierarchy Process (AHP), these opinions were translated into importance ratings, allowing the draft indicators to be weighted by these importance ratings to generate an overall index of sustainability.

To ensure that a comprehensive view was taken of the flow of materials and resources, innovation processes and their implications for the sustainability of the food system, the project included other important processes which are crucial for the functioning of the food system such as waste disposal, supply of equipment and materials such as packaging and the like. Finally, regulators were considered to be an important part of the food system. The project investigated their participation in the changes that are taking place within the system.

Results and outputs:
The research into the chicken supply chain demonstrated the complexity of food production and consumption systems which, although in an economic sense seems successful, are challenged by public concerns about the socio-environmental impacts associated with production and consumption. It showed that the chicken supply chain is getting shorter in terms of the number of economic actors, and increasingly time efficient at each stage of the supply chain, creating a short product life cycle of about 60–70 days. This allows the supply chain to be extremely sensitive and adjust to market conditions. On the other hand, the UK chicken supply chain is lengthening in terms of food miles, due to the import of chicken products from as far away as Brazil and Thailand. Not only are the products themselves supplied from foreign countries, but many inputs, such as feed and packaging material and technologies, are also imported from abroad which raises concerns about an increase in energy consumption and air pollution associated with these activities.

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Impacts achieved/potential for impact:
The project findings were of considerable interest to policy-makers and stakeholders from the food industry. Presentations on food sustainability and industry supply chains were made in a variety of fora including a Westminster Food and Diet Forum and were presented internationally including at conferences in the US, Germany and Finland. The value of the work on sustainability benchmarking for food supply chains is that social investors, consumers and environmental organisations, customers and policy makers can use the framework developed in the research as a tools to inform their decisions. The developed framework can be useful for policy makers to measure sustainability performance across various supply chains (major commodities and products). Focal companies within food supply chains such as food manufacturers and supermarket retailers can adopt this framework to assess the sustainability performance of their products and compare within the sector.