Exploring the future of our food and delivering a food system paradigm shift has never been of greater importance. The 20th Century approach has been to focus on low cost, safe, convenient foods, driven by consumer preferences. Now, with growing pressures from climate change and increasing global population, there is an urgent need for a new approach that can sustainably manage raw materials and energy, while balancing the need to satisfy short-term consumer needs and address long term health challenges.

The N8 AgriFood consortium was created precisely to tackle these challenges in a joined-up way, combining world-leading research expertise in a wide range of disciplines (such as biology, geography, chemistry, engineering, food science, nutrition, public health, economics and social sciences) in a single research initiative. It includes the 8 most research-intensive universities in the North of England (Durham, Lancaster, Leeds, Liverpool, Manchester, Newcastle, Sheffield and York) and covers three main themes:

• Sustainable food production
• Resilient supply chains
• Improved consumption and health.

The £16 million HEFCE-funded N8 AgriFood Resilience Programme is focused on ensuring the stability and integrity of national and global agri-food supply chains in the face of environmental and socioeconomic challenges.

Sustainable food production
Agriculture is facing multiple challenges, associated with sudden shifts in weather, markets, regulation and technology. One of the fast-growing sectors covered by N8 AgriFood is e-Agri, including device engineering, electronics and sensor system design to help deliver the information flows to support more precise management of crops, livestock and soils, leading to sustainable agriculture and food systems. Existing industry-sponsored research within the N8 includes projects related to:

• Subsurface impedance tomography
• Networked fungal pathogen sensing
• Mass producible low-cost wireless nodes for soil monitoring
• High-sensitivity graphene-based protein-receptor biosensors
• Close-proximity active hyperspectral imaging.

These technologies demonstrate how engineering research can be translated from non-agri-food duties, re-engineered and integrated with plant science industry, NGOs, governments, farming communities and citizens on a global as well as local level.

Some N8 AgriFood projects are highlighted below to show how the Programme is building bridges between disciplines and between the N8 universities and external stakeholders to catalyse novel research to improve our food system.

**Malou Lindholm** and **Professor Katherine Denby** describe the multidisciplinary approach to sustainable, resilient and healthy food supplies at the N8 universities in the North of England, where over 370 researchers work in the HEFCE-funded N8 AgriFood Resilience Programme.
and agronomy research to create novel ‘smart farming’ technologies.

**Achieving resilience in supply chains**

Another major focus for the N8 AgriFood Resilience Programme is to integrate our understanding of food supply networks from food production and supply through to consumption and nutrition to identify and apply innovative practices; Professor Steven Banwart is the N8 AgriFood Lead for Resilient supply chains and for International Engagement.

Global food security exists when people have physical, social and economic access to sufficient, safe and nutritious food to maintain active, healthy lives; achieving food security must also promote sustainable development.

This lies at the complex nexus of economic growth, resource demand, environmental sustainability and public health.

**Improved consumption and health**

The need for a secure food supply is a concern at local, regional, national and international levels. We bring together expertise from across the N8 universities in health, behaviour and policy to address these issues.

One of N8 AgriFood’s key goals is sustainable nutrition: providing people with sufficient, safe and nutritious food whilst lowering the burden of food production and distribution on the natural environment. In an era of food banks, greater social inequality and mass migrations, food...
insecurity is a growing challenge. Research must focus on consumers’ dietary needs, food preferences and practices and their links to public health, as well as questions of food supply, affordability and distribution. Hence N8 AgriFood is actively working towards a ‘systems approach’ looking at production, supply and consumption as well as the linkages between these.

Working with industry
N8 AgriFood has a strong track record of working with business to drive innovation and actively collaborates with a range of organisations to help deliver the maximum social and economic impact from the research. We work with partners, such as innovative businesses, farmers, agronomists, government and charities. N8 AgriFood supports engagement with external stakeholders through several routes, developing new models for multi-partner industry and university engagement. A key principle of the approach is to improve and extract maximum value from existing infrastructure wherever possible.

National and international engagement and impact
In the UK, N8 AgriFood

Case study: IKnowFood, University of York
A brand new £3.3 million, four-year project started in October 2016, led by the York Management School’s Professor Bob Doherty with collaborators from across the University of York and the Universities of Liverpool and Manchester. The research application was supported by a range of industry partners including fair trade pioneer Cafedirect, supermarkets Sainsbury’s and Waitrose, LEAF (Linking Environment and Farming), Soil Association, Institution for Agricultural Engineers (IAgrE), Luc Hoffmann Institute (WWF), National Farmers Union (NFU) and CABI (Centre for Agriculture and Biosciences International).

The project will build a new model of food system resilience to ensure all food stakeholders can adapt and learn when faced with external threats/shocks. It involves an interdisciplinary team across the three universities working with farmers, supply chain actors and consumers to develop new technologies, decision making tools and mobile technologies which will help manage the structural, institutional and informational obstacles that challenge the food system.

Case study: the effects of non-nutritive SWeetened beverages on appetITe during aCtive weigHt loss (SWITCH)
The University of Liverpool is conducting the largest ever investigation into low-calorie sweetened drinks and their effect on weight loss and weight maintenance. With the current emphasis on reducing sugar in the diet, low-calorie sweetened drinks provide a sugar free alternative to those who still wish to consume sweet drinks. While the benefits of drinking plenty of water are well understood, could drinking low-calorie sweetened drinks be just as effective when it comes to weight management or do they promote the consumption of other sweet foods?

The University has gathered a team consisting of professors, medics and nutritionists for the 4-year study. Understanding the effectiveness of low-calorie sweetened drinks will help shape best practice when it comes to weight management. An investigation of their effects on appetite and food choice on this scale has never been undertaken previously according to Professor Jason Halford, Principal Investigator for the SWITCH project and Theme 3 Leader with N8 AgriFood. The SWITCH study is aiming to better understand the relationship people have with low-calorie sweetened drinks. Some of the knowledge gained will help people decide on the best approach to weight management.

Kenyan farmers
With more than 370 researchers working in agri-food resilience, the Programme has the greatest concentration of academics engaged in agri-food research in the UK.

Case study: Chinese mission

N8 AgriFood leaders took part in a government-sponsored visit to China to promote UK research strengths to Chinese companies and to develop new partnerships for industry research in the sector. Professor Katherine Denby, Academic Director, N8 AgriFood at the University of York, Steven Banwart, Head of International Engagement, N8 AgriFood at the University of Leeds and Jonathan Oxley, Operations & Business Development Director, N8 AgriFood at Newcastle University attended the annual China Modern Agriculture Summit in Yangling, a city devoted to agriculture and innovation.

During the five-day summit (5-9 November) they took part in a two-day industry workshop organised jointly with the Foreign and Commonwealth Office Science and Innovation Network (SIN) and Innovate UK. Opportunities were identified for new projects and collaborations to strengthen regional and national agri-food research and business innovation in both the UK and China, by working with Chinese companies and research organisations.

The future – where next for N8 AgriFood?

Working with universities, industry and society, N8 AgriFood aims to maximise the impact of its research base for greater economic and social benefit. With more than 370 researchers working in agri-food resilience, the Programme has the greatest concentration of academics engaged in agri-food research in the UK.

Exciting new developments include 10 new professorial appointments – jointly appointed across the N8 universities - as well as 12 business-facing Knowledge Exchange Fellows working across the universities and disciplines to translate research findings into innovation.

With a Business Development team to engage farmers and companies directly, a series of Industry Innovation Forums catalysing interdisciplinary collaborations with businesses and other stakeholders and academic outreach and pump-priming funding enabling multidisciplinary teams to address stakeholders’ fundamental issues, N8 AgriFood is well placed to meet the many challenges that lie ahead.

Knowledge Exchange Fellows working across the universities and disciplines to translate research findings into innovation.

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