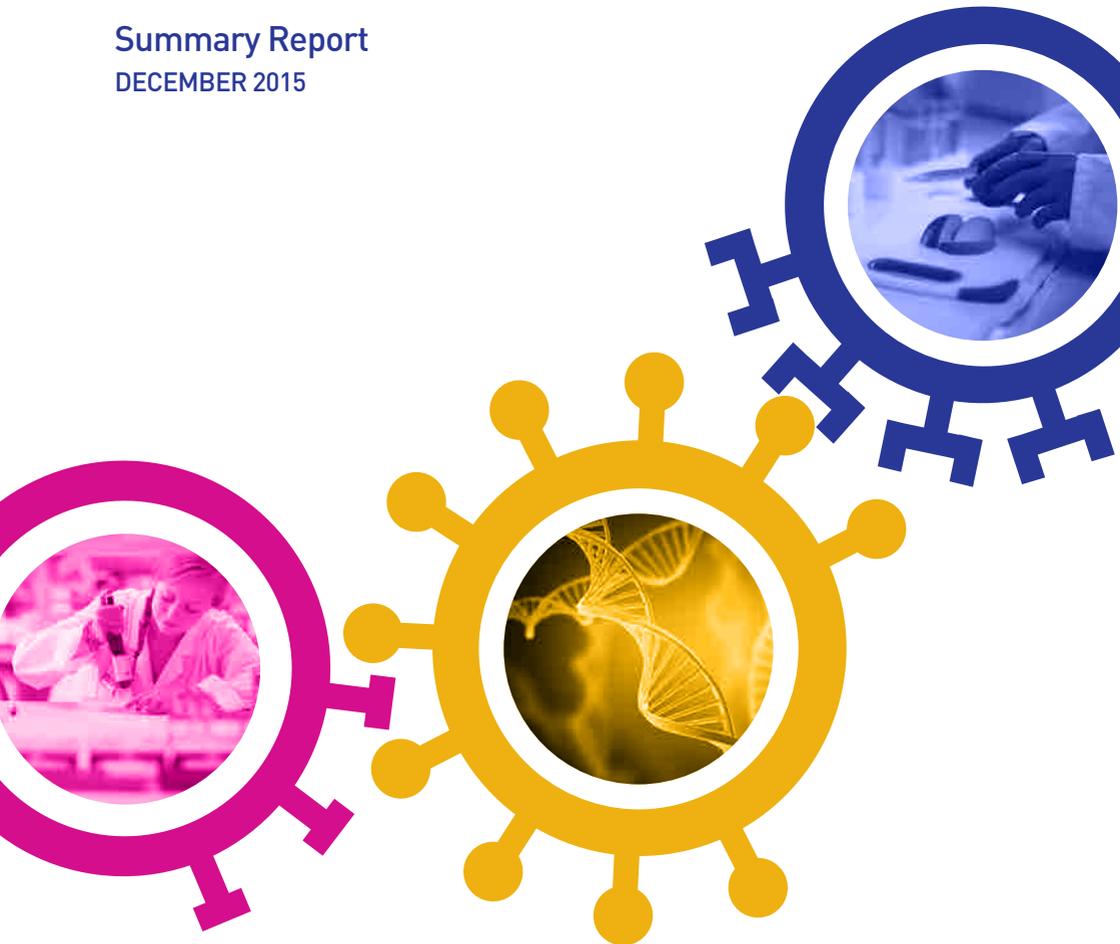


# BBSRC BIOSCIENCE ENABLING ECONOMIC ACTIVITY

## BBSRC impact in the REF

Summary Report  
DECEMBER 2015



# BBSRC in the REF

This analysis demonstrates how BBSRC investments support a growing bioeconomy.

## 2014

HEFCE published the results of the Research Excellence Framework<sup>1</sup>, their system for assessing the quality of research in UK higher education institutions. For the first time, REF 2014 required HEIs to submit case studies demonstrating the impact of their research, creating a unique overview of the impact of UK research on the economy and society<sup>2</sup>.

## 2015

Using the REF impact case studies from HEFCE, BBSRC conducted an analysis of the impacts reported for UK bioscience research. Specifically, BBSRC identified 642 impact case studies linked to BBSRC investments.

The analysis showed that bioscience research and training, supported by 20 years of investment from BBSRC, enabled £72Bn of economic activity and cost savings between 2008 and 2013.

Individually, the REF case studies underpinned by BBSRC show how such investment supports the bioeconomy in key sectors such as food manufacturing, biotechnology and agriculture. BBSRC's REF case studies include examples of major economic, political and societal impacts and show that BBSRC plays a pivotal role in the UK research landscape. They also show that BBSRC researchers are working, and having an impact, in the UK and globally, demonstrating the value of UK bioscience.

### This revealed:

**642**  
CASE STUDIES  
UNDERPINNED  
BY BBSRC  
INVESTMENTS

THESE  
INCLUDE

- 1/3** Of case studies in the medical and life sciences
- 2/3** Of all Units of Assessment in the REF include case studies linked to BBSRC, across all four main panels<sup>3</sup>
- 76** Different institutions submitted case studies linked to BBSRC investments
- 45%** Of all case studies in biological sciences and agriculture, food and veterinary sciences explicitly reference BBSRC

<sup>1</sup> REF 2014: <http://www.ref.ac.uk/>

<sup>2</sup> REF 2014 Impact Case Studies database

<sup>3</sup> Submissions to the REF were made in 36 units of assessment. An expert sub-panel for each unit of assessment assessed each submission, working under the leadership and guidance of four main panels.

# Geographical spread of BBSRC REF case studies

## BBSRC's REF case studies across the UK

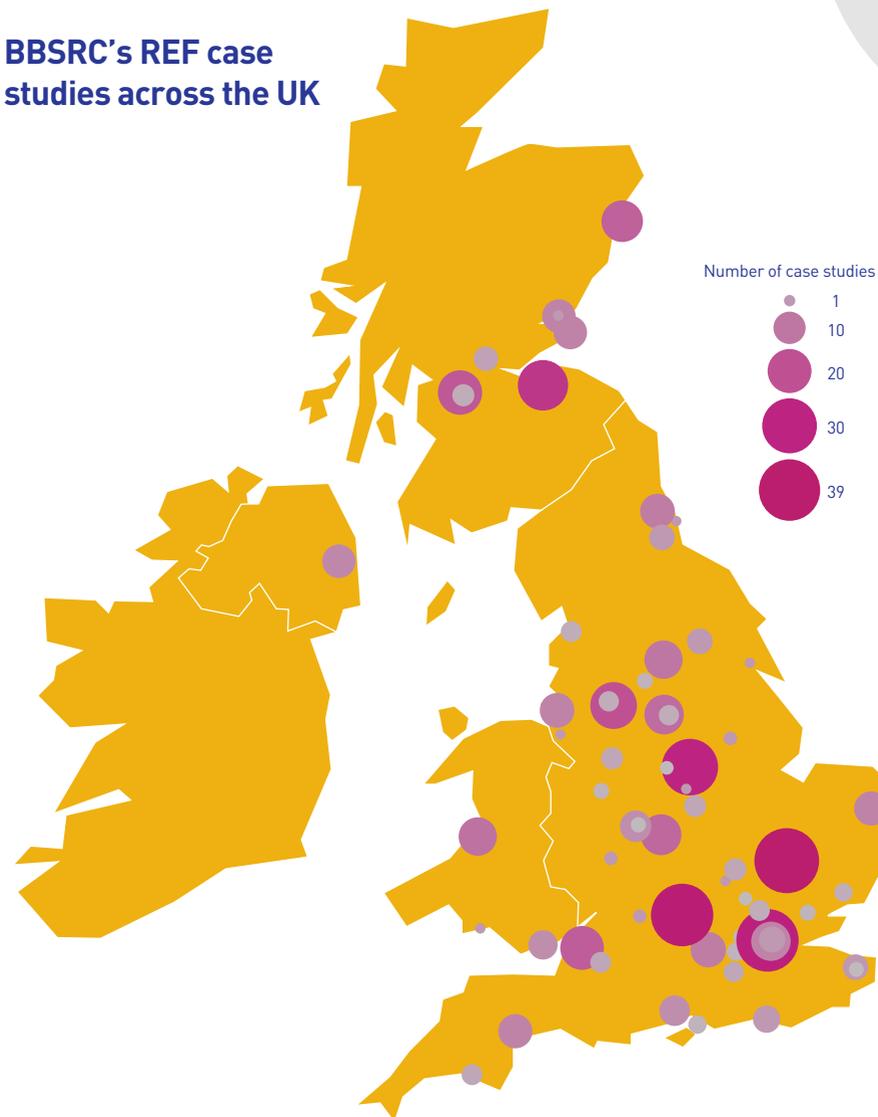


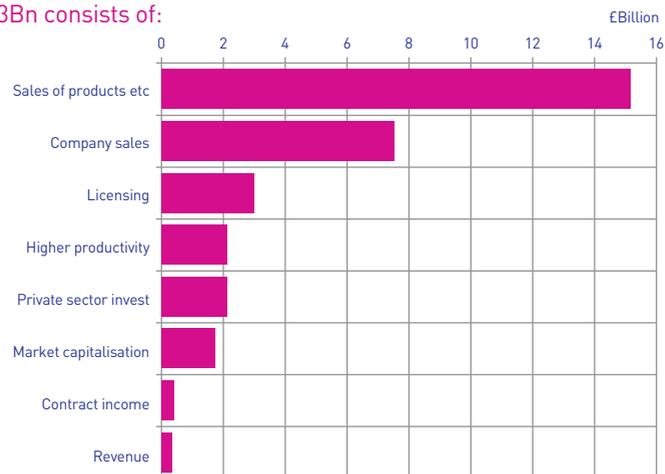
Image: BBSRC.

# Enabling economic activity

Analysis of the impact reported in the 642 case studies revealed:



The £33Bn consists of:



This includes **149 bioscience spin-out companies** established and/or strengthened.

HEFCE's analysis of the REF case studies<sup>2</sup> showed that the 'biological sciences' Unit of Assessment in the REF:

- **Produced more patents than any other UoA.**
- **Was second only to 'clinical sciences' in the number of licences generated.**
- **Generated as many spin-out companies as 'computer science and informatics'; joint second behind 'general engineering'.**

These findings are supported by an analysis from Digital Science for BBSRC<sup>3</sup>, which adopted a 'topic modelling' approach.

Topic modelling uses statistical analysis of the case studies text to reveal clusters of key words and associated case studies.

The analysis showed that the largest clusters of key words were in **'Technology IP/Commercialisation'** (which included 105 case studies) and in **'New products and services'** (also 105 case studies).

Case studies associated with these clusters arose from research in bioscience, chemistry and medical sciences, and many of the case studies were linked to other clusters such as 'regenerative medicine', 'imaging' and 'clinical trials'.

<sup>1</sup> Impacts are global and span the period 2008-2013.

<sup>2</sup> The nature, scale and beneficiaries of research impact: An initial analysis of Research Excellence Framework (REF) 2014 impact case studies', Digital Science and King's College London (2015).

<sup>3</sup> REF 2014 Impact Case Studies and the BBSRC' Digital Science (2015).

Available online from <http://www.bbsrc.ac.uk/documents/1507-ref-impact-case-studies-pdf/>

CASE STUDY

## Better brewing worldwide

Research led by BBSRC-funded Professor Graham Stewart and his team at Heriot-Watt University into the process of brewing beer and distilling spirits in a more cost-effective and quality-enhanced manner has led to substantial improvements in the High Gravity brewing process worldwide.

Working with the brewing industry, Professor Stewart addressed issues around beer foam stability, yeast fermentation performance and beer flavour. His findings enable up to 50% more beer to be made in the same brewery with reduced distilling costs, potentially saving the global brewing industry more than £555M in the capital costs associated with expanding the capacity of breweries.

## Neurosolutions – enabling neuroscience drug discovery

BBSRC funding for neuroscience research at the University of Warwick led to the creation of spin-out company Neurosolutions in 2000.

The company develops novel compounds and provides specialist biomedical services to pharmaceutical companies to facilitate pre-clinical drug discovery in areas including Alzheimer's disease and neuropathic pain.

By 2013, Neurosolutions was generating annual revenues of £1.4M and now employs 5 full-time staff in the UK and Canada. The company has worked with more than 100 industrial clients, including Merck, Eli-Lilly, GSK, and Pfizer, and proof-of-concept data from Neurosolutions has supported the creation of five biotechnology companies.



# BBSRC's pivotal role across the landscape

The REF case studies demonstrate BBSRC's pivotal role in the research landscape, both in terms of creating partnerships, collaborations and leveraging further funding as well as being crucial along the research pipeline from fundamental research through to real-world applications.

## From the 642 BBSRC impact case studies:

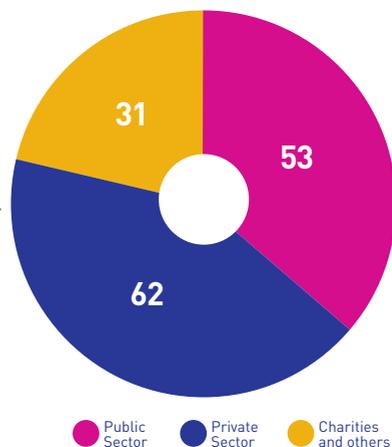
**258** reference at least one other Research Council  
**40** include Innovate UK

## Of the REF case studies specifically detailing BBSRC grant numbers:

- >90%** also include details of funding from at least one other organisation
- 56%** of these case studies include other public sector funders
- 58%** of these case studies include funding from industry
- 39%** of these case studies include funding from charities and others

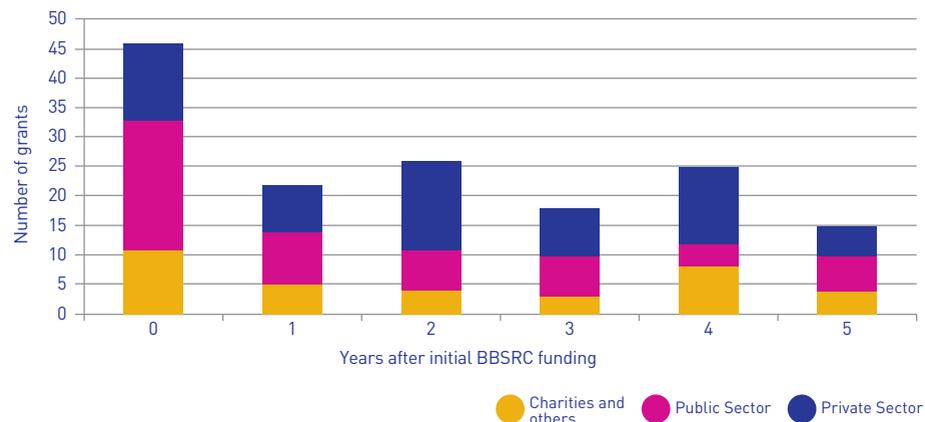
**146**  
 OTHER ORGANISATIONS FUNDED RESEARCH THAT WAS ALSO SUPPORTED BY BBSRC

Other funders - by sector



Much of BBSRC's funding enables research that is subsequently funded by others. In particular, BBSRC research often leads to funding from MRC, Innovate UK and industry.

BBSRC investments catalyses funding from other sources



## Reducing mould contamination in food manufacturing



Fungal biology research led by Professor David Archer at the University of Nottingham has enabled GlaxoSmithKline (GSK), and subsequently Lucozade Ribena Suntory (LRS), to understand how fungal spores contaminate their manufacturing processes, resulting in new ways to reduce fungal contamination and improve the use of existing preservatives.

Manufacturing improvements arising from the research contributed to the £1.35Bn value of GSK's Ribena and Lucozade business, which was sold to Japanese company Suntory in 2013.

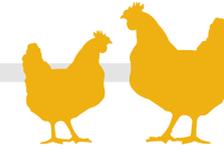
The research was funded through two BBSRC-Defra LINK grants, a Knowledge Transfer Partnership with GSK and a BBSRC Industry Partnering Award with GSK and life science and materials science company DSM.

# Supporting policy-making

Topic modelling by Digital Science found a cluster of 55 case studies linked to UK policy.

**55**  
**CASE**  
**STUDIES**  
**LINKED TO**  
**UK POLICY**

These case studies were associated with other key word clusters, including 'media', 'international food safety', 'human and animal disease', 'ageing population', 'environmental management'.



## Improving chicken welfare

With BBSRC and Defra funding, Professor Marian Dawkins CBE FRS, and colleagues from the University of Oxford have developed scientific ways of studying animal welfare, enabling better animal husbandry and improved animal health.

Dawkins' research varied the stocking density of 2.7 million chickens and found that, in commercial trials, the housing and environment in which the chickens are kept affect the welfare of broiler chickens even more than density.

Her findings influenced the 2007 EU Broiler directive, adopted by the UK in 2010. 800 million broiler chickens are reared in the UK each year.

## Informing EU & UK policy on sustainable agriculture

Research supported by the cross-Research Council Rural Economy and Land Use Programme (RELU) has informed EU and UK policy thinking on sustainable agriculture. University of Leeds researchers including Professor Tim Benton, Professor William Kunin and Dr Steven Sait, showed that sustainable landscapes do not necessarily arise from farms adopting sustainable agriculture, but can arise from a mixture of intensive agriculture and land managed for nature.

Benton provided evidence on sustainability during the reform of the EU Common Agricultural Policy. In the UK, the results were used in a House of Commons Environment, Food & Rural Affairs Committee report, 'Greening the common agricultural policy'. Benton's work has also contributed to a reassessment of sustainability strategies in parts of the food industry.

## Modelling plant diseases

Professor Chris Gilligan, a former BBSRC professorial fellow, and his University of Cambridge team developed a series of mathematical models to predict the spread of agricultural, horticultural and wild plant diseases.

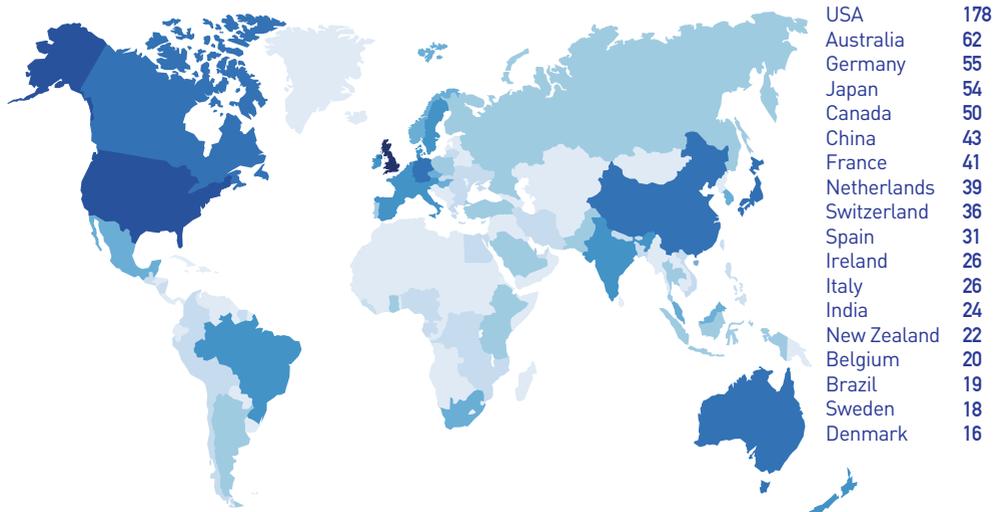
The models have been used by policy makers in Defra, the Forestry Commission and devolved nations, as well as the US Department of Agriculture, to manage outbreaks of tree diseases such as ash dieback and agricultural disease such as Rhizomania – a major threat to the UK's valuable sugar industry – as well as for emerging epidemics of wheat diseases in Africa.

To foster the use of their research by policymakers and practitioners, the team developed an epidemiological toolbox, with user-friendly models available online (<http://www.webidemics.com/>).



# The global reach of UK bioscience

Digital Science also geotagged a subset of the case studies, identifying locations included in case study text (431 case studies, coloured on a log scale. Dark blue = more case studies). Locations include where the impact occurred, as well as the locations of co-funders and collaborators.



## Improved food security for three million people

A new variety of disease-resistant pearl millet is boosting food security and financial stability for around three million people in India. The new variety, which produces up to 10% higher yields, has replaced the previous variety of pearl millet grown in north western India, generating £6.5M of net benefit in 2011 alone.

The pearl millet variety was developed by a team of researchers from Bangor University, the International Crops Research Institute for the Semi-Arid Tropics and two of BBSRC's strategically-funded institutes: The Institute of Biological, Environmental and Rural Sciences at Aberystwyth University and The John Innes Centre.

# Methods

Identifying BBSRC in the REF:

# 6679

REF CASE STUDIES  
AVAILABLE FOR ANALYSIS  
SEARCHED USING KEY WORDS  
& OTHER SEARCH TERMS

220 Include 'BBSRC' (and variations) in the text.

211 Include BBSRC institutes, spin-out companies (known to BBSRC) and DOIs of publications associated with BBSRC funding (based on information submitted to Researchfish and data from Web of Science). Detailed reading of all case studies in six UoAs to identify relevant case studies.

211 In Units of Assessment 5 (Biological Sciences) and 6 (Agriculture, Veterinary and Food Science) – included 'by association' as BBSRC is a major funder in these sectors.

**642 REF CASE STUDIES ASSOCIATED WITH BBSRC.**

From these, basic descriptive information could be extracted.

### Economic and other funders analyses:

All 642 case studies were read by BBSRC employees and key economic impact statements and funding dates extracted, coded and collated for analysis.

### Digital Science:

Digital Science were given the full set of 642 divided into the three subsets above and commissioned to conduct additional descriptive analysis and 'topic modelling'. Digital science report available here: <http://www.bbsrc.ac.uk/documents/1507-ref-impact-case-studies-pdf/>

### Limitations:

The analysis presented here is indicative of the impact of UK biosciences during the REF period (2008-2013). It is not a comprehensive analysis of the impact of BBSRC, and is subject to a number of recognised caveats and limitations.

In particular, the REF impact case studies:

- exclude (most of) BBSRC's strategically-funded institutes.
- were produced for a different purpose i.e. the HEFCE REF exercise, not BBSRC analysis.
- are a sample of impacts – this analysis effectively uses a sample of a sample.
- do not always include funding information.
- use no common standards for impact information or funding information.
- are dated – written in 2013 to describe impacts in the period 2008-2013.

For more information, contact:

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## About BBSRC

**The Biotechnology and Biological Sciences Research Council (BBSRC)  
invests in world-class bioscience research and training on behalf of the UK public.**

Our aim is to further scientific knowledge, to promote economic growth, wealth and job creation and to improve quality of life in the UK and beyond.

Funded by Government, BBSRC invested over £509M in world-class bioscience in 2014-15. We support research and training in universities and strategically funded institutes. BBSRC research and the people we fund are helping society to meet major challenges, including food security, green energy and healthier, longer lives. Our investments underpin important UK economic sectors, such as farming, food, industrial biotechnology and pharmaceuticals.

For more information about BBSRC, our science and our impact see:  
<http://www.bbsrc.ac.uk>



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