Science and Translation of Innovation in the Food Economy

Food Economy Task Force, Work Stream 2

Contents

Executive Summary

The UK food industry is a major employer, a massive contributor to the British economy, and a social necessity. We all encounter it every day, if only to consume its products.

The food industry is also a British success story, encompassing many profitable businesses. But it faces significant challenges. These include the effects of climate change on food production, potential shortages of land, water and other inputs, growing international competition, and changing consumer tastes.

While the UK food sector is already a high-technology industry, these issues can only be resolved if British food companies become more innovative. To do this, they will need better connections to the universities and research institutes that produce usable new knowledge in the food arena.

This report examines ways of improving these links. It looks at how companies in this sector think about and practice innovation, at the drivers and barriers to innovation along the supply chain, and at innovation relationships between companies, universities and research institutions. The food supply chain is exceptionally complex and involves a huge number of businesses of all sizes. This means that innovation and collaboration are difficult to achieve. This report contains evidenced proposals for change and improvement in food industry innovation.

The report is informed by semi-structured interviews with 30 technical directors, innovation managers, CEOs and managing directors from 26 companies. The interviews were designed to gain their opinions on innovation and collaboration. The responses were coded to discover the key topics of concern for companies in the agri-food sector. Common opinions have been presented, as well as topics where differences of opinion exist.

Principal findings highlighted in the report include:

- The major drivers for innovation are customer demand, competition, regulation and compliance, as well as cost reductions and resource efficiency.

- The major barriers to innovation are regulation, the profile and structure of the sector, resources, and talent and expertise.

- Collaboration for innovation is commonplace for companies in the agri-food industry. Almost all companies collaborate externally with suppliers, customers and academic institutions.

- Companies feel that they have limited awareness and knowledge of academic institutions with expertise in the agri-food industry. They feel that there are only a handful of universities with the right knowledge to be able to collaborate on innovation in this industry.

- Companies prefer to build up a relationship of trust with academic partners.

- There are a number of factors that hinder collaboration between industry and research institutions including timescales, barriers between the language used by academics and that used in industry, the cost of an academic partner and issues relating to intellectual property (IP).

Interviewees were asked what they would recommend be done in order to improve collaboration within the agri-food industry. Their responses fall into seven themes:

- Increasing knowledge-sharing and the visibility of academic research

- Improving the industry's profile and decreasing its fragmentation

- Increasing the impact of academic research

- Improving funding structures

- Increasing pre-competitive and industry collaboration

- Improving skills and training

- Decreasing intellectual property barriers

A focus group of universities, research institutions and industry organisations was held to discuss the findings and recommendations from this research. There were differing views on many of the issues discussed. For example, the call to increase the visibility of universities has to be balanced against their need to remain competitive. There are also problematic issues concerned with interdisciplinary research and collaboration, with funding, and with the differing timeframes of business and academia. But there was also a general consensus that more productive collaboration depends both on individual experts in this field being more visible, and on industry understanding how universities work.

This suggests several priority areas for UK agri-food innovation. The evidence from industry gathered by the NCUB Food Economy Task force has allowed it to create recommendations to deliver improvements in these areas.

01. Introduction

The National Centre for Universities and Business (NCUB) task force on the food economy was established to suggest better forms of collaboration between businesses, higher education, and other research institutions, in order to develop a more competitive and sustainable UK agri-food sector. This more successful industry will need to be highly innovative.

This report looks at the current state of innovation and collaboration within the UK food economy. It examines what is driving companies in the food and drink industry to innovate, and the factors that restrict their innovation. This helps to show where the food industry can improve the structures that support collaboration. Collaboration is important for innovation, and this report will demonstrate that many companies are seeking outside input into their efforts to innovate.

Open innovation, or innovation that is sourced outside a company, is important to the agri-food industry. It is difficult for many companies to meet the needs of their customers and end users on their own (Sarkar & Costa, 2008). For example, a manufacturer whose product includes a cereal such as wheat or oats is unlikely to grow it themselves. If they want to improve the health benefits of the input grain, they will need to collaborate with agricultural producers and plant breeders to have the characteristics they desire bred into the cereal.

This report looks at the key findings from a number of interviews conducted with the aim of understanding:

- How companies define and view innovation

- The key drivers and barriers for innovation

- How companies collaborate internally and externally on innovation projects

- Whether collaboration on innovation projects is seen as successful, and the reasons for this success

The report aims to understand what the innovation trends within industry are and where examples of best practice exist. It includes an analysis of areas in which companies have opinions in common, and of others on which they disagree. It is based on the point of view of the companies interviewed, and does not include a gap analysis based on the response. This approach was adopted in order to understand the key issues that are driving companies' innovative and collaborative activities in the agri-food sector, and how their perceptions are directing their innovation work with external collaborators. The report also discusses key topics that arose repeatedly during the interviews. These include the importance of internal collaboration, the reliance on networks for establishing a relationship with universities, which funding sources companies are accessing, and the increasing focus on supply chain and pre-competitive collaboration.

The companies that were interviewed ranged from large multi-national companies to small suppliers of agricultural support services. As can be seen from the chart below, the most highly represented group was in agricultural and horticultural production, followed by manufacturing and processing companies. These companies were self selected from a list of industry contacts. (See appendix 1 for details of the methodology.)

Figure 1: Sector representation in interviews
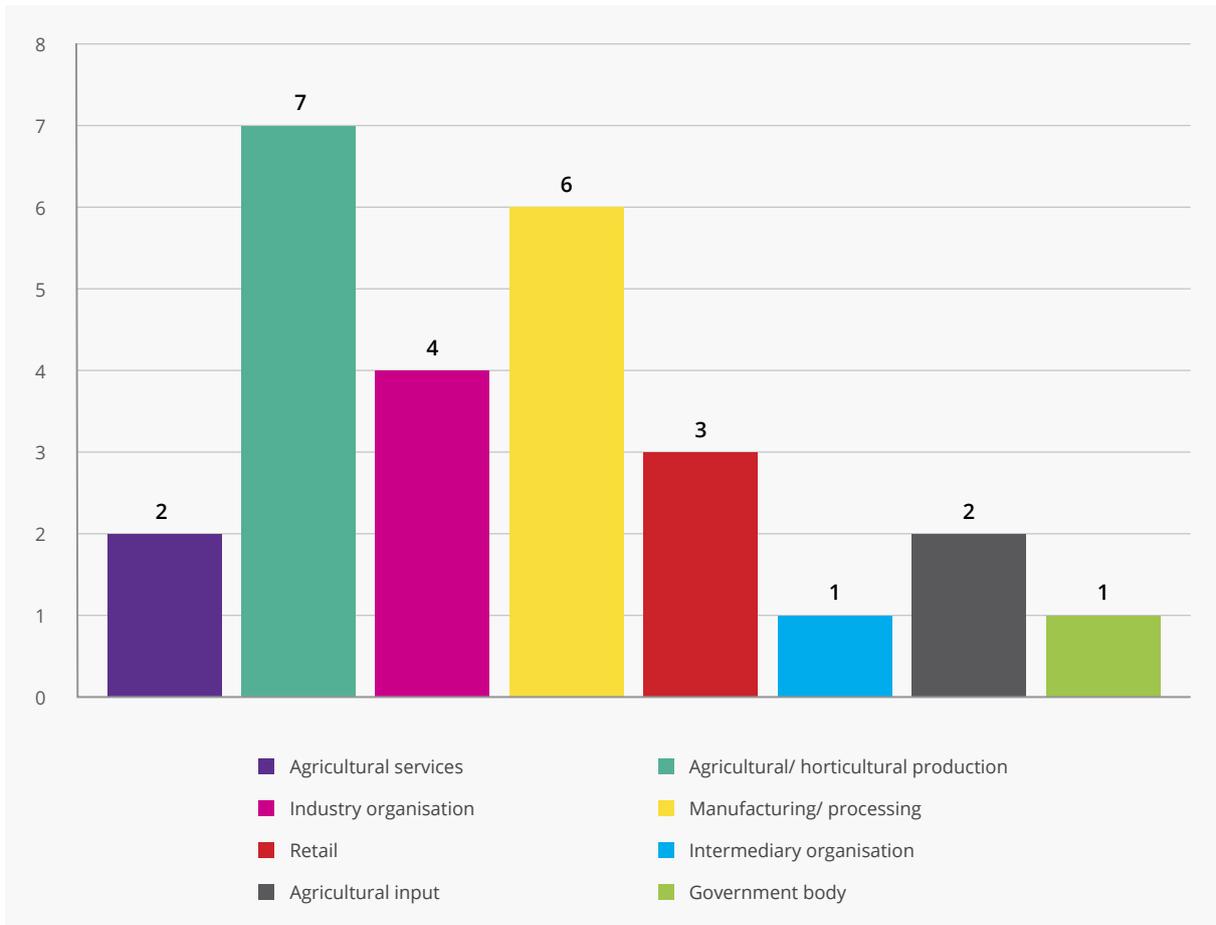
The difficulty of reaching a broader range of companies in terms of size and sector relates to the industry's structure. The industry represents around 15 per cent of UK manufacturing and is made up of approximately 6,500 businesses, most of which are small and medium enterprises (SMEs) (Food and Drink Federation, 2010). According to the Department for Business, Innovation and Skills, only 2 per cent of SMEs engage with universities on innovation, meaning that even with the large number of companies in the sector, few of these smaller companies are actively involved in innovation.

Key Findings

This section highlights the key findings from the field work in three areas: **innovation, collaboration**, and **funding.**

02. Innovation

2.1 Definition and measurement of innovation

Companies tend not to define innovation in a rigid way, but rather look at what innovation can do within their organisation to change and improve processes and products. 73 per cent of interviewees discussed innovation as involving both process and product, and felt that anything that can improve their business is innovation. The remaining 27 per cent focused on innovation in terms of products rather than processes. The majority of the companies with a product focus have a strong consumer-facing brand, with a wide portfolio of products, and their attention to products is a consequence of this business model. The other group that seemed product-focused were technology-based support services. These businesses do not have manufacturing processes that require innovation.

Interestingly, one respondent viewed true innovation as being separate from small product innovations such as a new flavour. They believed that step-change or large science-based innovations are true innovation, where companies are creating something that 'people cross the road for'. This reflects academic definitions of innovation, which estimate that these radical innovations represent only 2 per cent of all innovations. Most innovation is derivative, such as adding to an existing product line (Kemp, 2013). However, as one respondent pointed out, major innovations may only happen once or twice in a career and do not make up the bulk of research and development.

In contrast to this perspective, a number of other companies said that an innovation may not be something that they have developed, but rather the adoption of a new technology that creates an innovative process that is new to them. This absorptive capacity was stressed especially in interviews with companies whose focus is on process innovation, which tended to have pre-existing knowledge of technology. Firms which concentrate on product innovation placed a greater emphasis on original research and development (Cohen & Levinthal, 1990).

The survey showed that some businesses handled innovation in an informal way, while others had a formal structure such as an R&D department. Unsurprisingly, larger organisations often have R&D departments. But some smaller companies have also invested in an internal function capable of driving innovation. Not all companies with a dedicated R&D team suggested that innovation had become formalised as a result of this structure. Many said that their company still had flexibility over the process of innovating. However, as one respondent said, it is rare that any huge leap is discovered by accident.

When asked whether companies had experienced a disruptive event that had caused reactive innovation, half of the businesses interviewed said that they had. However, the majority of these respondents felt they did not innovate in any significant way as a result. Rather, they addressed the problem and moved forward. But five companies had implemented innovations as a reaction to a disruptive event. These companies felt that responding quickly was crucial, and that there were opportunities to create something new to the market through innovation.

In addition, opinion was divided on the definition of innovation, both between and within different parts of the supply chain. Within retail or agriculture there were distinct differences in how companies appear to view innovation. Some agricultural companies highlighted how they were constantly innovating new varieties, others said they receive new varieties from working with breeders, while others still said there was little money in the sector for any form of innovation to take place.

Within the retail sector, the survey found very different approaches to innovation among the three large chains interviewed. One focuses on big innovations that create first-to-market products; a second works with suppliers along the supply chain; while the third retailer sees its position much more as supporting and facilitating suppliers to innovate, rather than innovating itself.

A handful of respondents use a stage-gate approach to manage innovation projects and ensure that they are progressing as planned. While the main proponents of this approach were large organisations, one horticultural company has adopted the stage-gate method to match its major retail customer's approach, ensuring that their end result is accepted by the retailer. This is a good example of spill-over along the value chain.

The majority of companies measure the success of an innovation in financial terms, with nearly three quarters of respondents citing either return on investment, sales, or the percentage of profit derived from new product development as measures for success. Interestingly, one company stated that it measured the financial impact in terms of what the cost to the business would be if it did not innovate.

However, some products do not have a simple sales figure that can be used as a metric for their success. Process innovations were felt by some respondents to be harder to measure because they may simply become part of the day-to-day operations of a business. This is in line with industry research; a report by consultancy Arthur D Little found that 72 per cent of companies across all sectors believe that the indicators they use to measure success do not truly capture the full benefits of an innovation (Arthur D. Little, 2012).

More broadly, 40 per cent of respondents said that while financial measures were important, there are other important factors that need to be included when looking at what can be considered a successful innovation. For some companies the uptake of an innovation is an important measure, as it demonstrates market share. For others, the broader impact of the innovation, for example its customer or environmental impact, or impact on the greater good, may be more important measures than a straightforward view of its financial impact.

2.2 Drivers and barriers to innovation

Companies were asked to discuss their innovation activities, in an attempt to uncover the key areas of concern for innovation in the agri-food sector. They cited a number of areas on which their innovation is currently focused, which naturally varied depending on their business. These topics include:

- Health and nutrition

- Waste

- Resource efficiency

- Shelf life

- Responding to UK and EU regulation

Companies were then asked to state what they felt was driving innovation, and what was creating a barrier to it. Multiple respondents raised many of the topics, and some issues such as regulation were cited as both a barrier to and a driver of innovation.

2.1.1 Drivers of innovation

Chart 2: Drivers of innovation
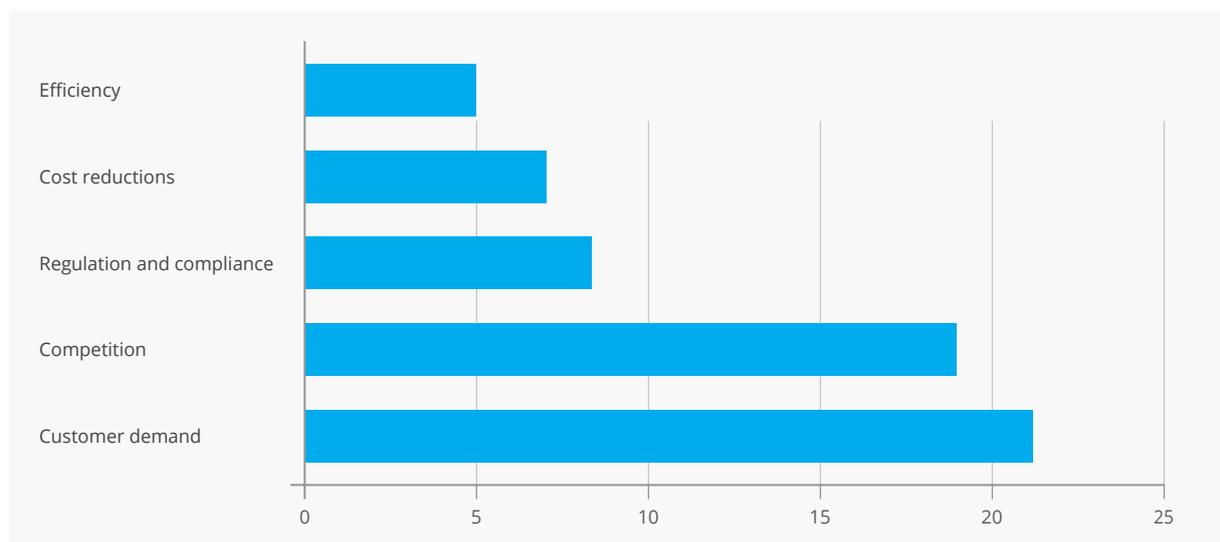
2.2.1.1 Customer demand

"Innovation is matching ourselves and our products with the changing customer"

Large Retailer

Consumers constantly want to try new products, particularly when it comes to food. This naturally requires that companies innovate to provide these products to market. 70 per cent of respondents mentioned issues relating to the demands of their customers and end consumers as driving their innovation activities. Key topics here include the increasing demand for products that deliver health benefits, as well as the increasing wealth of the British consumer, which enables them to buy more products. But while many companies look along the value chain and see consumers as the final destination for innovation, they are also aware of the position of the retailer as the route to market. The retailer is a surrogate customer and has the market knowledge of what consumers are buying, as well as the power to decide what is placed on a supermarket shelf. One company said they will only innovate if their retail customer expresses interest in the new idea for a product or process.

2.2.1.2 Competition

Competition is a natural driver for innovation. Companies want to stay ahead of the game. 63 per cent of respondents mentioned competition and market forces as a driver for innovation. Within the agricultural and horticultural sectors this was particularly evident. Here companies have high turnover and low profit margins and need to continually innovate to stay ahead of their competitors. One respondent said that the UK food sector is more competitive than ever before, as consumers have more product choice than in previous decades.

The difficulty for companies is that there is little way of knowing what competitors are researching for their next innovation. When asked whether they benchmark their rivals, a number of respondents discussed benchmarking at the level of marketed products, but only one stated that they benchmarked their innovation activities, which they achieve through product trials against competitors' products.

2.2.1.3 Regulation and compliance

A quarter of respondents stated that regulation is a major driver for companies to innovate.

"Done well and managed well [regulation] can really drive innovation. It can make industry look at itself and look at how to change"

Large Manufacturer

In recent times the focus has been on health and nutrition, driven by Government and through compliance with standards. This approach has led to many innovations. An example is salt reduction. This may not be a formal regulation, but support by big retailers for Government targets for salt reduction means that companies have felt it essential to their business to reduce salt. Reducing salt causes companies to innovate, as salt is used to extend product life. And for some processing companies such as bakeries, reducing salt requires process innovation. Salt has a role beyond flavouring in the baking process. It affects the texture of the dough and regulates yeast activity (Institute of Medicine (US), 2010).

Regulation around the environmental impact of a business has led to many companies improving the efficiency of their processes and products. In doing so, many companies have reported cost savings. The environmental agenda has also driven a number of efficiencies around waste, packaging and shelf life. Many companies raised shelf life and waste as a key driver for innovation. However, they admit there is a challenge in innovating something that will require a change in consumer perception to be accepted.

2.2.1.4 Cost reductions

Nearly a quarter of respondents felt that cost reduction was an important driver for innovation. This was often mentioned in the context of other drivers such as consumer benefit or competition, where cost savings

help improve competitiveness. Cost reduction is naturally seen as favourable for innovation projects, as the majority of companies view the success of innovation in financial terms.

2.2.1.5 Efficiency

Almost one-fifth of respondents mentioned efficiencies such as carbon and energy savings as a driver for innovation. While this driver can create financial benefits, a number of respondents mentioned it separately. They felt that reducing waste helps to drive down costs, but also helps in its own right to increase the environmental efficiency of a product or process.

2.2.2 Barriers to innovation

While competition and customers were discussed by the majority of respondents as being the key drivers for innovation, there was less agreement on the barriers to innovation. Four key barriers emerged. However, no one barrier stood out from among these, with no more than 30 per cent of respondents discussing any one theme.

Figure 3: Barriers to innovation
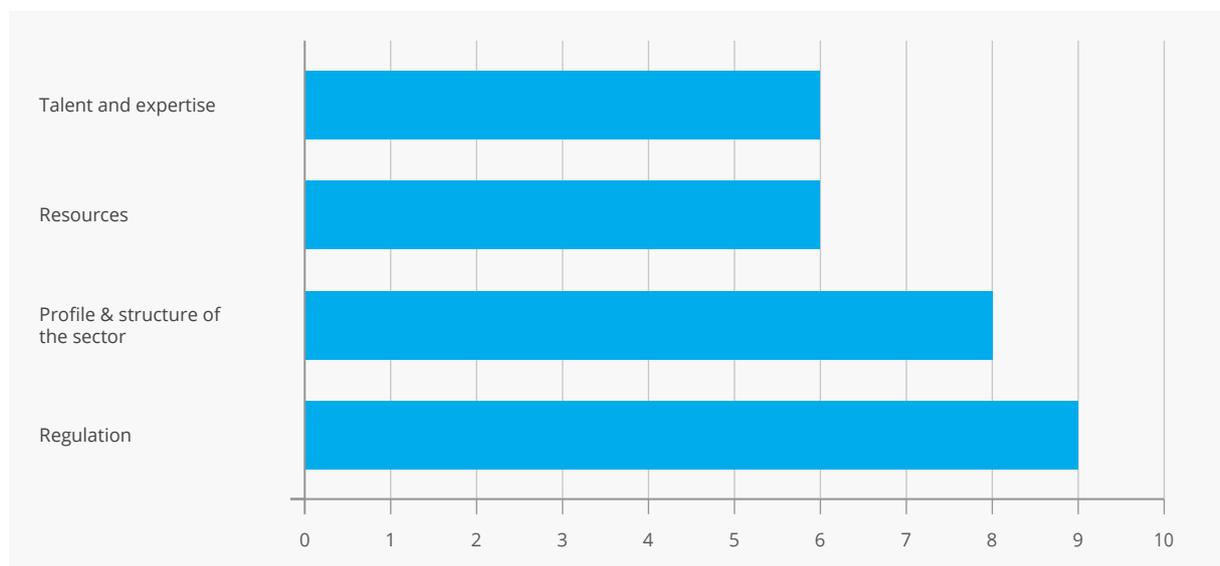
2.2.2.1 Regulation

Almost a third of respondents felt that regulation was a barrier for their innovative activities. In particular, companies in horticulture and agriculture which deal with pesticides say that EU and UK regulation is increasingly making the use of certain herbicides and pesticides impossible, and that innovating alternatives is incredibly difficult. Health claims are another area where regulation is a significant barrier. Several interviewees discussed their inability to innovate in areas that may create a healthier product because they have no way of communicating the benefits to consumers.

> *"I think regulation can inhibit innovation particularly in the area of health claims...they've made it really onerous. Even things like probiotics you can't make claims on"*
> **Large Retailer**

Regulation is also a barrier for plant breeding, where selective breeding is poorly understood and is sometimes treated as genetic modification (GM). GM is tightly regulated and the process for approval is long and costly. With current EU regulation allowing veto rights for any country, companies can go through significant periods of testing at their own cost, only to come out with something that cannot be commercialised within Europe.

2.2.2.2 Profile and structure of the sector

Over a quarter of respondents discussed the profile and structure of the agri-food industry as a barrier to innovation. Their concerns included the structure of the sector, especially its disjointed nature, as well as the general perception of the sector.

Structural issues are felt to hinder innovation, because a discovery found in one part of the supply chain may benefit a separate part. The company that made the discovery is unlikely to innovate when they will not be the ones to feel the benefit, meaning that the sector may be missing out on innovations that will benefit the supply chain as a whole. Another structural issue was the power of the retail sector. Retailers are in a position of power regarding the adoption of innovation, which they may be reluctant to embrace if their current product offer is working. This concern will be discussed in greater depth in section 5.2.

Awareness of the sector was also raised as a barrier to innovation, as it is felt that there is:

- Lack of understanding of how the agri-food sector works

- Difficulty recruiting the most talented graduates into the sector, due to a low level of awareness of the jobs in the sector, as well as problems relating to curriculum

- Failure to recognise the importance of the agri-food sector as the largest manufacturing sector in the UK

- Lack of understanding of the sector's activities

- Unnecessary use of complex jargon and technical language. This is felt to be more appropriate for an industry such as pharmaceuticals than for agri-food

2.2.2.3 Resources

A fifth of respondents felt financial resource barriers exist that restrict their ability to innovate. This was particularly apparent within agriculture and horticulture, where the margins are tight.

"The supply chain is so lean it makes innovation hard to do... I think the whole supply chain could move forward a lot quicker if we had a longer-term view of value supply chain deals"
Agricultural Producer

This emphasis on the need for a longer-term focus has been raised with regard to money because multiple respondents mentioned the role of the annual profit cycle in funding decisions. This approach can create a barrier to the long-term funding of innovation projects. The quote above comes from an agricultural producer who feels the pressure to innovate to remain competitive, but finds it difficult to commit long-term to innovation projects, as the business is required to tender for new contracts every six months. Speaking at the other end of the supply chain, one retail company admitted to being incredibly short-term oriented, saying they would struggle to make commitment to any project that they would consider long-term. This restricts not only innovation within the individual businesses involved, but along the supply chain too.

2.2.2.4 Talent and expertise

The talent and expertise of individuals in the sector was felt to be a barrier by a fifth of respondents. While farmers may understand how to innovate at the farm level, they do not have the project management experience required to manage an innovation project more broadly, and this can prevent implementation.

A number of respondents felt that the lack of talented graduates coming into the sector is preventing long-term innovation. This group felt that the industry is not seen as attractive to university students, which impacts on the uptake of careers in the agri-food sector.

Other interviewees were concerned with the way certain topics relating to the industry are taught in universities. One industry organisation described how bio-sciences in universities are focused on bio-medicine. Undergraduate students are often taught little if any plant science during their three years at university.

03. Collaboration

Innovation requires the skills and knowledge of individuals to research and develop new products and processes. The right people may not be on the payroll of any specific company, which means that it must look for individuals both internal and external to its business to find the right skills to enable innovation (Costa, 2013). And even internal innovation activities may require teams across a business to collaborate. Where companies are unable to innovate internally, seeking external expertise to bring in knowledge and skills, they are seen to be operating a strategy of 'open innovation'. Under this model, ideas and technologies flow from both within a business and from outside it, with partners that include customers, suppliers and research institutions (Chesbrough, 2003).

3.1 Internal collaboration and innovation

When asked to rate the importance of their internal innovation activities, 100 per cent of respondents rated internal collaboration as either essential (65 per cent) or very important (34 per cent). There were no distinctive clusters visible within the two ratings; among agricultural and horticultural companies, opinion as to whether internal collaboration is essential or very important was divided evenly. But despite this universal agreement that internal collaboration was very important or essential, not one company said they were completely successful at it. 86 per cent stated that they were successful at collaborating internally, but many recognised that they could do better. Two respondents said they were not very successful at collaborating internally but thought they were successful at innovating generally, suggesting that they are reliant on external support to innovate.

One company said that encouraging internal collaboration helped prevent siloed thinking that was focused on a specific innovation that might not succeed. Instead, drawing knowledge from different teams or business units helps to ensure that teams such as marketing and R&D work together to create a marketable new product with a greater chance of success.

> *"One of the most important ways to collaborate internally [is with] the sales team...Getting real time market intelligence is important...it needs to be applicable"*
>
> **Large Manufacturer**

Several respondents stressed the importance of ensuring people understand the market benefits of innovation, perhaps to an R&D team asking for feedback from sales, or from a sales-driven innovation.

While companies recognise the need to collaborate internally, not all of these processes are formalised. One respondent said the flexibility of not having an internal collaboration process enables people to connect in a way that suits them. Other companies found that external collaboration was sometimes easier than internal collaboration. Companies that are very focused on short-term business and day-to-day operations may not have the internal capacity to invest time in a longer-term project.

3.2 External collaboration

The majority of companies were experienced in external collaboration, although a few said they are only just beginning to collaborate externally for innovation, or did not collaborate often. Some companies appear to collaborate externally with great regularity, recognising that they are unable to innovate solely through internal collaboration. Other companies are highly selective about when they choose to collaborate. Naturally this approach requires companies to have internal capabilities to conduct research without an external partner.

Companies will collaborate with research institutions including universities as well as their suppliers and customers. When asked to rate the importance of working with academic bodies or research institutes on innovation, 91 per cent stated it was either essential (36 per cent) or very important (55 per cent).

A key finding that emerged from many of the interviews was that the majority of collaborations with researchers arose out of a company's internally identified need, rather than from an academic approaching a business. Moreover, collaborations were discussed by 80 per cent of the businesses interviewed in terms of collaborative projects, rather than ongoing partnerships. This aligns with the way they discussed managing the innovation process within the business, which appears to be overwhelmingly project-based rather than growing out of a continuing process.

3.3 The importance of relationships

3.3.1 Relationship with university and academics

There are a variety of ways in which relationships between universities and businesses are established. Many appear to be somewhat by chance; someone meets an individual at a conference or a retailer event and starts a conversation about the research being conducted at a particular university.

Building trust and establishing a long-term relationship with a university appeared to be a key concern for companies when discussing how to establish a collaborative relationship. One industry body highlighted the importance of establishing a relationship for collaborative projects to work:

> *"I think once they have these collaborations set up, then it can work quite well. I think lots of companies will go back to the same academics and vice-versa, once they've got some kind of relationship established"*
>
> **Industry Organisation**

This trend of going back to the same academic partner appears to be a common one; almost all respondents that work with universities mentioned returning to the same university. While some respondents felt this is at least in part due to the limited number of institutions with expertise in the UK, others felt it was to do with the way the relationship with universities works.

> *"Most of our communication tends to be because there's relationships...somebody went there, or somebody's worked with them in the past. It's not because we have a good communication system that tells me x or y research institute is up to this or that. There doesn't seem to be a nice forum for finding information, it tends to be experience and personal contacts"*
>
> **Horticultural Producer**

One interviewee stated:

> *"The important thing to say is that we generally don't work with universities, we work with academics, specific academics... you don't go to Oxford University and say that we want to work with you...You identify the academic that's there that can answer your needs"*
>
> **Multinational Manufacturer**

The trend of personal relationships emerged through many interviews. It is important to note that a quarter of the companies which discussed their relationship with universities were discussing their relationship with a specific individual, rather than with the university more broadly.

Many collaboration projects are one-off in nature. But where collaboration appears to be working well, there is often a long-established relationship, with a much higher level of trust. One respondent felt that this idea of a strategic partnership enhances the collaboration because business feels more inclined to share information with their academic partner.

One interviewee who felt they were proficient at working with universities said that it is important to understand that working with a university or an academic is different from working with a business. Understanding what they are good at and can be relied upon to do is important, as managing expectations prevents problems within projects. For example, not all academics are good project managers, so the interviewee said they as the business maintained the project management of a collaboration, and that this created better outcomes.

3.3.2 Knowledge of universities' expertise

Throughout the interview process, companies discussed the universities that they collaborate with in current collaborations as well as their previous work. The chart below includes all the universities mentioned in the interviews and shows how many interviews they each featured in.

Figure 4: Universities mentioned by business
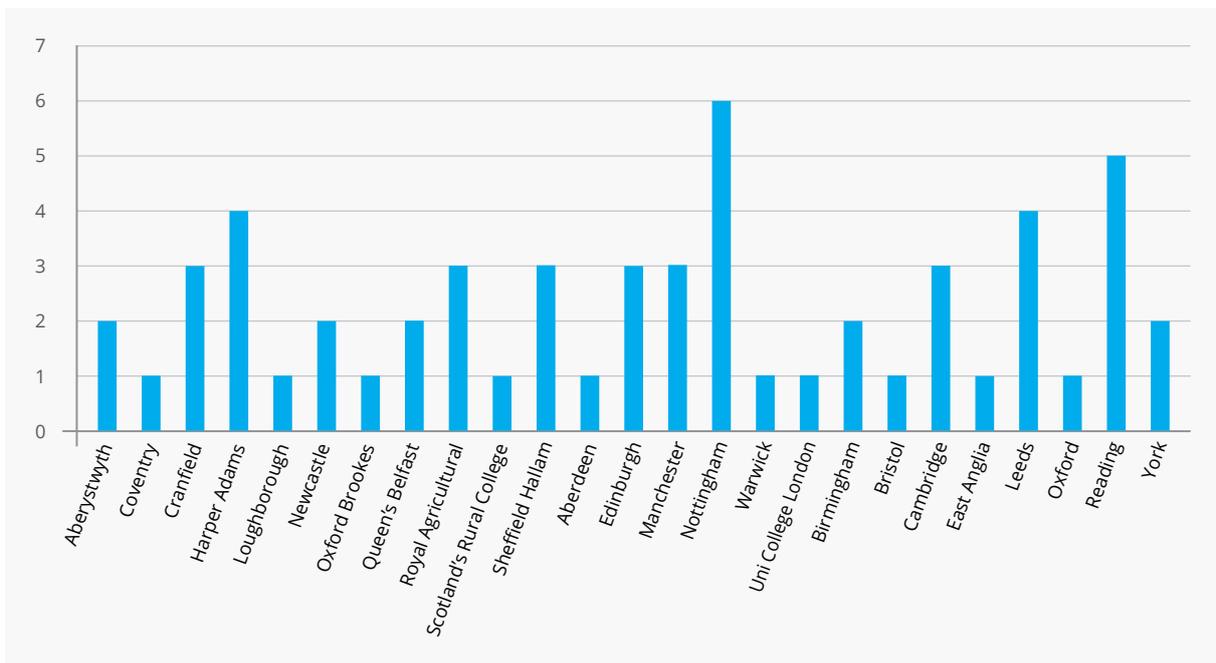
While there were 25 universities mentioned by businesses, 15 were only mentioned by one or two respondents. On average the corporate respondents only mentioned two universities each. This is in line with the fact that a third of the respondents indicated they did not know where to go, or would go back to someone they know already, if they felt the need for an academic partnership. This is partly because they might want to build on an established relationship, but also because they wouldn't know where else to look. Ignorance of which university has specific knowledge, or more specifically which academic at a university has a particular expertise, appears to be a significant barrier which prevents many companies from collaborating with universities on innovation projects.

From the interviews it appears that the more collaborative projects companies do, the better they become at collaborating, and the greater their understanding of academia becomes. This was more apparent with

companies that undertake funded projects with different academic partners. They have had an opportunity to understand where the research of particular institutions is heading, and what can be of value to them. It was apparent that the group of respondents that felt they knew where to go, without the aid of a third party, had invested time in understanding the areas of expertise of specific universities.

"I think we make it our business to know who's doing what ...and we've engaged with the universities that supply the people with skills in this industry from the word go. We fund scholarships, competitions with universities. We try to engage proactively with universities for obvious reasons"

Agricultural Company

This idea of self-interest is important. Companies which have a close relationship with universities feel they are able to benefit from the relationship. In some cases the interviewees discussed the fact that they were able to approach universities with simple questions, had less formal paperwork, and had built up significant trust, from their longer-term relationships with academic partners.

Companies continually stated they would go to the universities considered best for a specific area of research. However, a look at academic rankings according to the Witty review and the Complete University Guide makes it clear that companies do not use traditional measures such as publications to assess which university is the best in a specific field (see appendix 2 for the full table). Only ten of the top 35 Universities listed in the Complete University Guide as being ranked on research in food science were mentioned by respondents (The Complete University Guide, 2014).

Figure 5: Number of times area cited

Name of Research Institution / University	Sir Andrew Witty Review Agri-Science Research Excellence	Sir Andrew Witty Review Agri-tech Research Excellence	Complete University Guide Ranking - Food Science	Complete University Guide Ranking - Agriculture and Forestry
Aberystwyth University	28	30		9
Coventry University		93	9	
Cranfield University	27	26		
Harper Adams University			12	7
Loughborough University	89	65		
Oxford Brookes University	66	56	33	
Queen's University Belfast	30	24	6	5
Royal Agricultural University			32	12
Scotland's Rural College	54	29		
Sheffield Hallam University			20	19
University College London	22	22		
University of Aberdeen	6	4		3

Name of Research Institution / University	Sir Andrew Witty Review Agri-Science Research Excellence	Sir Andrew Witty Review Agri-tech Research Excellence	Complete University Guide Ranking - Food Science	Complete University Guide Ranking - Agriculture and Forestry
University of Birmingham	41	28		
University of Bristol	10	12		
University of Cambridge	4	10		
University of East Anglia	12	7		
University of Edinburgh	3	3		
University of Leeds	7	2	2	
University of Manchester	21	8		
University of Newcastle	18	22	5	2
University of Nottingham	23	34	4	1
University of Oxford	2	14		
University of Reading	11	9	3	6
University of Warwick	34	52		
University of York	16	13		

3.3.3 Location and specialism of an academic partner

Nearly half of the respondents felt that they were not restricted to using a local academic partner, and would go anywhere within the United Kingdom, or indeed overseas where appropriate, if they could find an academic partner with the right skills. This group discussed universities that are known for certain areas of expertise, and the importance of this expertise over location. A number of these respondents discussed the relatively small number of experts in the UK and felt that companies need to be flexible with location. There were exceptions to this; 16 per cent of companies felt that location was very useful in certain collaborative projects. This was generally in projects that involved a work placement, for example a PhD student, as they were better able to remain in contact if they were close by.

One industry body felt that companies liked having a nearby academic partner to help with informal initial discussions, which may turn into full projects. They also discussed the ability to create clusters of expertise, like that of East Anglia for plant breeding. Several plant breeding companies are supported by nearby academic institutions such as the University of Cambridge and the University of East Anglia. Three respondents in favour of these clusters, or Centres for Excellence, mentioned Sheffield Hallam University as an example of a university where students could learn skills required by industry and where academic expertise supports the research needs of industry through tailored solutions.

3.3.4 The role of intermediary / facilitator bodies and research institutes

While two-thirds of companies felt they know where to go to find an academic partner, a fifth achieve this by using a facilitator to establish the relationship. Respondents mentioned the use of a number of intermediaries to help them find an academic partner, including the BBSRC, Knowledge Transfer Networks

(KTNs), Innovate UK, Interface Scotland, and the Food and Drink Federation. This reliance on industry organisations to help broker a relationship demonstrates that even the group that feels it has a good handle on where to go has not come by this information easily. It is notable that the facilitating organisations, as well as other associations, mentioned a number of universities that were not mentioned by any companies; Severn, Herriot-Watt, Imperial College London, and Queen Mary University.

An interview with one of the better known intermediaries discussed their focus on matching a company with the right academic partner to establish a long-term collaboration rather than simply focusing on one specific funded project. This intermediary felt that this focus creates better long-term outcomes.
Over a quarter of companies discussed working with other research bodies including Rothamsted Research, Campden BRI and Leatherhead Food Research. Respondents appear to know how to approach these organisations and in the case of the latter two their companies are often members of the organisations, paying a fee for their services. Moreover, they feel able to contract a piece of work easily with these institutions. However, one respondent did state that if academic rigour were a priority, they would prefer working with a university than with some research institutes or consultants.

3.4 Factors aiding and hindering collaboration

3.4.1 Visibility of universities

One issue raised by multiple respondents was their knowledge of where to look to find an academic partner. Almost a third of the interviewees who discussed this issue felt they do not know who would be the most appropriate academic partner for a specific type of research, or where to go to find them.

"The problem is that you know that there is a university out there that will have the expertise that you need to access but we certainly wouldn't have known which university to approach and short of emailing them all or asking them all one-by-one I don't know how to get the information out."

Large Manufacturer

This lack of visibility is restrictive. One company suggested that without the help of the National Skills Academy they would not have known to contact Newcastle University regarding a specific project and without Newcastle, the project would not have been initiated.

3.4.2 Mismatch of timescales

A number of issues were raised regarding the timescales of business, which is generally focused on the short term, and of universities, which take a longer-term view of research. This was mentioned as being a barrier for nearly a quarter of companies. The real issue is often the parties' relative understanding of urgency, not the actual amount of time needed for a collaborative project. While companies may be willing to invest longer-term in some research, they will also have certain research that may need shorter time frames, and for this, universities were found to move at a slower pace. Companies also worry that in a four-year project, for example, academics will not make a start during the first two years. It therefore appears to be an issue of pace that is hindering these collaborations. Some respondents said they would toss up whether they need external expertise to complete a project before committing to the timeframe of a university-business collaboration.

"You have to be quite careful internally when you decide. Do we need the expertise of a university to be involved in this, and because we need it we're prepared for this project to take a lot longer? Or is this something we're able to do internally using our own resource?"

Large Manufacturer

This point was reiterated by other companies, which said they would work out what they needed project-by-project. For longer-term research, engaging with a university was appropriate, whereas research might be placed elsewhere for contracted short-term pieces.

Over two-thirds of the companies did not feel that timescales were an issue; they understand that the academic rigour that comes with a project conducted through a university takes more time. Several of these respondents actually felt that this longer lag time was better for the innovation as a whole. A project conducted internally may be faster, but may be focused on an outcome that in fact prevents the optimal result being achieved.

Moreover, one respondent said that through building trust with an academic partner, the academic was better able to understand the business needs and delivered on time because they knew what was demanded of them.

3.4.3 Agreeing on the direction and language of research

Language barriers and issues around the types of research conducted by universities were mentioned by a fifth of respondents. One respondent said that language barriers were a form of communication breakdown which occurred where there wasn't a level of trust. Developing a relationship helps to remove this barrier. Another respondent said it could be an issue, but it equally could be avoided by working with academic partners who are not divorced from industry.

A small number of companies felt that academics were conducting research within a collaborative project that was not what they originally requested. On the other hand, there were also companies which felt that once a relationship of trust was established, allowing an academic to explore can sometimes yield positive results. So it was not always negative to have an academic test different areas of an issue. As long as the academic works towards the business need, one respondent felt they could handle some exploration.

3.4.4 Cost of an academic partner

Some companies find the cost of an academic partner to be prohibitive, with a quarter of respondents raising this issue. For a piece of work commissioned by a company, with no Government funding, these firms feel that academia can become too costly if the full overhead cost of the academic partner is applied. This is particularly true where projects are a step removed from commercial viability and a guaranteed outcome.

This point was stressed by larger companies, which add that the situation must be even harder for smaller organisations. However, one intermediary had found the use of innovation vouchers, worth up to £5000, can enable small and medium enterprises (SMEs) to overcome the costs of an academic partner.

One company stated that the cost of an academic partner in the UK had meant that they had sought expertise from the Middle East instead, where costs were lower. Conversely other respondents said they would like to work with universities overseas, but doing so would be more expensive as they would be ineligible for UK Government funding if they use a foreign academic partner. This highlights the importance of funding to help cover the cost of an academic partner.

3.4.5 Intellectual property

The issue of intellectual property (IP) ownership divided opinion among the respondents. 30 per cent of respondents stated that IP created problems for collaboration, 27 per cent stated it was not an issue, 13 per cent said it could be either, and 30 per cent did not raise the issue at all. While many respondents acknowledged that IP can be a hindrance to working collaboratively, not all of this group said that it was restricting their ability to run collaborative innovation projects with academic partners. The companies that did feel that IP issues restrict their willingness and ability to collaborate seemed concerned that universities approach IP from a standpoint that may not be appropriate for the agri-food sector.

However, nearly a third of companies did not appear concerned with the issue of IP. This group often didn't believe that the projects they were working on were in fact generating worthwhile IP. Some made the point that IP in food was very difficult to gain. There are too many different ways of achieving any given outcome. Moreover many stated that the innovations undertaken in certain collaborative projects are not about intellectual property. The translation of the project outcome into some form of competitive advantage is what sets competitors apart, rather than the innovation itself.

04. Funding

Almost all of the companies interviewed discussed one or more types of Government funding. The current funding structures for innovation raised divided opinion from these interviewees, with 40% of respondents pleased with funding processes and 40% unhappy. Of those that are happy with the process, some received an automatic allocation of public funds from the UK and EU Governments, so the process is relatively straightforward for them.

While one might assume that the larger companies are less concerned with funding than smaller companies, this is not necessarily the case. One of the businesses interviewed was a global food company that highlighted its struggles with the structure and type of funding available. The interviewee criticised the current funding structures' focus on agriculture to the detriment of manufacturing, and discussed the need to look at funding in other industries such as high-value manufacturing to see how to better serve the food manufacturing sector. Another respondent from a horticultural producer summarised two of the issues people raised:

> *"It's not the access to the money, the money's there. It exists. It's actually getting hold of it. Writing the papers for applications, using the terminology that they want to hear"*
> **Horticultural Producer**

The difficulties of the application process were raised by nearly a quarter of respondents. These respondents feel the process is very onerous, and while they understand the need for due diligence on the part of the funders, they believe it could be streamlined. The process around the grants was also criticised. One major retailer suggested that there is a disconnect between the funding that is available and the companies that are able to access it. This respondent was especially critical of the Agri-tech strategy.

A third of respondents found the Innovate UK funding mechanism to be relatively straightforward. They stated that it had a better structure than other forms of funding, and created positive projects that had improved innovation for the sector in broad terms. One company stated that if you can justify it internally, it should not be overly difficult to justify it to the funding board.

4.1 Funding competitions

> *"Some of the companies that are really innovative are really small and they're not going to apply for that funding because they don't have the resources to set up the grant, then manage it"*
> **Large Retailer**

Some respondents felt that the competitions that are currently available do not suit their business needs, and as a result companies find it difficult to obtain funding from them. While the majority of companies had received some funding via competitions, the issue of inappropriateness was raised widely in connection with them. The most common issues were:

- Complex administration

- Inappropriateness of funding competitions, particularly regarding what is being funded

- Timescales for project funding

- Financial contribution expected of the company

One interviewee summed up what many were feeling: that there are multiple different funding options available that have a large amount of overlap. These funding schemes often do not fit what companies want to fund. One issue is that the calls can be highly specific. When you do find a competition that is appropriate you may have waited too long (sometimes 2 -3 years), and the planned project may no longer be relevant. Some companies rely on their academic partner to navigate the available funding, as they feel that academics are better at it, and have greater knowledge of what is available. A respondent who helps allocate funding for one scheme said that projects with academic partners often have better success because the partner knows what to do.

Companies who are more aware of the funding available, and feel comfortable applying for funding, appear to take the time to understand the process, and often mentioned working with trade bodies, BBSRC clubs and the like. These interviewees found that money that came from levies paid to a trade body or research club funded projects that were better aligned with industry needs than general government funding, as industry decides what gets funded through these mechanisms.

4.1.1 Agri-tech strategy

There were a variety of concerns over the focus of the Agri-tech strategy, with over a quarter of the respondents criticising the funding, administrative process and focus of the strategy. The largest concern was focused on the strategy's goals and structure: 17 per cent of respondents criticised the focus on agriculture and farming and on larger companies. They feel that this structure will potentially misplace the funds, as the focus is not on the end consumer. For example, it might encourage a farmer-friendly approach to yields in research on wheat. This would take funding away from broader benefits for consumers such as health and nutrition, which might be achieved by work on wheat with low Glycaemic Index or increased vitamin D. These companies would prefer an Agri-food strategy that includes research beyond the farm gate as well as on the farm.

Only two respondents were enthusiasts for the strategy. They stated the increased funding for agriculture had opened up projects that were previously unavailable to them and accelerated innovation in the industry.

05. Supply Chain Collaboration

The fragmented structure of the food economy has been seen as a barrier to successful innovation that involves collaboration along the entire supply chain.

Almost half the respondents highlighted the need to work across the supply chain on collaboration projects to tackle some of the system-wide issues. This group discussed the need to work with suppliers and customers, as well as competitors in certain circumstances. Some of the largest companies interviewed for this report were the ones most interested in collaborating with competitors and along the supply chain.

> *"Quite often…the innovation takes part in one part of the value chain and the benefit is in another part of the value chain. So unless you're a vertically integrated business…you're not going to innovate, are you?"*
>
> **Large retailer**

While many companies highlighted the importance of supply chain collaboration, they also indicated that it is not currently the norm within industry. There appears to be a lack of connection and collaboration between different parts of the supply chain. One reason for this, highlighted by a major retailer, is that an innovation may only benefit part of the supply chain.

But there are cases of successful collaboration along the supply chain. One manufacturing company was able to ensure the best quality wheat for its products by working with farmers and plant breeders, and paying them a premium for supplying the product that best suits its needs. This created value along the food chain and shifted the innovation emphasis from yield to quality.

While companies indicated that collaboration does occur at points along the supply chain, there is a lack of overall connection which involves all parties along a supply chain working together. In the example above, plant breeders may work with an agricultural grower on varieties that will increase yield for that grower. But a lack of collaboration with the manufacturer and retailer may mean they are not focusing on the characteristics required to produce the optimal product for the end consumer.

The need to have these different sectors joined up was highlighted by one retail company, which pointed out that insight into the market lies with the retailer, but 70 per cent of the value of the supply chain lies in agriculture. Without joining these ends together, as well as the middle section of the chain, there is scope for value to go missing along the supply chain.

Within the discussion of supply chain collaboration, respondents raised two major issues; precompetitive collaboration, and the role of retail companies.

5.1 Precompetitive collaboration

Precompetitive collaboration is becoming an increasingly important topic as companies understand that there are issues, particularly in the food industry, that one company alone cannot tackle. Interviewees indicated a variety of issues that they believe require collaboration with competitors, other companies along the supply chain, and research institutions. Some issues need to be tackled from a systems or supply chain perspective, particularly where the impact of an innovation is felt at a different part of the supply chain from its origin.

Amongst the survey responses, the most commonly reported such issues were disease control and resistance to herbicides, along with environmental issues. Companies believe that these impact all

competitors and are too big for any one company to tackle alone, even with an appropriate academic partner. Companies also recognise that benefits from solving certain sustainability issues are shared by all, and therefore there is a decreased risk of a collaborative project benefiting only one of the project partners.

5.2 The role of retailers

The role of the retailer in supply chain collaboration was discussed by multiple respondents. A variety of respondents felt that the retailers need to be involved in collaborations because of their access to and knowledge of consumers, as well as their purchasing power. One horticultural company interviewed discussed how the very short supply chain for their business means that the key relationship is between the grower and their customer, with inputs from services like packaging. Given this short supply chain, they work very closely with the retailers, making them an important partner. A good interpretation of the evidence is that retailers have a role in enabling collaborations and innovations all along the supply chain.

Retailers are important enough to impact innovations within companies supplying to them. A supplier to one of the large UK retailers stated that they carry out innovation in areas discussed with that customer. This is done through joint business plans and by adopting the same process management techniques that the retailer uses. It is made clear to the supplier that it is unable to innovate without approval from the customer.

Three major retailers were interviewed for this report. They all stated that they are collaborating with academic institutions and also suppliers. One of these retailers made the point that the company does not own much of their supply chain. So for innovation to come through their doors, it will normally originate with a supplier. The retailer therefore feels that while it is the supplier's role to innovate, the retailer has scope to support suppliers where it feels the innovation will have a positive impact, and help facilitate collaboration between suppliers and academic partners. Moreover this respondent said that while it was important for universities to speak to the retail companies, the process is not so effective without engaging the manufacturers.

06. Recommendations

The individuals interviewed were asked to put forward recommendations for NCUB and the taskforce that in their opinion would help to improve the state of collaboration and innovation in the sector. Respondents gave one or more responses to this question, which have been categorised into nine key areas, seen in the chart below. These broad categories represent a variety of initiatives as well as areas for improvement, and are discussed in greater detail below.

Figure 6: Suggested areas of recommendation for government intervention
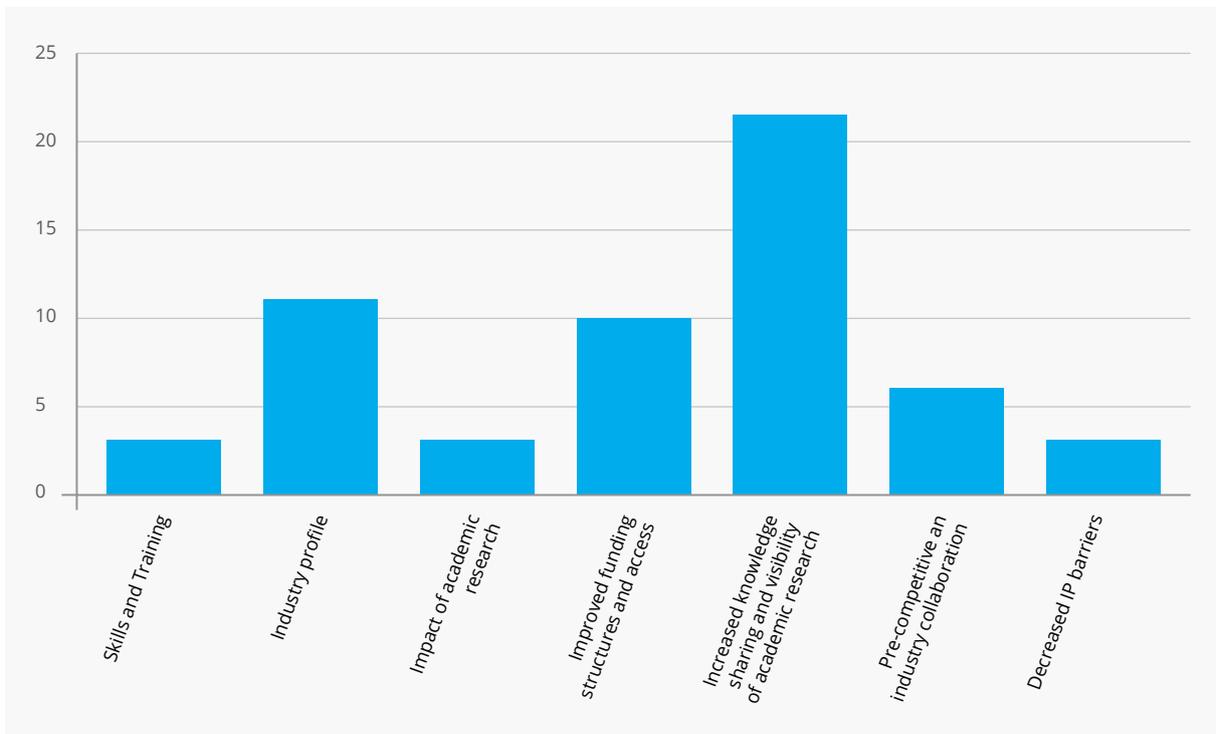
6.1 Increased knowledge sharing and higher visibility for academic research

By far the most frequently suggested category of recommendation was some form of increased knowledge sharing and networking. Multiple respondents discussed options to increase collaboration through getting to know both who and what is out there in terms of research. Many companies are currently relying on some form of networking to meet academic partners, and feel that increasing the channels through which they are able to network will benefit the food industry as a whole. Coming back to the issue of academic visibility, companies want to be able to find academic partners, and if possible to see what research is currently being conducted.

The suggestion of a website or online portal where companies can search for key topics of expertise and see who is associated with them was raised by multiple respondents, as was access to samples of research. They feel that current suggestions like looking at academic journals or searching LinkedIn are far too time consuming and fragmented. A dedicated website where they are able to access information was felt to be a far better option.

Another recommendation to do with knowledge-sharing involved the use of intermediaries as a broker for relationships. A number of respondents suggested expanding on what is currently offered. They feel having a one-stop-shop where companies can go with an issue and have the appropriate academic partner sought for them would save time and effort.

As previously mentioned, one major concern for multiple respondents was the issue of understanding which universities and specific academics are experts that could be useful for a collaborative project. Companies feel ill-equipped to find out where areas of expertise are located. Some respondents have suggested that work be done on improving the visibility of universities, academics, and their research and areas of expertise.

Suggestions include:

- Online spaces where universities and business alike can discuss what they're working on

- Emphasis on funding Centres for Excellence, including increased visibility so companies know where to go

- Forums and industry-wide trade shows and conferences where companies could meet universities and vice versa

In an interview with an industry body, the issue of universities not being fully aware of what industry wants was also raised. The respondent felt that universities were unable to see where their research might be applied or directed because they too do not have the level of awareness of what is occurring within industry.

6.2 Industry profile

A key issue for many respondents was the profile of the food industry in the UK. Many interviewees felt that the food economy, as the single largest manufacturing sector, does not have an appropriate profile amongst academics, Government and the broader economy. Without having an appropriate understanding of the industry, respondents have questioned the ability of academics, as well as Government, to truly understand what the industry needs. They may only be aware of issues in a very small section of the industry. One interviewee felt that if the profile of the industry is raised to an appropriate level in a unified way, Government may be better able to create strategies that the industry as a whole is able to respond to, fund them appropriately, and through more targeted actions see better outcomes.

One respondent believes that segmentation in the industry has meant that separate sectors such as agriculture, manufacturing, processing, support and inputs and retail all speak to government separately, and consequently there is no powerful unified voice representing the food sector as a whole. They suggested creating a single confederation that includes interest groups such as the National Farmers' Union (NFU), the Food and Drink Federation (FDF) Horticultural Development Council (HDC) and Agricultural Industries Confederation (AIC) with the purpose of strengthening each sector's position by having a stronger industry body. This would strengthen the industry's profile, create a vision for the industry and enable it to speak to Government from a position of greater strength.

More broadly, issues relating to the understanding of the industry focused on the language used when communicating with agri-food businesses. More than one respondent felt that the way the Government speaks to food companies is more appropriate for industries like pharmaceuticals and other manufacturing sectors. This language barrier, as previously mentioned in section 3.4.3, can restrict innovation in the sector. For example, the approach from funding bodies may not be appropriate for projects that involve farming and food if they are approached in the same way they would be for the pharmaceutical industry.

A number of respondents offered recommendations to attract more talent into the sector. 10 per cent of companies feel a lack of talent hinders innovation. Too few of the best graduates chose to enter the food sector.

Companies recommended:

- Ensuring undergraduate students learn practical, applicable science

- Raising the awareness of the sector in schools and universities to encourage the best talent into the industry

- Changing current BBSRC funding for PhDs being restricted to UK students only

6.3 Impact of academic research

Three respondents discussed the need to ensure that academics are researching areas that are relevant to business. While a small number of respondents were aware that 20% of the funding allocated to research through the Research Excellence Framework (REF) is based on the impact of research, many others were not. Even within the group that were aware of the funding rules, many thought 20% was not enough, or that it wasn't having an impact on industry. These respondents still feel that academics are not focused on researching topics that are commercially viable.

Some companies feel that they've been approached by universities to sign off on projects solely so that this funding stipulation can be met. For these reasons this group of recommendations centres on improving how this impact is assessed, and suggests more broadly that the issue of university funding be revisited in order that more impact is felt.

6.4 Improved funding structures

One of the most commonly-recommended actions by the interviewees was to improve the way funding is structured in order to make it more accessible. A third of respondents felt that there were significant barriers to funding that need to be addressed.

As previously mentioned, the barriers include:

- Lack of understanding. Some respondents felt that the people judging the submissions did not understand the technical details of the proposals they had put forward.

- Difficult and complex process. A number of respondents, even those that have successfully bid for funding, felt that the complexity of the funding process is a significant barrier.

- Restrictive competitions. Many respondents felt that the funding competitions are very focused towards certain areas of industry. For example, the manufacturing companies we spoke to felt that there was a large focus on agriculture, and not enough funding available that they are able to access. Moreover one respondent felt that the competitions were restrictive and do not provide unrestricted funding when it is needed. Companies are unable to wait two to three years for the right competition to come along.

Respondents feel that funding structures need to be more flexible in terms of the types of projects funded, especially via funding competitions, and that competitions need to be more thoughtfully timed. There was also a call for better administrative processes, streamlined and run by people who understand the science. People want to have a person to go to if they need to discuss their tender. Some feel that the system is faceless and there is no point of contact to ensure that the application is progressing as it should. Decision-makers should be expert in the food industry, speak its language and understand the science.

6.5 Pre-competitive and industry collaboration

A fifth of respondents felt the need to increase collaboration around precompetitive innovation, as well as increasing supply chain collaboration more broadly. They want government strategies to be focused on creating the right structures to support precompetitive collaboration which can tackle big issues for the agri-food sector. Moreover, they feel that the entire supply chain needs help if it is to work together to optimise innovation.

6.6 Skills and training

For a small number of respondents, the problem with innovation in the sector is related to a lack of training and education, both internally within their organisations, and externally with their customers. A lack of internal training also appears to hinder innovation projects for some companies. For example, employees may have ideas worth exploring, but a lack of project management expertise prevents them from translating their ideas into a meaningful project. Project management training may help companies with this problem to get innovative projects started.

Another concern raised by respondents was to do with the skills base of their customers, especially in agriculture. The fear was that they might lack the IT skills needed to use products designed to assist with farming. Increased skills training for farmers, available at local hubs, would help to upskill them and increase farm efficiency.

6.7 Decreased IP barriers

A tenth of recommendations were concerned with lowering the barriers that IP creates around projects. Companies that are concerned with this issue believe that there is a need to improve the understanding of what can be considered IP in an agri-food innovation project. They also suggested improvements to make IP easier to navigate in collaborative projects more generally.

07. Universities' Perspective

A focus group was held with 15 academics from universities, research institutes and organisations representing industry on October 2, 2014 to gain their opinion on the research findings from industry. This was also an opportunity to understand university-business collaborations from the perspective of the research organisations working in the agri-food sector.

Three topics arising from the business interview findings were highlighted to drive discussion from the academic perspective. These topics were:

1. **Visibility; industry reported that universities' areas of expertise were generally hard to discover**

2. **Timeframes**

3. **Interdisciplinary research and rewards**

7.1 Visibility

The industry interviews overwhelmingly asked for universities to improve their visibility. The focus group participants were prompted to respond to this challenge. A number of universities stated that they want to increase their visibility and suggested approaches to doing so.

Some universities are already raising their profile with industry through dedicated staff whose jobs are focused on increasing the relationships between the university and business, or through actively promoting their university's profile. More broadly, the focus group felt that some process or system needs to be put in place to point industry in the direction of universities with relevant expertise. It was suggested that that this would need to be more sophisticated than an online database. One suggestion for increasing visibility for collaboration was the use of a brokerage system. The one now run by Interface Scotland could be extended across the UK and managed by regional agencies. Another suggestion was a form of skills audit, making the skills of academics in the sector more visible, signposting where the experts are, displaying the subjects they cover and providing a point of contact.

University representatives made the point that brokerage was preferable to making details of the competitive research they are conducting public. This risks reducing academics' own competitiveness. Some focus group members felt it is important for industry to understand that universities are businesses in competition with each other. They also want industry to understand that while some may assume that universities' primary role is to engage with business, this is not the case for the whole of academia.

The focus group further pointed out that there is too much emphasis on the university 'brand.' For example, a university may attract business solely on the basis of its position as a Russell Group institution, rather than through its expertise. The group felt that there should be more emphasis on individual experts. There is also room for businesses to break down their stereotypes about universities and broaden their understanding of the wide range of universities and research organisations in the UK. A particular business may well be unaware of institutions with expertise of value for its industry.

The focus group highlighted three key points:

- Universities will approach business with ideas and proposals, and not just wait to be contacted. A university will generally try to approach businesses that they think are most likely to be interested in their work. This could be made easier if businesses were open about what they are currently interested in and what they believe they will need in five years' time.

- Universities run events that showcase their key activities, and businesses are invited.

- Knowledge Transfer Networks (KTNs) are a good way to promote universities' expertise, and both universities and business should make more use of the opportunities they provide. This is also true of the BBSRC sponsored industry clubs.

7.2 Timeframes

One key concern for business has been the delays that occur during the initial phases of a collaboration, such as those due to contract negotiations. While industry may assume that the problem stems from the university side of the collaboration, the focus group felt that it can also develop from the companies' side, as their objectives and staff are constantly changing. It was noted that 'master service agreements' can take up to 12 months to set up because of negotiations between the two sides. Unfortunately, the focus group did not feel able to suggest ways to cure this problem. The Lambert Agreements (model contracts for university/industry collaboration) were raised as part of the solution. Universities also agreed that the scoping and costing phases of project definition could be problematic, but felt that they are used to handling these issues on a day-to-day basis. Moreover, in connection with the issue of speed, one university ventured that it is actively encouraging academics to disseminate information as quickly as possible to progress collaborative projects.

There was a general acceptance by the focus group that industry lacks an understanding of the business model of universities, while academics feel that industry see academic institutions as a body there to serve industry by solving a problem cheaply and quickly. Universities feel industry needs to understand that they are not going to enter into a collaboration that will cost them money. They need to see mutual benefits rather than one-sided benefits in favour of industry. This can restrict work with organisations such as SMEs where universities are unsure of the benefit they may receive, especially given the time invested in establishing even a small project. Some universities are creating structures that support collaboration with business with a view of decreasing these barriers.

While industry sees academia's role as engaging in contracted pieces of research, the academic institutions represented in the focus group stated this is not a university's main function. Academics feel more able to solve problems and work with industry when they have an ongoing relationship rather than individual contracted pieces of work. Academic resources tend to be deployed to ongoing fundamental research, and these resources cannot be redeployed to a contracted piece of research at a moment's notice. The focus group highlighted how crucial staff capacity in universities was to all of this.

Points that were noted were:

- There are shortages of food economy-relevant PhD students and postdoctoral researchers in the UK

- It was suggested that either government or business should support fellowship schemes to keep postdoctoral in the UK

- Industry often fails to give the right messages, by suggesting that qualifications such as PhDs are not needed to succeed in the sector. This undervalues those who undertake further study, and discourages the take-up of research.

Universities are much more likely to collaborate if it is likely that a longer-term relationship, with potential for follow-on funding, will be built. Experience suggests that these are likely to be the most productive relationships. Unfortunately, academics feel that even bigger corporations don't always develop these relationships. One key factor which is crucial to the success of these longer-term relationships is consistency in their management on both sides.

One other concern regarding timeframes around collaboration is continuity of funding, both from business partners and from government. A number of funds were mentioned in a positive light, including the BBSRC Advanced Training Partnerships and the Innovate UK Innovation Platform. But the fact that they all had expiry dates creates uncertainty over longer-term funding opportunities and forces universities to be risk-

averse. Recent moves to broaden the remit of the Agri-tech strategy so that it covers research beyond the farm gate was viewed in principle as a good thing, but the downside again was that the changes could also create uncertainty over what would be supported in the future. Without certainty of funding it is not possible for universities to keep a cadre of postdoctoral researchers employed. Part of the delay at the start of a project will be due to the need to recruit for it.

7.3 Interdisciplinary research and collaboration

There was divided opinion on the need to enhance interdisciplinary research. One group stated that in contrast to five years ago, when there was a clear need for increased interdisciplinarity, universities have improved the structures that enable them to work in an interdisciplinary way with business, and that they increasingly work on broader "grand challenges". This also helps to dispel the myth of what one university referred to as 'silo-based responses' to industry questions. However, the group acknowledged that if business still feels this is a problem, then they need to market their interdisciplinary research better. Moreover some group members felt that universities need to be able to demonstrate the cost-benefit analysis of a collaborative project so that businesses can better judge the benefits of collaboration.

Another group acknowledged that a barrier to interdisciplinary collaboration is where to publish the research. Some of the highest-impact journals will not accept this type of research, causing it to become unattractive to academics. Papers in certain journals are considered better, so there is a funding issue attached to the rating. If an academic's most highly cited papers appear in a lower impact journal it can be hard for it to be recognised. The way that research is funded through research councils, often via single-discipline panels, can also be a significant barrier to more interdisciplinary working. This was raised by some group members as a greater barrier than where to publish interdisciplinary research.

The focus group mentioned a further key area where interdisciplinary research needs improvement in universities; offering students interdisciplinary education so that they are able to learn how their area of expertise may be applied in other disciplines.

Members of the focus group were also concerned with the focus that businesses in the interviews had on product innovation rather than process innovation. Some focus group members believe there is work to be done on innovation in big-picture issues such as land use practices. These issues require a multifaceted approach to collaboration.

7.4 Intellectual property and funding concerns

One key concern for universities is the way in which industry uses PhDs as a way of contracting out research while retaining IP ownership. The round tables felt that industry expects a funded PhD to be a technician that they can approach with any issue at all times. They don't appreciate that the individual needs academic mobility and has academic requirements to adhere to.

The issue of IP was raised in another regard too. Some of the academics at the focus group felt that the primary use of IP is in creating mutually beneficial partnerships, helping to drive productive interactions, rather than protecting information. This suggests an approach to collaboration with business more akin to the way academic-to-academic partnerships are undertaken, with a greater focus on mutually beneficial outcomes rather than on who owns what part of a collaboration.

The security of funding and the quantum of funding are important factors for universities when they are taking decisions about how, and who, they work with. In many cases it does not make sense to work with SMEs because the amount of funding is too small to make it worthwhile, the administrative burden of supporting this type of activity is disproportionate, and there is less likelihood of follow-on activities. So work with SMEs risks being a short term distraction. This is not to say that academics do not work with SMEs. Some mentioned work with SMEs and the funding that is available for it. But the focus group suggested that junior academics, such as postdoctoral researchers, are more likely to engage with SMEs as they begin to build their careers, as opposed to academics with a long-established record.

8. Appendices

8.1 Appendix 1. Methodology

8.1.1 Data collection

This report is based on primary research collected through interviews with senior industry figures including innovation managers, technical directors and managing directors of companies along the supply chain. Members of the Food Economy Taskforce's Science and Translation Work Stream were asked to provide a list of contacts from industry, which NCUB compiled into a single document. An email was then sent to 70 contacts, with a maximum of two contacts per company, requesting an hour of their time between August 1 and September 10, 2014 for an interview. 30 responses were received from 26 companies willing to participate in the interviews within the allocated time frame. Interviews were conducted with these individuals, who represented a broad range of the food economy, including agricultural and horticultural producers, support and input industries, manufacturing and processing companies, retail, and industry bodies.

The companies interviewed varied in size from small agricultural support companies to large multi-national branded manufacturers. The majority were medium to large sized companies. As can be seen from the chart below, the majority of the companies surveyed were privately owned, which was a common finding independent of the company size.

Figure 7: Ownership structure of companies surveyed
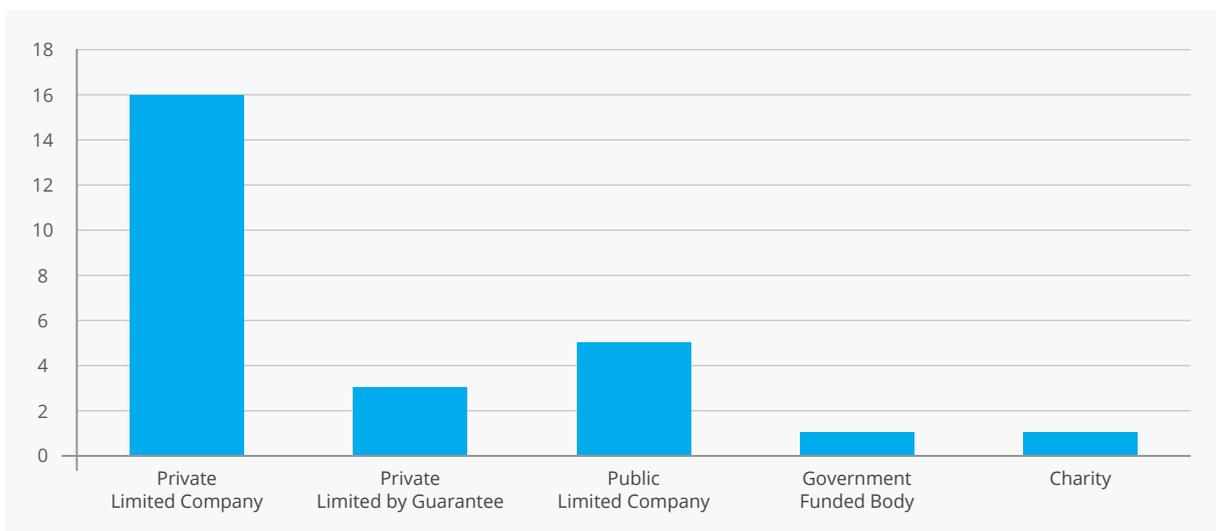
The interviewees' responses were coded for input into the survey findings (Auerbach & Silverstein, 2003).

8.1.2 Limitations of research

While we have managed to get a broad range of views, we acknowledge that the sample of companies underrepresents certain areas of the agri-food industry. For example, we did not have a chance to interview any livestock producers. Moreover the respondents' companies are overwhelmingly large in size. With a few exceptions, SMEs are not represented in the study. These factors naturally affect some of the findings, such as which universities are mentioned by respondents, as well as what are considered to be the primary drivers and barriers to innovation.

The timeframe allocated to conduct the research has further impacted the findings. More time would have enabled further interviews to have been conducted with a broader range of companies.

8.2 Appendix 2. Interview questions

The following appendix details the interview questions, including the project background, used for each structured interview with industry.

Background to the Project

NCUB is a body created to encourage universities and business to work together, to share ideas, to collaborate and to create prosperity.

The UK government has started to recognise the economic importance of the agri-food industry for the UK. It has noted the food and drinks industry's positive impact on jobs and wealth creation as well as becoming alert to the wider issues of traceability and authenticity across the UK and internationally.

The NCUB have established a Task Force to develop a number of key recommendations to determine how universities, business, schools and government can work together more effectively to benefit the UKs agriculture sector.

A key question for NCUB is how can the UK integrate collaboration between businesses, higher education and other research institutions to develop a more competitive and sustainable UK agriculture food sector?

There are three work streams of the Task Force;

1. Developing the right graduate and research talent - now and for the future

2. Science and translation and the race to the top in global innovation

3. How to optimise the use of land, resources, and pull through into innovation

We are interested here in the Science and Translation work stream.

We have two phases of work consisting of:

Phase 1: Identifying how we can translate the strengths of the agri-food industry and its research into an economic and social benefit for UK society

To be addressed with the industry survey.

Phase 2: Understanding where the gaps are in the UK knowledge and expertise and optimising existing research to ensure long term competitiveness.

The work stream will develop and utilise the collection of case studies and 'easy wins' to address this.

Background to the Survey

We are interviewing about 30 senior experts across industry, who can provide insight into the subject of innovation.

The interviews will be conducted in person, they will be about one hour long and they are confidential. There will be a summary document written up once the surveys are complete and published in a final report in November. We will send you a copy of this report and no individual or business will be identified.

Questions:

Defining Innovation

How do you define Innovation in your business? Is it about new products, improving processes or something else? Is this your definition or is there one used across your business in a standardized way?

Prompts

How and why is Innovation important in your business?
How has this changed over time?

The Innovation Process

How do you manage the innovation process in your business?

Prompts

How do you prioritise areas for development?
How do you incentivise innovation activity?
Is the innovation process formalized?
Do you attend regular innovation meetings?
How long does it take to move an idea through the process?

Innovation Trends

What drives Innovation in your business? How do you rate the importance of regulation and incentives or competition and market forces?

Prompts

Competition growth, regulation, value, provenance, shelf life, packaging, healthy, etc. and how do they affect innovation?
What are the main barriers to successful innovation in your business?
Do you have experience with implementing reactive innovation as a result of disruptive events?

Measuring Success

How do you measure the success of Innovation?

Prompts

Is it in terms of sales/markets, profit or something else?
What are the examples of successful innovation in your business e.g. ingredients, packaging, process, machinery, sustainability, ethics / social, supply chain, waste? How did you create and discover this/ what were the reasons for success?
Do you use any benchmarking?
How do you rate your innovative activities?

The Importance of Collaboration

How important is internal collaboration for innovation in your business?

Prompts

Cross department/function
Cross organization
Cross geography/location
Is colocation an important enabler of internal collaboration?

Do you bring outside parties like suppliers, research institutions or other experts into your process on a regular basis?

Prompts

Have you any experience of working with higher education bodies in this area? How do you link with research bodies?
Is colocation an important enabler of external collaboration?

How do you rate collaboration in your business? How important is working with academic bodies or research institutes?

Prompts

Are you aware that 20% of university funding is dependent on demonstrating research impact?
What could be done in your view to encourage more collaboration in your sector? How?

Funding Innovation

Have you looked to secure external funding? Do you know what the options are and have you had any success here?

Prompts

If you were to prioritise government intervention in innovation, what methods other than increased funding would you recommend?

Thank you for taking the time and are there any other points you think are relevant?

8.3 Appendix 3. Full university ranking tables

The table below includes the full ranking of universities and research institutions mentioned in either the Witty review, as an institution for research excellence in agri-tech or agri-science, or as one of the Complete University Guide's top-ranked universities for food science or agriculture and forestry. While these rankings are only two of many approaches to envisaging academic research, and have been produced for specific purposes, they act as a proxy for understanding which universities are considered the best for research in this field of knowledge. Note that as the name suggests, the Complete University Guide does not cover research establishments outside the higher education sector.

Name of Research Institution / University	Sir Andrew Witty Review Agri-Science Research Excellence	Sir Andrew Witty Review Agri-tech Research Excellence	Complete University Guide Ranking - Food Science	Complete University Guide Ranking - Agriculture and Forestry
ADAS	58	37		
Anglia Ruskin University		91		
Aston University		87		
Bath Spa University			24	
Bournemouth University	59	62	30	
British Antarctic Survey	36	36		
British Geological Survey	49	48		
Brunel University	86	72		
Cardiff Metropolitan University			29	
Cardiff University	35	61		
Central Science Laboratory York	87	95		
Centre for Ecology and Hydrology	1	1		
Centre for the Environment Fisheries and Aquaculture Science	61	98		
Coventry University		93	9	
Cranfield University	27	26		
Dunstaffnage Marine Laboratory	57	55		
Environment Agency	63	49		
European Centre for Medium-Range Weather Forecasts	79	46		
Fisheries Research Services	93	73		
Forest Research	48	41		
Glyndwr University				17
Harper Adams University			12	7
Health Protection Agency London		81		
Heriot-Watt University	78			

Imperial College London	8	17		
Institute of Food Research	71			
John Innes Centre	47			
Keele University		83		
King's College London	44	43	1	
Kingston University	92	59	34	
Lancaster University	13	5		
Leeds Metropolitan University			17	
Leeds Trinity University			26	
Liverpool John Moores University	67		15	
London Metropolitan University	99	98	21	
London School of Economics	82	89		
London School of Hygiene and Tropical Medicine	25			
London South Bank University			36	
Loughborough University	89	65		
Macaulay Institute	19	13		
Manchester Metropolitan University	50	32	22	
Marine Biological Association	76	94		
Met Office	40	23		
Northumbria University	100	85	10	
Nottingham Trent University	95			18
Open University Milton Keynes	38	35		
Oxford Brookes University	66	56	33	
Plymouth Marine Laboratory	42	54		
Proudman Oceanographic Laboratory		82		
Queen Mary, University of London	39	40	19	
Queen's University Belfast	30	24	6	5
Robert Gordon University			11	
Rothamsted Research	5	6		
Royal Agricultural University			32	12
Royal Botanic Garden Edinburgh	60	71		
Royal Botanic Gardens, Kew	31			
Royal Holloway University of London	56	51		

Rutherford Appleton Laboratory		78		
Scottish Agricultural College	54	29		
Scottish Crop Research Institute	37	42		
Sheffield Hallam University			20	19
St Mary's University			31	
Syngenta	73			
The Lodge RSPB	33	19		
The Natural History Museum, London	32	39		
Unilever	96	70		
University College London	22	22		
University of Aberdeen	6	4		3
University of Abertay Dundee	72	67		
University of Bath	70	77		
University of Birmingham	41	28		
University of Bradford	85	76		
University of Brighton	94	92		
University of Bristol	10	12		
University of Cambridge	4	10		
University of Central Lancashire	98		27	11
University of Chester		100	16	
University of Cumbria				20
University of Dundee	55	57		
University of Durham	24	18		
University of East Anglia	12	7		
University of East London		84		
University of Edinburgh	3	3		
University of Essex	64	66		
University of Exeter	20	21		
University of Glamorgan		90		
University of Glasgow	43	45		4
University of Gloucestershire	90	64		
University of Greenwich	65		13	13
University of Hertfordshire		69	18	
University of Huddersfield			23	
University of Hull	62	63		

University of Kent	69	60		
University of Leeds	7	2	2	
University of Leicester	46	33		
University of Lincoln	53	50	25	8
University of Liverpool	14	38		
University of London	91	88		
University of Manchester	21	8		
University of Newcastle upon Tyne	18	22	5	2
University of Northampton	81			
University of Nottingham	23	34	4	1
University of Oxford	2	14		
University of Plymouth	26	27	14	15
University of Portsmouth	75	75		
University of Reading	11	9	3	6
University of Roehampton			35	
University of Salford	84	79		
University of Sheffield	9	15		
University of Southampton	17	25		
University of St. Andrews	45	53		
University of Stirling	29	31		
University of Strathclyde	77	74		
University of Surrey	80	68	7	
University of Sussex	51	49		
University of the Highlands and Islands				16
University of the West of England	88	99		10
University of Ulster	74	58	8	
University of Wales Aberystwyth	28	30		9
University of Wales Bangor	15	16		14
University of Wales Swansea	52	44		
University of Warwick	34	52		
University of Westminster		86	28	
University of Wolverhampton	83	80		
University of York	16	13		
Wellcome Research Laboratories	97			
Zoological Society of London Institute of Zoology	68	97		

09. Bibliography

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1   According to The Complete University Guide's website, their ranking of institutions is based on research conducted by the Research Councils in 2008. The Witty review's methodology can be found in the final report and recommendations available here: www.gov.uk/government/uploads/system/uploads/attachment_data/file/249720/bis-13-1241-encouraging-a-british-invention-revolution-andrew-witty-review-R1.pdf