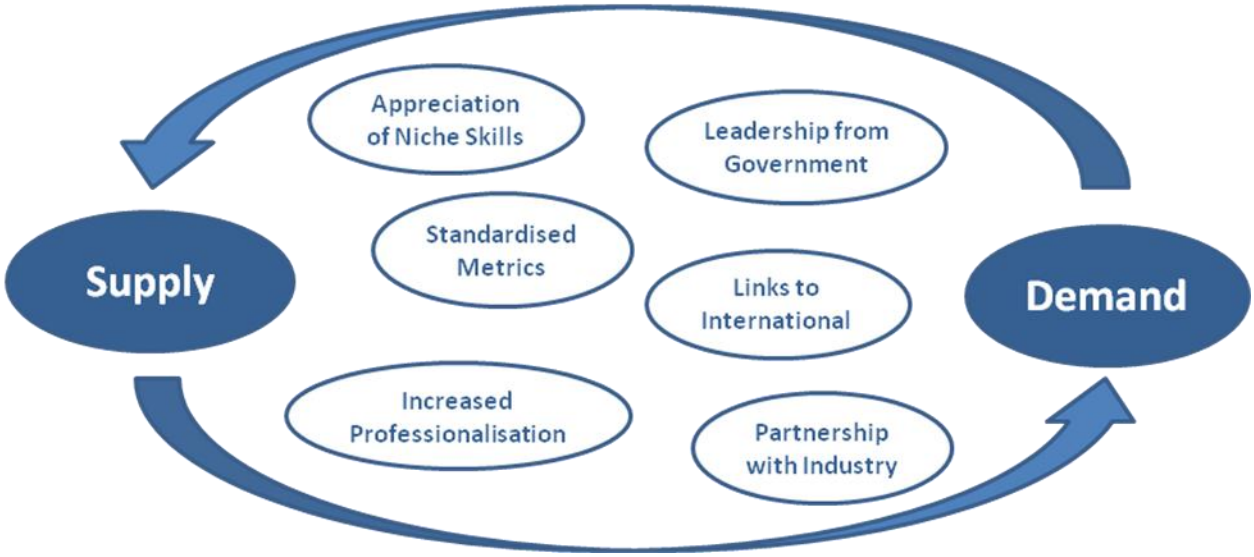


High-level Skills for Food

Report from the Food Research Partnership Skills Sub-Group

January 2010





FORWARD

Achieving the Government's vision for a sustainable, secure food system will require an adequate supply of highly skilled people: to provide the research to support effective, joined-up policies; to develop and disseminate new knowledge and technologies; and to exploit the opportunities for innovation.

The Food Research Partnership skills sub-group has explored in some depth the main issues around high-level skills in the agriculture and food sectors. It has looked closely at key opportunities & challenges, and identified priorities for action - focusing on high level (undergraduate) and very high (Masters and PhD level) skills.

This report summarises the findings. It highlights the conclusion that the supply of high level skills in the agri-food sector is at least sufficient to satisfy current demand, but there is very little accurate data exploring the future demand for high level skills in individual sectors.

The changes in the Higher Education Institutes (HEIs) are not seen to have disadvantaged the supply of graduates and higher level skills to the industry or research base, but have led to the loss or reduction of some specialist capabilities in the HEI sector. There are also some niche areas of concern in the very high skill levels required to maintain the research base and support key future agricultural research.

A significant finding is that clear, common metrics, agreed across government and implemented consistently across bodies collecting and collating the data, will be essential in addressing the skill's supply and demand issues in the agri-food sector.

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Government Chief Scientific Adviser

High-level Skills for Food

Executive Summary

i. The 'Food Research Partnership' (FRP) brings together key public sector funders of food-related research with senior representatives from the research community, Non Governmental Organisations and the agri-food industry to promote cross-sector dialogue and to jointly deliver enhanced leadership in addressing key strategic issues for food research and innovation. The Skills Sub-Group of the Food Research Partnership (the Sub-Group) was established in order to consider the issues around high-level skills in the agriculture and food sectors. There was a perception that: the closure of institutes and specialist departments in universities was affecting the sector; that there were falling numbers of graduates in both agriculture and food-related subjects; and that the graduate quality was not as high as for other bioscience subjects in the UK. In addition there was a perception of a significant and potentially unmet demand within the industry for new graduates and there was a view that there was insufficient knowledge exchange between the industry and research base, in part due to a lack of appropriately skilled people. A final concern was that there is a shortage of very high level (Masters, PhD) skills to support research both in the research base and industry.

ii. The Sub-Group was asked to consider the availability and access to evidence of the problems relating to high level skills in agri-food, and to gather and analyse the available data. It was also asked to consider what is being done to address the skills issues, what success would look like if the issues were addressed, and the priorities for action in order to achieve such success. Throughout the exercise, the focus was primarily on high (level 4, undergraduate) and very high (Masters and PhD level skills).

iii. Data were obtained from a variety of sources including Higher Education Statistics Agency (HESA), Sector Skills Councils, the Higher Education Funding Council (HEFCE), and the Biotechnology and Biological Sciences Research Council (BBSRC). In addition, a number of reports, case studies and some survey data were provided by both the agriculture and food industries and other sources. Substantial anecdotal evidence was also given.

iv. These data show that:

- There is a significant lack of consistency within the available data, with many gaps and little ability to compare data from different sources. These difficulties are common to all sectors, and can both mask specific, acute problems and confuse understanding of the real skills needs. In addition, the data do not cover all sectors equally, for example skills required for post harvest and distribution waste management are not addressed at all.
- The supply of high level skills in the agri-food sector is at least sufficient to satisfy current demand, but there is very little accurate data exploring the future demand for high level skills in any relevant sector.
- The changes in HEIs have not disadvantaged the supply of graduates and higher level skills to the industry or research base, but have led to the loss or reduction of some specialist capabilities in the HEI sector.
- There is a significant overseas student presence on HEI courses at all levels, but it is not easy to determine what proportion of the high skills cohorts these students represent.
- There are some specific niche areas of concern in the very high skill levels required to support the research base and the future needs of agricultural research.

- The immediate and urgent need in both agriculture and the food sectors is to increase the skills levels of current owners, managers and workers. The issue is more of demand for training than a shortage of supply. A concerted effort to increase the professionalisation of the sectors is necessary to enable them to respond to the increasingly complex context in which food is produced and consumed.
- There are no consistent metrics to enable measures of progress in addressing real or perceived skills issues in any relevant sector.

v. From these data, the Sub-Group concluded that:

- The nature of the supply of and demand for high level skills in agri-food is such as to require partnership between all relevant industry and users, skills providers, research and policy makers so as to understand the issues and develop solutions to addressing them. The work being undertaken by the Agri-Skills Forum provides an ideal opportunity to develop this approach, so long as it is across the whole sector and at all skill levels.
- In order to ensure that skills and other needs in both the agriculture and food sectors can be properly understood, it is important to resolve the problems of the inconsistency and lack of granularity of the data. This needs to be done in partnership between all the bodies responsible for gathering such data and with those who will use it (e.g. HEFCE, HESA).
- There is not an immediate issue in the supply of high level skills to the agri-food sectors. However, this does not properly take into account the major re-focusing of research in agriculture and food, the skills that will be required for the application of the new technologies and developments arising from this, nor the aim for greater professionalisation of the sectors. In the context of food security, the strategic importance of subjects supporting the agri-food industry may well need re-appraisal.
- The immediate and urgent need in both agriculture and the food sectors is to increase the skill's levels of current owners, managers and workers. This professionalisation of the sectors is necessary to enable an effective response to the increasingly complex context in which food is produced and consumed.
- Clear, common metrics to ensure progress in addressing the skill's demand and supply issues in agri-food are essential.
- There are some specific areas of niche very high level skills that require addressing.

vi. The principle recommendations of the Sub-Group are:

- To support the Agri-Skills Forum in its work to develop a co-ordinated approach to understanding and addressing the skills supply and demand issues in agriculture and food, and promoting the further professionalisation of all components of the sectors. This should include an appropriate expansion of its membership to consider high and very high level skills demand and supply.
- That clear and common metrics relating to important indicators such as skill level, qualification and job classification in the agri-food sector should be agreed cross-government, and implemented across bodies collecting and collating the data. In some cases this may require surrogate measures for skill levels where the level and type of formal qualifications are not an effective metric. The views of industry and the supply sector should be sought so as to ensure that the resulting data and metrics are useful to users as well as government and providers. Such metrics should fit with the overall government strategies, including the Food 2030 Strategy and research excellence framework (REF).
- To support the development by BBSRC of Advanced Training Partnerships to address in particular very high level skills needs in the agriculture and food sectors.

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Report to the Food Research Partnership from the Food Research Partnership Skills Sub-Group

January 2010

1. Introduction

1.1. This is a very exciting and important time for food research. The Government vision of the need to ensure a sustainable, affordable, safe and healthy food supply by 2030 has resulted in the widespread realisation that a long-term view is needed of UK and worldwide food provision. The role of research and development in achieving this vision is recognised by the UK government Food Strategy Task Force, which has established the Food Research Group with its stakeholder group the Food Research Partnership (FRP) to consider the relevant research issues of importance to stakeholders.

1.2. Membership of the FRG includes key public funders of food research and its aims are: to initiate taking forward the recommendations of the *Food Matters* report for a Joint Research Strategy for Food; to promote the coordination and coherence of food and agricultural research programmes and funding across Departments and the wider public sector; to provide a forum where key cross-government food research and innovation issues and priorities can be discussed and addressed; to facilitate engagement with the wider stakeholders groups, including research providers, funders and users.

1.3. In order to address stakeholder engagement, the Food Research Partnership (FRP) was set up consisting of membership of the FRG and stakeholders representing key industrial and consumer sectors with aims including: to provide a high level forum to promote cross-sector dialogue and to jointly deliver enhanced leadership in addressing key strategic issues for food research and innovation; to provide the opportunity of a challenge and "sounding board" function as individual organisation strategies and programmes are developed, and in relation to the development of the institutional landscape for food research as a whole; to forge links between member organisations, and encourage collaboration and a coherent approach to research across government, the research community and the private sector.

1.4. The Food Research Partnership identified that the introduction of new practices and products to all aspects of the agri-food sector is dependent on the presence of high level skills, suitable for both undertaking research and understanding its application and the translation of such research into practice. Whilst there is anecdotal evidence of problems in both the supply of high level skills and of research translation, the FRP agreed that substantive evidence should be sought, so as to aid the choice of solutions to any material problems in these areas.

1.5. At the first meeting of the FRP in April 2009 key issues were identified as being critical to the future of the sector and it was recommended that a number of Sub-Groups be commissioned to explore these issues in more detail. To address the issues around high level skills, the FRP established a Skills Sub-Group (the Sub-Group) to consider the availability and access to evidence of the actual issues relating to high level skills in agri-food, what is being done to address these, what success would look like if the issues were addressed, and the priorities for action in order to achieve such success. Terms of Reference and membership of the Skills group are provided in Annex 1.

1.6. The context in which the Sub-Group met was a perception that the closure of specialist departments in universities was affecting the sector, that there were falling numbers of

graduates, in particular UK nationals, in both agriculture and food-related subjects, and that their quality was not as high as for other bioscience subjects in the UK. There was also a perception of a significant and potentially unmet demand within the industry for new graduates. Furthermore, there was a view that there was insufficient knowledge exchange between the industry and research base, and that this was in part a skills issue due to a lack of a sufficient applied research base in the first instance and a lack of appropriately skilled people within the industry able to take up and put into practice new findings. A final concern was that there is a shortage of very high level (Masters, PhD) skills to support research both in the research base and industry.

2. The role of the Sub-Group

2.1. The Sub-Group was tasked with reporting back the following to the FRP:

- A clear articulation of the issues. This is provided in sections 4 and 5 below and in Annexes 2 to 9.
- Current efforts to tackle the issues, including who is involved. These are outlined in sections 4 and 5 below and in Annexes 2 to 9.
- A view of what success would look like, and of the most important steps needed achieve this. This is addressed in section 6 below and Annex 10.
- Proposals for concrete, realistic actions that FRP members could take either directly, or through wider influencing, that would make a significant impact. These are given in section 6.

2.2. **'**Skills' in the context of agri-food research was taken to mean research-informed technical expertise and the high-level (i.e. graduate and postgraduate, Level 4 and above) skills that give individuals the ability to understand and make use of specialist knowledge and new findings. In other words, 'skills' covers the ability of the owners, managers and staff in the agri-food sector to take advantage of developments in science and technology. Factors that contribute to skills levels in agriculture and food sectors include the maintenance and improvement of the skills of the existing workforce at all levels, the employment of specialists, and careers for high-calibre students.

2.3. A wide range of skills needs in the land based sectors to support agriculture and primary food production, especially those below level 4, are being considered by the Agri-Skills Forum established by Lantra at the request for the Secretary of State for Defra. The draft report and recommendations have been made available to the Skills Sub-Group.

2.4. The Sub-Group did not undertake any analysis of the role of research funding schemes at Universities and institutes in the development and career progression of high level skills.

3. The work of the Sub-Group

3.1. In order to address the terms of reference set by the FRP, the Sub-Group agreed that in the time available it would only be possible to use existing data on the demand for and supply of skills. Sub-Group members provided available data to which they had access and additional evidence was sought more widely wherever possible. Data for this report have been obtained from HEFCE, HESA, Sector Skills Councils and a number of individual organisations, and are set out in detail in Annexes 2 to 7.

3.2. The available evidence has a number of common limitations. In general it is very high level, with limited granularity and even more limited accurate, consistent division by relevant subject. Further complications lie in the nature of the industry: for example, a self classified 'farmer' may not be classed as a role using high level skills, whereas in

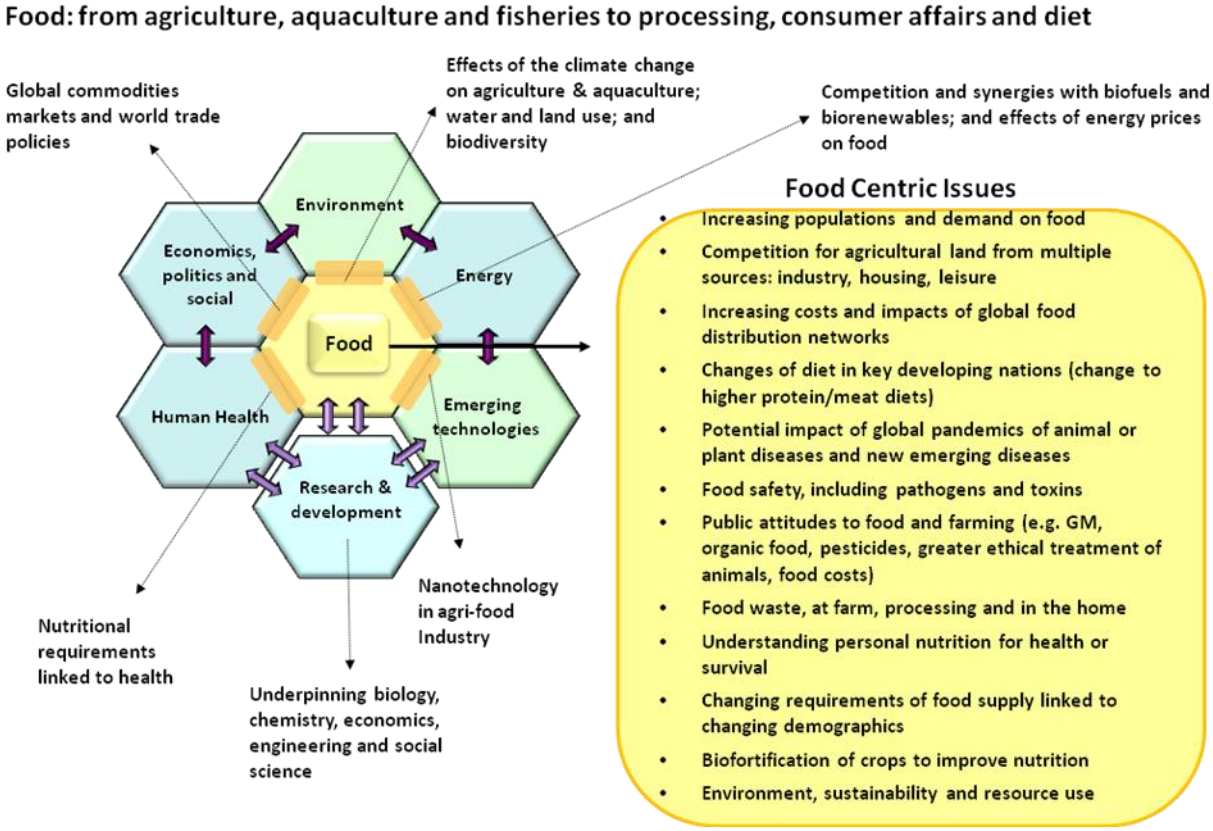
reality a farmer may also be a graduate, which can distort the interpretation of the data. There are also issues distinguishing between skills for primary production (agriculture) and skills for food manufacture and retail, with some evidence of assumptions that the supply and demand sides of each area are the same. On the supply side, there is also the difficulty of dissecting out the UK national student numbers from those of overseas students. Details of the limitations of the data are given at Annex 8.

3.3. In addition, no clear data describing a substantial industry demand for high-level skills within the workforce, nor showing a significant increase in the numbers of jobs requiring high-level skills could be made available, although there is some anecdotal support for both. Some of this evidence is given in Annex 3.

3.4. In parallel with the formation of the Skills Sub-Group, a second Sub-Group looking at the translation pipeline of research into use was established, chaired by Professor Chris Gaskell. The membership of the translation Sub-Group included Dr Celia Caulcott in order to ensure cross-representation, given the closely interconnected nature of the two sets of issues.

3.5. The definition of Food and Food Security used in this report is based on the remit of the FRG and the UK food research strategy defined below:

> *It is challenging and probably artificial to arrive at a single definition of food research, given the strong links and interactions with a range of other areas, from the environment to human health, from biofuels to global trade policies. The UK food research strategy does not attempt it. However, its dominant focus can be seen as being broadly in the central space illustrated in the diagram below:*



4. The evidence

4.1. The report has been broken into a number of evidence based sections in Annex 2-9:

- Annex 1 Membership of Sub-Group and Terms of Reference
- Annex 2 Complexity of the area
- Annex 3 Demand for High-level Skills
- Annex 4 Niche skills
- Annex 5 Supply of High-level Skills
- Annex 6 Mismatch Between Supply and Demand
- Annex 7 Examples from industry: in-house skills activities and niche skills gap
- Annex 8 Limitations of the data
- Annex 9 International dimensions to UK skills
- Annex 10 Working in Partnership to Match Demand and Supply and to Raise Employer Ambition
- Appendix 1 Further analyses and explanations of the UCAS data

Summary of the evidence

4.2. In nearly all areas, there are very real difficulties in comparing data from different sources, or even from the same source but over time. These limitations are common across the entire area and are not a result of the time restraints placed on the group in gathering the data.

4.3. Particular and significant limitations of the data are in: differentiating between levels 3, 4 and very high level skills in different sectors; understanding the balance between UK and overseas students; understanding the extent to which bioscience degrees include agri-food components; and the inability to compare different datasets. These difficulties have the effect of masking specific, acute problems (such as the likely shortage of crop breeders or veterinarians with large animal experience) but also confuse understanding of the type of skills that are needed. Further information on the limitations of the data is given in Annex 8. Obtaining improved data is likely to be important to UK government policy in the future, and will be necessary to support appropriate metrics of progress in the Government's Food policies linked to skills.

4.4. A further problem is the tendency to merge issues within agriculture, i.e. primary production in the land-based sector with issues in food manufacture and distribution. These are not the same, and whilst there are distinct data, there is a tendency to assume that what is true in one sector is true in the other which is more often than not an incorrect conclusion.

4.5. Reduction in waste throughout the production and distribution systems is an important route to increasing the available supplies of food, particularly in the international context. However, there are virtually no data on the supply or demand for high level skills in these areas.

4.6. The data available to the Sub-Group were from a wide variety of sources including reports, statistical summaries, case studies and in some cases aggregated anecdotal reports. The information shows the following, with relevant sections of the Annexes given where appropriate. Note that further information is shown in the Annexes which should be read in conjunction with this report.

Demand for high level skills (Annex 3)

4.7. The skill levels of workers within the land based sector are in general lower than for all UK sectors, with fewer workers having level 4 or level 3 skills (paragraph A3.20).

4.8. There is predicted to be a decline in the requirement for low level skills in both the land based and food and drink sectors (paragraph A3.22). However, there was generally very little data on the future demands for high level skills in the agri-food sector.

4.9. For land-based skills, there is a slight oversupply of graduates, but a significant undersupply of individuals with level 3 (technical and A level) skills (paragraph A3.23).

4.10. In several sectors, in particular specialist research areas and land based skills, there is some evidence of a demographic problem (paragraphs A3.25-27, Annex 4, Box 1) and A6.14), but these data can be confounded by the structure of some industries, such as the high number of self- employed people or micro businesses in the farming and food sectors (paragraph A3.39).

4.11. In line with government approach, qualification level is used as a surrogate for skill level in a number of areas. It is observed that for the agri-food sectors this may not be valid as much of the training is acquired on the job as opposed to within an academic setting (paragraph A3.36).

4.12. User sectors as widely spread as farming, processing and food technology indicated that it was vital to see an increase in the skill sets of the existing workforce, with the general acknowledgement that there needed to be 'professionalisation' of the sector (paragraphs A3.35-3.42).

Niche skills (Annex 4)

4.13. The skills shortages perceived by professional societies and other bodies in some areas of agricultural research are, in general, attributable to a number of specific 'niche' research skills where there is clear but very limited demand. The reasons for vulnerability of these subjects are varied, and include both supply- and demand-side issues relating to demography, low levels of research spend in industry and the research base, and a lack of recognition and reward for applied scientists (Annex 4).

Supply of high level skills (Annex 5)

4.14. HEFCE data prior to 2002 are not comparable with later data, but in the period 1994-2002 agriculture graduate numbers were constant, whereas bioscience graduate numbers increased by about 40% (paragraph A5.9).

4.15. The numbers of undergraduates completing degrees in agriculture and food-related sciences has remained constant since 2002 but this must be considered in the light of the rising numbers of both bioscience and all graduates (paragraphs A5.11 and A5.12). It should also be noted that there will be bioscience graduates whose degree studies include components of agriculture and food science, but the data do not allow any analysis of this.

4.16. In 2008 there were around 2400 graduates in agriculture and food related sciences (excluding veterinary), compared to over 31,000 in biological sciences and related degrees.

4.17. Agriculture and food science graduates have a slightly lower A level score than other bioscience undergraduates, which may be indicative of a lower quality (paragraph A5.6).

4.18. There are increasing numbers of postgraduate (primarily MSc) awards in agri-food, but it is not clear whether these are UK or overseas students as some data does not differentiate between UK and overseas undergraduate and postgraduate students (paragraph A5.13).

4.19. The RAE 2008 suggests a greater increase in research activity in the general areas of agriculture and food since the RAE2001 than in bioscience in general. However, this is

likely to be exaggerated due to the move of several agri-food institutes into the HEI sector. Equally, the broad performance of the agri-food sector in the RAE 2008 was lower than that of biological sciences (paragraphs A5.16-A5.22).

4.20. There has been a reduction in the number of agri-food departments within the HEI sector in the last 20 years, often through consolidation of such departments into larger bioscience departments to enhance flexibility and succession planning, and to update and modernise courses (paragraphs A5.26-A5.30). This has led to loss of some specialist capabilities in the HEI sector.

4.21. HEFCE report that their funding formula is not intended to influence Higher Education Institution decisions (paragraphs A5.31-A5.40). However, there are some issues in the academic community as to how the funding formula works in reality, with a perception that the HEFCE funding formula encourages HEIs to make investments in some areas and not others.

Mismatch between supply and demand (Annex 6)

4.22. Nearly half of agri-food science graduates entered non-graduate occupations as their first destination after graduation, compared to under 30% of all subject graduates. After three and a half years, 31% of agri-food graduates were still in non-graduate occupations, compared to an average of 19% for all graduates (paragraph A6.5). However, these figures represent averages across the sector and some institutions report high levels of graduate employment within the agri-food sector.

Examples from Industry (Annex 7)

4.23. A survey conducted by IGD on recruitment and skills gaps in major food retail, manufacturing, wholesale and food service companies (including a combined response from the Sector Skills Council Improve), showed that there were some shortages in the number of highly skilled employees in this sector, but that recruitment difficulties were easing in light of the current economic situation. Some reported no difficulty in recruiting, but for those that did, the main reasons for recruitment difficulties were a lack of suitably qualified candidates; geographic location of companies; and a lack of understanding of the types of roles available within the sector. The majority of respondents reported that no additional rewards or incentives were used to help attract the best people into the jobs. It should be noted that due to the small number of respondents to the survey, the results are not necessarily representative of the sector which comprises a large number of small, medium and large companies.

Limitations of the data (Annex 8)

4.24. Data are regularly collected across sectors and across skills levels. However due to the complexities in the agri-food sector it is clear that current data collected are too aggregated to fully capture the issues in agri-food.

International Dimensions to skills (Annex 9)

4.25. Undergraduate and postgraduate courses in agri-food have significant numbers of International students, but due to the lack of detail in the data, the relative proportions are not always apparent. Whilst there are advantages for the development agenda in the UK providing training for a significant number of overseas students in agriculture and food the lack of detail in the data make it impossible to accurately determine the supply of UK graduates.

4.26. There is a significant opportunity for the UK to contribute as a leading international authority to the longer-term global food security agenda. Further consideration (BIS/Go-Science – Foresight) should be given to the future skills sets required to meet this increased need and the provision of training and skills development to meet the global demand for skills in agri-food. This will ultimately strengthen the position in research and training in this area.

5. Conclusions of the Sub-Group

The importance of partnership

5.1. In reaching its conclusions, the Sub-Group recognised that the key route forward in the area of agri-food skills is to develop and support partnerships between the industry, skills providers, research and policy makers. This partnership working is necessary to ensure and encourage an appreciation of the need to increase the skills of the current workforce, and in developing routes to addressing this. It is also important in ensuring that there is a supply of skilled people to match employer demand for niche high-level skills, and to further raise employer awareness of the need for these skills, leading to the development of employment opportunities for individuals with high-level skills.

5.2. Such partnerships would lead to a flexible skills system, where:

- Owners and managers across the agri-food sector recognise the importance of maintaining and developing their own and their employees' skills, and actively seek opportunities to do so;
- Providers of high-level skills can respond appropriately to the needs of industry;
- Industry can access information and support on how to recruit and develop high-skilled people;
- There is a supportive dialogue and knowledge exchange between industry and high-level skills providers; and
- Employers can access information about how investment in high-skill jobs is crucial not just for future business success, but also in order to attract talented and high-skilled individuals to work in the sector.

The quality of the available data

5.3. There is a genuine problem in the consistency and level of granularity of the data describing the skills demand and supply sides in agri-food, with data from different sources being non-comparable. Appropriate, comparable data need to be collected in the future, and will provide comprehensive and informative metrics for use by both the government and the agri-food sector. Alignment of data and metrics to constant standards would also streamline HEI data gathering.

5.4. In addressing the issues of the quality of the data, it is important to consider the appropriateness of the use of qualification level as a surrogate for skill level in this sector.

The supply of trained individuals

5.5. A key problem is the perceived lack of attractiveness to young people of careers in the agri-food sector. This is seen as affecting the quality of people being recruited into the sector, particularly at the degree and lower levels. Emphasis should be placed on the quality, rather than quantity, of recruits, so that the UK is able to respond to near and future skills needs in the area.

5.6. Whilst there have been changes in the structure of provision of higher education in agri-food, the data do not suggest that this has systematically disadvantaged the broad provision of skilled (level 4) people to date. Overall there appears to be a sufficient supply of new graduates with high-level skills in the agri-food area.

5.7. An appropriate supply of graduates is one that is both sufficient in number and fit for purpose to the sector. The sector should ensure that agri-food skills at the undergraduate level are adequate and specific, for example through exploring the accreditation of biological sciences degrees.

5.8. Food, and the agriculture and manufacturing to support this, is both an international issue and part of the global market. High and very high level skills can be sourced from around the world, thus addressing some immediate demand issues. Equally, this is an opportunity for the UK to train such individuals to support the global challenges in agricultural production and waste reduction, and food science and technology.

The demand for skills in the current workforce

5.9. The development of skills within the existing workforce (at all levels) will be vital for the future sustainability, productivity and competiveness of the UK agri-food sector. There is an urgent need to increase the skills of the existing workforce, including owners and managers, recognising that drivers such as climate change, sustainability and increasing understanding around nutrition require increased competency in practitioners as well as researchers. This 'professionalisation' of the sector is essential for its future economic and social success and is considered to be more appropriate than increasing the skill levels of new recruits.

5.10. It is also important to ensure that the supply of high and very high level skills reflects the anticipated demands for these from both the agriculture and food sectors.

5.11. It is important that companies can access information about the benefits of up-skilling their workforce and are aware of the support available to do this.

5.12. Very high level niche skills shortages perceived by professional societies and other bodies should be addressed by both Higher Education Institutions and other organisations, to ensure that critical 'pinch points' within the sector are managed**.**

The nature and metrics of success

5.13. That a successful skills landscape in the complex agri-food industry would be one where individuals and organisations:

- will have (in appropriate forms) the skills and competencies needed to understand and develop their component of the sector in a changing and complex world,
- will have the necessary skills to run their business in an efficient and sustainable way, with due regard to the environment, food safety etc,
- can identify those skills that they need but do not currently have in order to achieve the above, and
- will have routes for acquiring, developing or accessing those skills.

5.14. In discussion of how this skills landscape will be measured, a number of possible metrics were proposed (Annexes 8.12 and 9.6) which should be fed into the Defra development of indicators to underpin delivery of the Food 2030 strategy. The following were suggested (taken in the context on the need to improve data quality discussed in Annex 8):

- number of people employed in the business with relevant bioscience degrees and how many of these people are doing jobs requiring said degree
- number of graduates in the business, including wider skills such as management
- number of days of training each worker receives which up-skills their knowledge and allows them to undertake or translate new R&D
- number of graduates in the UK, in agri-food subjects
- the relative number and proportion of the graduates within the HEI sector that are UK, EU, from developing countries, or international
- the short term and medium term destinations of these graduates; both whether they stay in the sector, are in industry or academia and which country they are in.
- as a proxy for potential recruitment demand, data from HEI and public funded institutes on post doctoral recruitment, both number of applicants, applicants of appropriate qualification, and origins of applicants; and how this changes over time.

5.15. The recognition and reward of academics who undertake strategic and applied research is important and incentives should be provided to encourage this, both by the funding councils (for example, through the forthcoming Research Excellence Framework), by the research councils, and via other mechanisms such as the development of partnerships with industry.

6. Recommendations of the Sub-Group

6.1. The Sub-Group was asked to put forward proposals for concrete, realistic actions that FRP members could take either directly, or through wider influencing, that would make a significant impact. Based on the conclusions above, the Sub-Group identified a number of recommendations for action. These are given in the table below.

No.	Recommendation	Who will undertake the action?	By when?	Who will report back to FRP?	Measures of Success?
KEY RECOMMENDATIONS					
1.	In order to understand and analyse the issues in agri-food skills and translation, clear and common metrics relating to important indicators such as skill level, qualification and job classification should be agreed cross government and implemented across bodies collecting and collating the data. This needs to consider how best to develop surrogate measures for skill levels where qualifications are not effective and the level of data required. The views of industry should be sought so as to ensure that the resulting data and metrics as useful to users as well as government and providers. Such metrics should fit with the overall government food strategy.	Lantra, HEFCE, Improve, HESA, BBSRC, Defra, BIS (through consultation with industry)	Agreement April 2010	GO-Science with others	Agreement and use a common set of metrics.
2.	The suggested metrics in Annexes 8.12 and 9.6 and the limitations of current data (Annex 8) to be fed into the Defra development of indicators to underpin delivery of the 2030 Food Strategy.	Go-Science, Defra	April 2010	Defra representative on FRP	Clear and robust set of metrics for measuring progress in the up-skilling and the skills needed to support innovation in the agri-food sectors are developed.
3.	Agri-Skills forum to consider mechanisms to engage with other funders of skills	Lantra, Defra, AHDB	April 2010	DEFRA	Agri-Skills Forum membership to be expanded to include appropriate additional representatives.
4.	BBSRC to lead the establishment of Advanced Training Partnerships in agri-food to enable specialist agricultural HE institutions, employers,	BBSRC	Outline call March 2010	BBSRC through the FRP	A successful call for proposals that generates interest from a range of commercial and publicly funded

	levy bodies, trade associations, research funders, universities and research institutes to work in partnership to ensure that the niche expertise, high and very high-level skills needed by this sector are developed in collaboration.			membership	organisations to work together to provide the specialist expertise and high-level skills.
ADDITIONAL RECOMMENDATIONS					
5.	In light of recent developments and the increased importance of food-security in the public policy arena, HEFCE (and other funding councils) should revisit the issue of the strategic importance and vulnerability of Land-based studies, including food science and technology, and in particular look wider into whether the wider agri-food skills area is receiving appropriate funding based on its comparative strategic importance compared to other areas such as STEM subjects.	HEFCE	Initiate review by July 2010	BIS	A report from HEFCE to the FRP and BIS setting out the outcome of its considerations of this issue.
6.	Sector Skills Councils and AHDB to create, implement and evaluate an action plan as part of the Agri-Skills Strategy to stimulate the professionalization of the sector. This will include the benefits of: • Promoting to agriculture and food businesses the value and financial benefits which further professionalisation and investment in high-level skills (through training, recruitment and the use of consultancy services) can bring. • Provision of clear information on the funding schemes available to support such high-level training and development.	AHDB, Lantra, Improve, the Agri-Skills Forum, Defra, UKCES	December 2010	FRP to identify reporting line	An action plan, including metrics and evaluation, will have been produced and accepted by the Agri-Skills Forum

	• Developing a communication plan and metrics for evaluating the impact of the actions.				
7.	HEFCE to work with AHDB, Defra, BBSRC, Sector Skills Councils and the food industry (IGD and AIC, or others) to ensure that there are appropriate metrics for assessment of impact, KE and other applied research activities embedded in the REF, such that research base staff are recognised and rewarded for this and that institutions are not penalised for pursuing applied agri-food research.	HEFCE with AHDB, Defra, and BBSRC	October 2010	BIS	Clear information is available to staff in Higher Education which shows how a wider range of metrics in the REF will reward KE and applied research activities.
8.	The FRP to support current discussions to explore the accreditation of biological degrees and the potential benefit this could have in ensuring that key areas of food research are underpinned within wider biological science degrees, and that agri-food components take account of the wider stakeholder needs.	FRP	October 2010	BBSRC	A plan to develop key accreditation components for bioscience degrees relevant to agri-food user industries.
9.	The International dimensions of Agri-food skills to be explored in more detail by FRP	FRP	October 2010	FRP sub-group	Identification of the impact of the international dimension on UK agri-food research expertise and training.
10.	FRG to consider and identify who should have leadership on high level skills in agri-food where current responsibilities are unclear	FRG	January 2010	GCSA	A lead has been identified, working across Government to coordinate and champion activities and strategies for high-level skills.
11.	The FRP should agree to monitor progress against and take ownership of listed recommendations, coordinating activities with those of the Translation Sub-Group and the Agri-Skills Forum as appropriate.	FRP	Ongoing	GCSA	An action sheet is provided to FRP with updates against each recommendation.

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Annex 1. Membership of Sub-Group and Terms of Reference

Terms of Reference

Purpose

To address the question posed by the Food Research Partnership (FRP): 'Where are the most serious skills and capacity problems, and what further measures could address these and promote more positive attitudes to the agri-food sector?'

- To provide a report before the FRP autumn 2009 meeting *(a revised report was provided to the FRP in December 2009)* that:
- Clearly articulates the issues
- Summarises current efforts to tackle these, including who is involved
- Describes the outcomes if the issues are successfully addressed
- Identifies those actions that are of highest priority in order to achieve these successful outcomes
- Sets out material, realistic actions that will make a significant impact and that the FRP/FRG members and others can take forward either directly or through a wider role of influence.

Mode of working

The group should have no more than 12 members, excluding chair and secretariat to provide more focussed discussions

Two meetings are proposed, with an information gathering exercise after the first meeting, *(however three meetings were actually needed).*

Members are expected to contribute substantively to the work of the group through their personal knowledge of issues, access to wider knowledge within their organisation, sector or through other groups they are members of.

Where members are unable to physically attend meetings their views will be sought through email and 1-1 meetings.

A report and feedback to the FRP is planned for the end of August 2009. *(Following this meeting a revised report was presented to the FRP on the 3rd December)*

Membership of the group

NAME	ORGANISATION
Celia Caulcott (Chair)	Biotechnology and Biological Sciences Research Council (BBSRC)
Judith Batchelar	Sainsbury's
Charlie Battle	Agricultural Industries Confederation (AIC)
Andrée Carter	UK Collaborative on Development Sciences (UKCDS)
Paul Chapman	Improve Sector Skills Council
Angela Coleshill	Food and Drink Federation (FDF)
Martin Grantley-Smith	Agriculture and Horticulture Development Board (AHDB)
Paul Hazell	Higher Education Funding Council England (HEFCE)
David Llewellyn	Harper Adams University College
Mike Segal	Department for Environment, Food and Rural Affairs (DEFRA)
James Stillman	Pepsico Europe
David Swales	Lantra Sector Skills Council
Christine Williams	University of Reading

Deputies were sent to meeting when appropriate

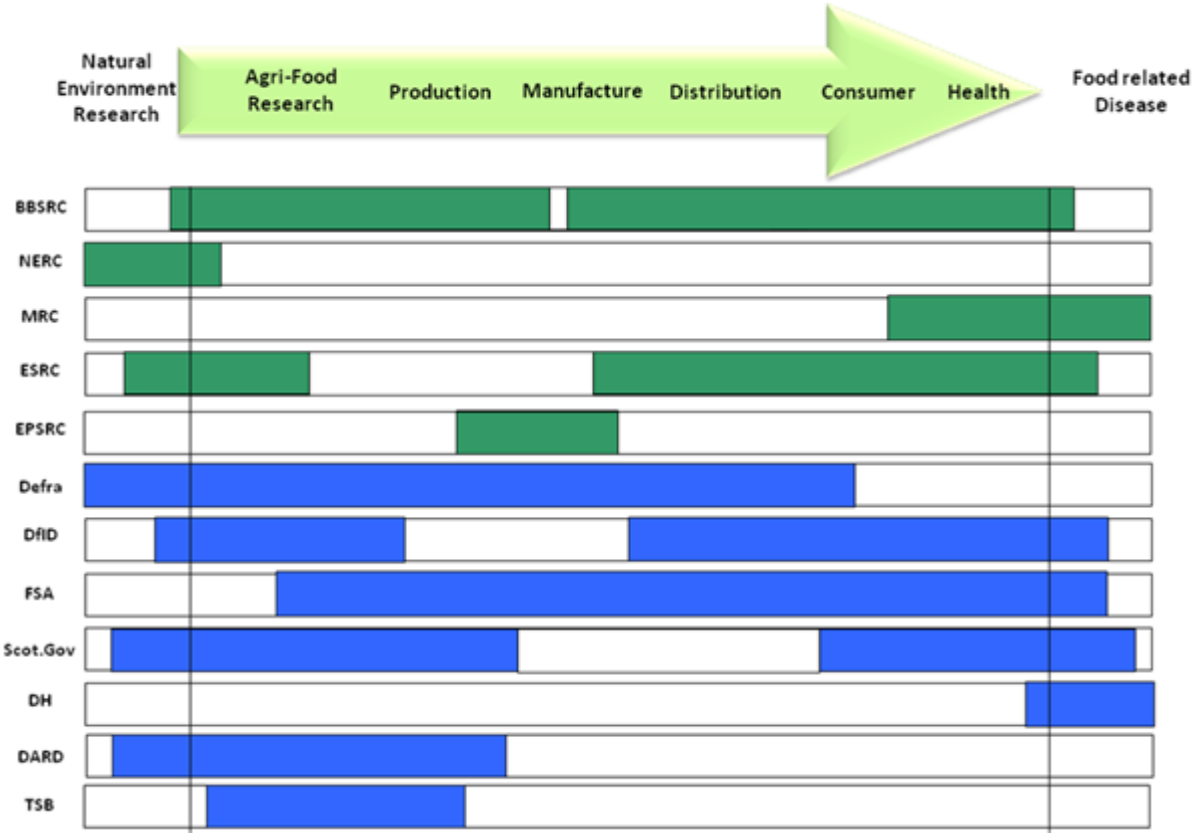
Officials
Adam Staines, BBSRC
Elizabeth Warham, Government Office for Science

Ian Lyne, BBSRC
Clare Nixon, BBSRC

Annex 2. Complexity of the area

Complexity of the Agri-food area

A2.1. From both a policy and research perspective the topic of food is highly complex. There are many interests across Government Departments, a large and diverse industry sector and an extensive range of scientific disciplines that are relevant, ranging from biotechnology through to behavioural research. The diagram below illustrates the number of primary government departments and Research Councils involved in this space and excludes many important secondary partners such as Department of transport, Department of Energy and Climate Change, Foreign and Commonwealth Office.



A2.2. In the definition given in paragraph 3.5 of the report, food research has been articulated in a wide landscape in relation to other relevant sectors such as the environment and health. This gives food a broad definition encompassing basic science underpinning primary production through to diet and health and consumer practice. This is an attractive generic description of a wide area of activity that has a single primary focus: that of feeding people.

A2.3. Though this area has a single primary function the use of food or agri-food to describe an industrial or academic sector has dangers in that it assumes that this is a single cohesive sector similar to any other main academic or industrial sectors such as computer science or aerospace. This assumption causes a number of flawed deductions which must be countered: such as the idea of a single university degree in agri-food, or that there is a representative industry body that can speak for the whole sector.

A2.4. This level of complexity within the agri-food sector is an order of magnitude more complicated than, for example, the pharmaceutical industry. The UK agri-food sector

comprises an enormous range of companies, including over 200,000 farm holdings and 6,900 food processing companies, involved at varying stages of the food chain "from farm to fork", and divided between a number of sub-sectors. Farmers/producers, processors, food service providers, retailers, consultants and policy makers all require continual supply of new skills and training to improve practices and develop new products but whose structures, needs, and capacity to respond are different.

A2.5. Therefore the issues and challenges within each sector, at every stage of the food chain, and between individual companies, will be equally wide ranging. This is in addition to further considerations such as the different characteristics of sectors and companies in terms of preferred channels of communication and support networks. The different sectors and their research and innovation needs are, however, necessarily connected. This complexity needs to be acknowledged both in analysing the research skills problems that might exist and in scoping effective solutions.

Complexity of skills

A2.6. The issues around the highly-skilled individuals developing the skills and understanding needed to bring about the translation of research into new practices new products, and services, etc, are extremely complex. The research and development needed stretches across the public sector, producers, manufacturers, servers, and retailers, as well as policy makers and regulators - and ranges from very small business to multinational corporations.

A2.7. These issues extend to the impact on translation and not just the skills base, for example, if companies do not have staff with the high-level skills needed to take up and apply new research findings - or cannot access expertise through consultants or other advisory channels - then the translation of new research will be severely constrained. However, equally, if companies do not see the value or cost-benefit of investing in new technologies or innovative practices, they will not create the employment opportunities (either in-house or in the consultancy sector) which are needed to attract talented individuals into areas where they can use their expertise.

A2.8. This means that 'skills' in the context of food research means both specialist, research-based, technical expertise and the high-level (i.e. graduate and postgraduate) skills, both of which give individuals the ability to understand and make use of specialist knowledge and new findings.

Complexity of Agri-food skills landscape

A2.9. There are significant structural issues in the agricultural sector (such as the large numbers of small farming businesses) which appear to result in a low-level of investment in high-skilled roles. This in turn results in a low of growth in employment opportunities for high-skilled individuals – these may be understood as a 'derived demand' from the investment by business in long-term strategies which stress innovation of processes, practices, products and services. Addressing this low level of investment in employment opportunities ultimately depends on support and encouragement for companies to take up new innovation; therefore it will depend crucially on solving the issues around the translation of new research to the industry.

A2.10. The complexity of the issues across the sectors means that there are a range of perspectives and views that the Sub-Group has sought to synthesise. In the sections which follow, text boxes highlighting specific perspectives and case studies have been used, but these should not necessarily be taken to represent the conclusions reached by the Sub-Group or be indicative of the sector as a whole..

Annex 3. Demand for High-level Skills

A3.1. This section looks at issues of employer demand for high-level skills in the agri-food sectors, and sets out the broader policy context in which the Government is seeking to encourage a demand-led pull on skills. As indicated above, 'skills' must be construed broadly to cover not just education and training, but also the availability of employment opportunities that make high-level and specialist skills available to employers.

The nature of the high-level skills in agri-food

A3.2. The term 'high-level skills' is used to cover skills at Level 4 and above, that is, first degrees, higher diplomas and postgraduate qualifications. Within postgraduate qualifications, however, there is often a need to distinguish postgraduate research expertise – i.e. very high-level specialist skills.

Qualifications by level The analysis in this report classifies qualifications into the five levels set out below.	
Level 1:	GCSEs, O-Levels or equivalent at grades D-G; National Vocational Qualification (NVQ) Level 1; Business Training and Education Council (BTEC) first or general certificate; General National Vocational Qualification (GNVQ) foundation level; Royal Society of Arts (RSA); SCOTVEC modules.
Level 2:	Five or more GCSEs, O-Levels or equivalent at grades A*-C; NVQ Level 2; BTEC first or general diploma; GNVQ intermediate level; City and Guilds Craft; RSA diploma; BTEC, SCOTVEC first or general diploma.
Level 3:	Two or more A-Levels or equivalent; NVQ Level 3; BTEC National; Ordinary National Diploma (OND); Ordinary National Certificate (ONC); City and Guilds Advanced Craft; 3 or more Scottish highers.
Level 4:	First or other degree; NVQ Level 4; Higher National Diploma (HND); Higher National Certificate (HNC); higher education diploma; nursing; teaching (including further education, secondary, primary and others).
Level 5:	Higher degree; Doctor of Philosophy (Ph.D.); NVQ Level 5

These levels can be further classified into low skills (no qualifications and Level 1); intermediate skills (Level 2 and 3) and high skills (Level 4 and above). This 'common currency' allows comparisons across sub-groups of the population, time and, to a certain extent, between countries. There is some debate at an international level: Level 2 can be classified as either low or intermediate level.

A3.3. There is a key distinction in the industrial sector of a difference between a skills gap and a skills shortage which can often be inappropriately amalgamated into a single issue. For the purpose of this report:

- a skills gap is defined as a deficiency or weaknesses in the current skills and capabilities of the current workforce of a particular employer or employment sector.
- a skills shortage is defined as hard-to-fill vacancies and therefore a mis-match between employer recruitment need and the availability of people with the required skills.

A3.4. The Agri-food sector is potentially one of the most complex industrial sectors in the UK. Rather than being a small number of focussed businesses requiring a specific sub-set of skills, there are thousands of different businesses covering skills needs from farm to fork.

The diagram below indicates some of the key skills demand areas across the chain:

Sub Areas of Agri-Food Skills:

Plant Scientist
Animal Science
Horticultural/Crop Scientist
Soil Scientist
Agriculture/ Agronomy
Plant Breeder
Animal Husbandry
Farm management
Farm technical and advisory services
Food transportation
Food Chemistry
Food Manufacture
Food Retail (and marketing)
Food service industry
Food Economics
Nutrition
Consumer Science
Food choice and Behaviour
Food and Society

A3.5. There are potentially 19 different broad skills areas in this chain, in any one of which a skills shortage could have deleterious effects on the whole chain. Within each of these broad areas there may be niche skills for which there are specific issues, and which while seemingly minor in the overall context, could have significant impact on the whole chain.

Knowledge Exchange Skills

A3.6. Skills areas are often viewed by training providers (e.g. HEIs) in terms of the academic discipline in which the skills are taught. However, there is a key additional cross-cutting skills area in Agri-food that needs to be covered alongside academic subject knowledge, and which could be called "practical translation" or "knowledge brokering". This is the provision of people trained to understand the science of R&D who can discuss with end-users the benefits and practical implementation, such as informing farmers of new seeds, discussing benefits of new vaccines, informing retailers of improved hygiene techniques. Here, credibility with end-users is vital to being able to convey new scientific thinking.

Lab coat to Welly Boot

A view held by 55% of interviewees was that the gaining of agricultural and farming **credibility** was the single most important skill at risk of being lost.

From: Survey of arable specialists undertaken for the Rothamsted Research Association: *Scientific Skills for Knowledge Transfer in Arable Agriculture in England* (December 2005), page 10. Available at: http://www.rothra.org/documents/Extension%20Specialists%20Audit%20Survey.pdf

A3.7. In addition to providing the vital link in the translation pipeline, these individuals often provide users with a scientific consultancy and in effect promote new research and the benefits of R&D to the user-base, thus pushing usage and creating drivers for new research.

The demand-led approach

A3.8. The need for a 'demand-led' approach in the provision of support for skills and training is now well recognised. The 2006 report by Lord Leitch[1] argued strongly for the need for the UK to develop a skills system which responds to employer skills needs in a more responsive manner, rather than relying on central planning and funding by Government or other national bodies.

Leitch Review of Skills: A demand-led system

The Review's analysis shows that previous approaches to delivering skills have been too 'supply driven', based on the Government planning supply to meet ineffectively articulated employer demand. This approach has a poor track record – it has not proved possible for employers and individuals to collectively articulate their needs or for provision to be effectively planned to meet them. Employers are confused by the plethora of advisory, strategic and planning bodies they are asked to input to. Under a planned system, the incentives are for providers to continue doing what they have done in the past so long as that meets the requirements of planning, rather than responding flexibly as demand changes.
Prosperity for all in the global economy – world class skills (December 2006), available at: http://www.hm-treasury.gov.uk/leitch_review_index.htm

[1] The Leitch Review of Skills commissioned by the Government in 2004: http://www.hm-treasury.gov.uk/leitch_review_index.htm

A3.9. Lord Leitch emphasises the need to ensure that individuals see the value of investing their time, energy and money in acquiring higher level skills, and that it is these skills which are needed to support innovation. In simple terms, this means that individuals need to perceive there to be attractive employment opportunities and professional careers utilising the specialist expertise that their investment in training would give them.

Ambition for the UK's Skills Profile 2020

The UK is already making good progress in improving its skill profile and has stretching targets in place to improve the nation's skills by 2010. Although meeting current targets will be a significant challenge, the Review believes that in order to support growth and rise to the challenge of a high-skill economy in 2020, the UK will need to be even more ambitious. Further improvements must be made to the stock of skills in the working age population:

- it is not possible to rely solely on the flow of better-qualified young people to drive further change by 2020. Seven out of ten of the workforce in 15 years time have already finished compulsory education;

- further action is required to reduce the stock of adults without basic literacy and numeracy skills and to encourage progression to Level 2 and beyond to enable expansion of the economy's capacity in higher-end skills; and

- at the higher end of the spectrum in particular, further consideration must be given to whether people have the right incentives to gain skills that are commercially valuable and support innovation.

Skills in the UK: The Long-term Challenge (Interim Report) (December 2005), (paragraph 6.7) available at: http://www.hm-treasury.gov.uk/leitch_review_index.htm

A3.10. At the heart of the demand-led approach is the idea that there is no point in investing in training where there are not the jobs for people to use those skills. In a fast-moving and globally competitive market for goods and services, the UK must clearly avoid investing in skills which are no longer needed, and ensure that the skills system responds rapidly to new demands from UK and international businesses.

A3.11. However, the demand-led approach relies on employers actually having a demand for high-level skills by moving to higher value-added activities, and being able to articulate this demand to the supply sector. If UK business is not investing in its human resourcing by creating jobs that require high-level skills, or 'professionalising' its existing employment structure, this will send signals back down the skills supply chain. In other words, individuals will be less likely to invest the time, energy and money in acquiring high-level skills if they are not confident of there being job opportunities for them (or indeed jobs that are sufficiently attractive in pay and conditions to make their personal investment worthwhile).

A3.12. A recent report by the UKCES provides information on the rate at which high-skill jobs are being created in the UK compared to other countries, and also in comparison with the growth in numbers of people with high-level skills.

Ambition 2020

The UKCES report shows:

- The growth in the numbers of high skilled people significantly exceeds the growth in the numbers of high skill jobs in the UK (p. 9).
- The UK has too few high performance workplaces, too few employers producing high quality goods and services, too few businesses in high value added sectors (p. 10).
- Increasing the skills in the population only makes sense if jobs are available to make use of those skills (p. 84).
- There has been a growth in the proportion of jobs needing Level 4+ qualification (graph on p. 85), and overall the UK has more high skill jobs than high skill people (p. 114). However, it is the rates of growth which are very different.
- The growth in supply of people with high level skills exceeds the growth in demand by a factor of approximately 4 to 1. The relative growth in demand in the UK is the slowest of any OECD country with the exception of Netherlands and Ireland (p. 115).
- The requirement for high level skills is a 'derived demand' – i.e. it depends on employers shifting into higher added value services and products (p. 137).
- There is a need to help companies move up the value chain, to choose to produce higher specification goods and services, to innovate, to be creative (p. 137).

Ambition 2020: World Class Skills and Jobs for the UK (2009), available at: http://www.ukces.org.uk/our-work/research-and-policy/ambition-2020/

A3.13. The UKCES report concludes that, arguably, too much emphasis has been placed on raising the overall qualification levels of the workforce, and too little on the demand side, i.e. raising employer ambition, helping companies to 'raise their game' (p. 146).

A3.14. A limitation of the demand-led approach is that it may not recognise the extent to which the state acts as a proxy customer for some types of expert services, which creates a demand (and therefore employment opportunities) that commercial companies can benefit from. An example would be where reductions in public R&D investment in agriculture and agronomy may inadvertently cause the loss of a valuable training stage for very highly skilled people (i.e. postdoctoral research posts in universities and research institutes), and therefore a reduction in the pool of people from which businesses can draw.

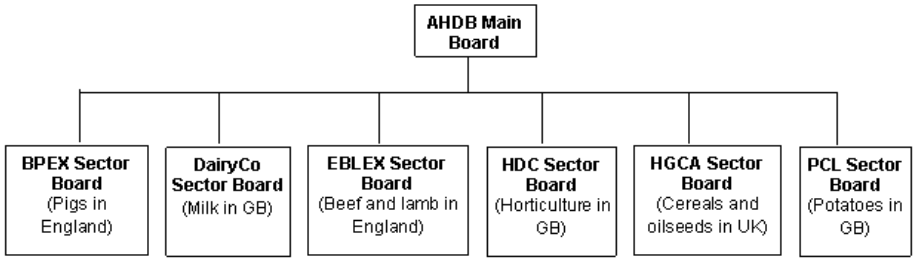
A3.15. A further limitation to a simple demand-led approach is where a fragmented industry may not be able to provide clear demand signals – individual small businesses cannot afford to invest in high skilled individuals and their expertise, whereas collectively it may be both cost effective and raise the productivity of a group of UK business against global competition.

A3.16. The Levy Bodies under the newly formed Agriculture and Horticulture Development Board have a role in investing in R&D and in promoting and stimulating demand for up-skilling in their sectors, and helping to ensure that the training available suits their needs. In this way, they are able to articulate demand for innovation on behalf of their levy payers.

Levy Bodies and the AHDB

Funding:
AHDB is funded by a statutory levy (a parafiscal tax) paid by producers, growers and processors and AHDB is responsible for the collection of all levies. Levies raised from each sector are ring-fenced to ensure they can only be used to the benefit of the sectors from which they were raised. The responsibility for setting and delivering the strategies to deploy the levy income is delegated to six AHDB sector boards which are comprised of levy payers and other stakeholders from each sector.

Structure:
In order to maintain its sector focus AHDB is organised with six sector boards representing the commodity sectors covered by its statutory remit. The sector boards are made up of members, representing their specific sectors, appointed by AHDB. The primary function of the sector boards is to act in the very best interests of the sector at all times. Each board has delegated functions from AHDB giving it the duty to develop the most appropriate strategies to meet the challenges of the sector; to ensure the relevant levy rate is recommended in order to provide adequate funding for the required work, monitor strategy implementation and approve remedies where performance deviates from plan.



From: http://www.ahdb.org.uk/about/default.aspx (accessed 3 September 2009)

A3.17. The complex and fragmented nature of the agri-food sectors is likely to affect demand for high-level expertise, and make it difficult for clear demand signals to be sent from the industry to the skills supply. Partnerships between the Levy Bodies and higher education institutions will be crucial to ensuring that demand signals can be effectively communicated.

The evidence of demand for high level skills

A3.18. In recognition that within the economy, the skills needs of different sectors are likely to be different, the government has established Sector Skills Councils. For the industrial sectors involved in food security issues these are primarily Lantra (for the land-based industries) and Improve (for food and drink manufacture).

About Sector Skills Councils

Sector Skills Councils (SSCs) are independent, employer-led, UK–wide organisations designed to build a skills system that is driven by employer demand. There are currently 25 SSCs covering over 90% of the economy and they all work towards the following four key goals:

- reduced skills gaps and shortages
- improved productivity, business and public service performance

- increased opportunities to boost the skills and productivity of everyone in the sector's workforce
- improved learning supply through National Occupational Standards, apprenticeships, and further and higher education.

SSCs have been established and developed during the last five years and in that time they have built strong working relationships with the UK Government and the devolved administrations, training providers, bodies which fund training and other important skills stakeholders. They have played a leading role on a range of skills issues, including:

- working with employers to identify future skills needs
- developing skills and training solutions
- setting occupational standards
- influencing and shaping the future development of qualifications
- designing apprenticeship frameworks
- encouraging greater investment in training
- providing labour market information that assists in long-term business planning.

From: http://www.ukces.org.uk/sector-skills-councils/about-sscs/ accessed 3 September 2009

A3.19. The need for UK companies in all sectors to innovate to meet the challenges they face is well recognised. As well as the challenge of remaining competitive in a global market-place, the agri-food sector faces a range of additional changes – for example, relating to new environmental regulatory measures and lowering emissions of greenhouse gases.

A3.20. Data from Lantra indicates a mixed story in terms of the performance of the UK agricultural sector in comparison with the UK's competitors. Lantra and Improve have also been able to provide an analysis of the changes in the skills 'profile' of the sectors – with a reduction in the proportion of low and unskilled jobs and an increasing proportion of high-skilled roles. However, the growth in high-skilled roles is low compared to other UK sectors, and therefore the risk is that the growth is lower than other comparable sectors in competitor countries (further research would be needed to fully confirm this).

UK Agricultural Productivity

Total factor productivity[2] across the wider agricultural sector has risen steadily since the 1970s. The sector has become much more efficient, producing more with less. The sector has increased the value of its outputs by 20% in real terms since 1973, despite the levels of inputs (notably labour) falling by 20%.

[2] Total Factor Productivity is an economic measure the part of the growth in output that is not simply explained by change in capital and labour inputs. It is increasingly used to capture the impact of innovation – i.e. all the other activities that enterprises can undertake to improve their productivity, including R&D, purchasing of new technology, managerial or operational changes, and advertising as well as increasing the skills levels of staff inputs. For further information on the use of TFP in this context see: *Sectors Matter: An International Study of Sector Skills and Productivity (*UKCES 2005), available at: http://www.ukces.org.uk/sectors-matter-an-international-study-of-sector-skills-and-productivity-research-report-14

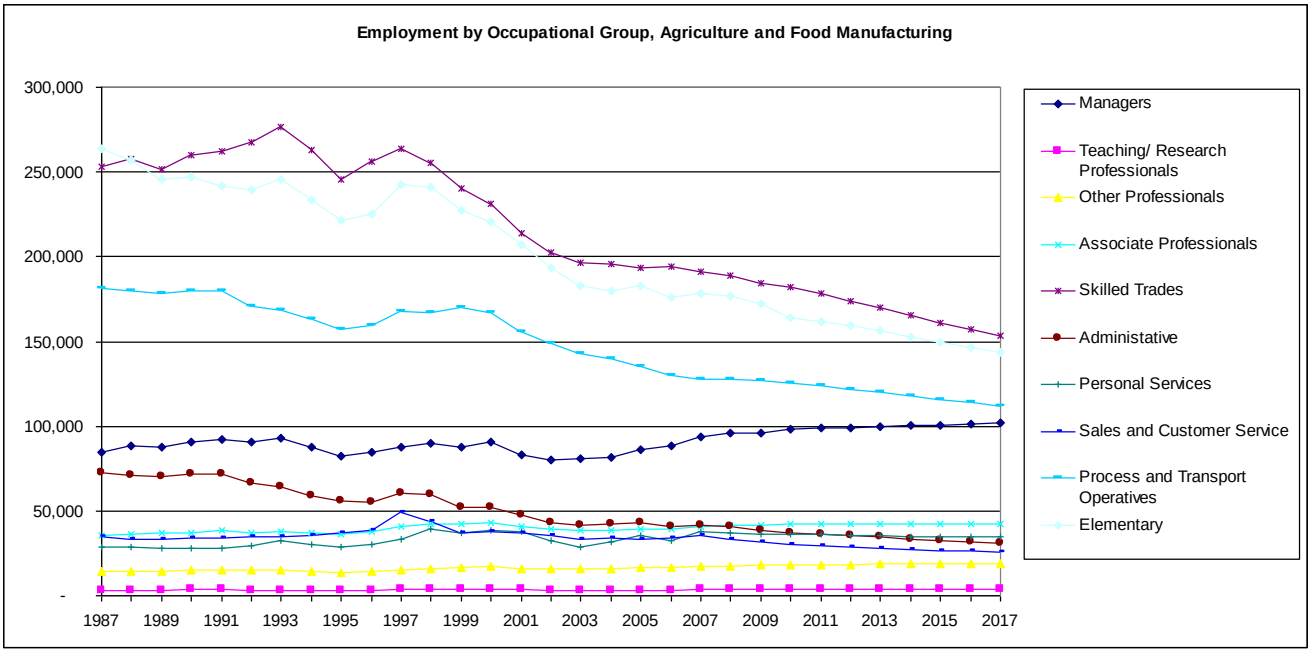
With the agricultural sector Gross Value Added (GVA) per full time equivalent worker is 29,000 Euro in agriculture. On this measure UK productivity is the sixth highest in the EU. The sector is significantly more productive in the UK than in the Eastern European states. However, productivity lags behind that of small Northern European states, such as the Netherlands, Denmark, Belgium, and Luxembourg. The UK has higher animal health and welfare standards than most of the EU, and it could be argued that there is a trade off between these issues and economic measures of performance.

Key factors which have led to increased productivity in agriculture have been the technological development and capital investment in machinery (particularly in the arable sector), the introduction of new farming practices and methods, introduction of new crop strains and animal breeds. Since the 1970s average farm size has increased, and larger farms are able to make greater labour savings from investment in machinery.

From: A skills assessment for the environmental and land-based industries (Lantra, forthcoming)

A3.21. One key question in the debate on skills is whether there is sufficient or growing demand for the current supply of high-skilled people. 1.6% of the UK labour force currently works in Agriculture, a drop of almost 30% in the last 20 years, and though this is primarily reduction in lower skilled jobs there is inevitably an effect on demand for skilled workers.

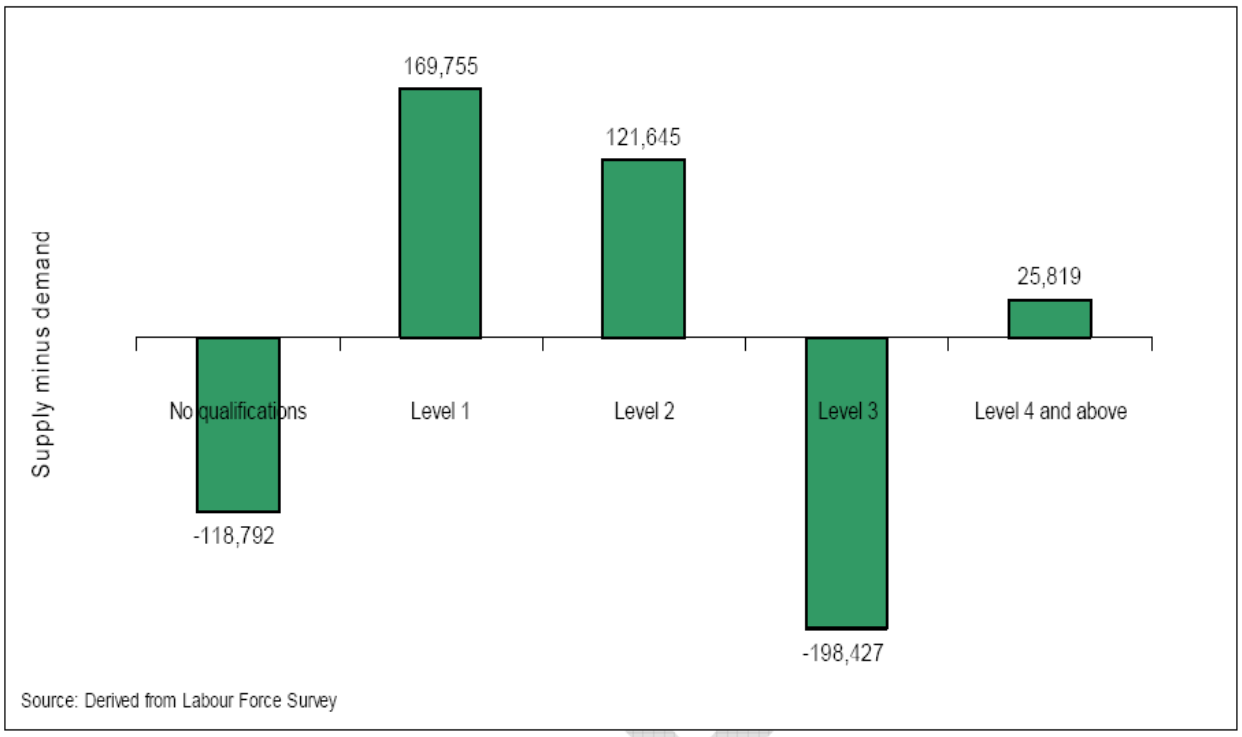
A3.22. Future predictions from the Sector Skills Councils indicate a contraction in both Agriculture and Food sectors up to 2017, however again this is primarily in unskilled labour.



(Data provided by Lantra / Improve)

Agricultural Sector

A3.23. For the agricultural sector there is evidence that there are already more high-skilled people employed than there are high-skilled roles, and that the main skills gaps are at lower, intermediate levels. These are not the skill levels typically needed by a business seeking to develop an innovation-led strategy, or seeking to move into higher value-adding processes, practices, products and services.



A3.24. The chart above shows where qualifications at a particular level are currently in over-supply (where the numbers are positive); from: Lantra, A skills assessment for the environmental and land-based industries (July 2009). This information should be treated with some caution, and viewed in conjunction with other evidence. It is based on comparing the qualifications held by workforce with those expected to be required in the role at the broad occupational level.

A3.25. The average age of skilled workers in the agri-food sector is variable, but significantly higher than that for related sectors. Data from the NFU revealed that the average age of the organisation's members was 59.6 years, and had been a similar age each year since 2004:

Table 1: Average age of NFU members 2004/05 to 2008/09

Membership year	Date of count	No. of members with Date of birth data	Average Age
2008/9	16/03/2009	19142	59.6
2007/8	31/10/2008	18903	59.69
2006/7	31/10/2007	18153	60.02
2005/6	31/10/2006	17641	60.22
2004/5	31/10/2005	17265	60.4

Source: NFU membership records

A3.26. Further details from an ADAS 2004 report[3] reveal that almost one in four (23%) of all UK farm businesses included a decision-maker aged 65 years or over while just 5% were aged 35 years or less. Though not strictly comparable, the report compares these statistics with the age structure of the entire UK labour force, showing that in Spring 2003, 37.8% of the UK labour force was under 35 years old and only 3.1% over retirement age – significantly lower than the proportion in the farming community.

A3.27. By way of comparison, the average age of plant and food scientists at the BBSRC-sponsored John Innes Centre and Institute of Food Research is 41.3 and 42.7 years, respectively, while the average age of life scientists within the academic sector, based on the University of Manchester (721 staff members) is similar, and of the UK as a whole in mid 2008 is similar: 38.3 and 39 years respectively[4]. Further information from the Association of the British Pharmaceutical Industry (ABPI)[5] showed that the majority of employees within the pharmaceutical and bioscience sector fall into the 25-44 age group (56%), while 13% are aged under 25, 22% are aged between 45 and 54, and 8% are aged over 55. The survey also indicates that there are variations between different business activities.

Data from the UKCES Working Futures 2007-17 report shows:

For the agricultural sector, zero expansion demand (as opposed to replacement demand as people retire) for science and technology professionals, teaching / research professionals, and science and technology associate professionals; and a reduction in number of managerial roles.

Food and Drink Sector

A3.28. Much of the discussion on agri-food is often focused at the primary production end and on farmers in particular; however the manufacture, distribution and retail of food and drink is an important aspect to the food chain.

Data from the UKCES Working Futures 2007-17 report shows:

- a continuing contraction of the food and drink industries, but with the loss of job roles being concentrated in low and mid-skill occupations, with expanding numbers of high-level occupations.
- a forecast growth in science and technology professionals (approximately an additional 1,000 posts over the period), and significant growth in the number of managerial roles, but no expansion demand for teaching / research professionals or science and technology associate professionals.

A3.29. There is evidence already of high levels of hard-to-fill vacancies in food technology, for example. Information from Improve indicates that currently one in four positions for food scientists and technologists in the industry is unfilled. This issue of niche skills is discussed in more detail in Annex 4.

[3] ADAS Consulting Ltd June 2004: "Entry to and Exit from Farming in the United Kingdom: Final Report"
[4] www.statistics.gov.uk/cci/nugget.asp?ID=6
[5] ABPI - Semta Pharmaceutical and Bioscience Labour Market Survey 2006

Reasons for 'under demand' of high-level skills

A3.30. It is often claimed that the low-cost focus of some major food retailers (responding to the low-cost focus of many consumers) means that businesses across the whole agri-food chain find it difficult to invest in capabilities for innovation. Equally, however, the financial benefits which can result from the investment in high-level skills and expert advice may not be sufficiently understood by farmers and producers.

The financial benefits of investing in skills

One issue that continually stands out in the transfer of technical knowledge to primary producers is the lack of a sufficient link with the financial benefits of the improvement. Farmers need to know what effect the change will make to their bottom line so that they can decide whether such a change is right for their particular enterprise. **The scientific community should seek to work more closely with economists to demonstrate the financial impacts of their improvements and a means of selling in their ideas.** The integration of new ideas into an existing enterprise are more complex than many imagine and as well as the financial dimension there are the social implications and peer group pressure. For example using AI in a beef herd gives cost effective access to high quality genetics but it takes time to observe cows in oestrus. Does the farmer have the time? Would he rather be playing cricket?

From: The AHDB response to BBSRC's consultation on food security research (2009); see: http://www.bbsrc.ac.uk/organisation/policies/reviews/consultations/0905_food_security.html. (Emphasis added)

A3.31. Another important factor in the demand, or lack of demand, for high-level skills is represented by the independent advisory sector (which has developed following the privatisation of ADAS), as well as the way larger farm companies have developed their own in-house expertise. For example, demand from farm businesses for specialist scientific and technical advice effectively results in an investment in the consultancy sector, which in turn creates employment opportunities and careers for highly-skilled individuals. If, however, farmers do not see the benefits of investing in high-level skills (through paying for consultancy advice), then this itself may result in an 'under demand' for individuals who can provide such expertise; i.e. little or no growth in career opportunities.

A3.32. Arguably, the previous public funding levels of ADAS provided a clear demand-signal for high-level skills in place of investment by businesses doing this.

ADAS

ADAS provided a government funded advisory service for farmers, which was privatised following the recommendations from the Barnes review. Although the numbers of ADAS advisory staff reduced, the demand was potentially met by external consultants and an increase in advisors working for suppliers.

However, arguably this means it is difficult to assess the level and range of skills now provided, there is now no formal career structure for these consultants, who are more generalists and who have less scope for specialisation, and farmers now pay for the advice which brings a self imposed limitation on the amount of knowledge they receive.

The complexity of the food chain means there is a range of access to advice in different farming sectors. It is easier for Arable farmers to see returns on new crop technologies and they still broadly engage with advisors, but cattle and sheep farmers with increasingly small margins find it difficult to justify expenditure on technical advice and often only receive information from limited interactions with vets, which is reducing demand for skills in this area.

Though there is no evidence of a current demand pressure on these skills, a significant concern in this sector is that the supply of consultants was from Agriculture students often trained at ADAS, and that this supply pipeline no longer exists which will create significant demand pressures as consultants retire.

A3.33. Evidence on the extent to which agricultural business have invested in high-level skills through consultancy, or have developed activities which need high-skilled people, is difficult to come by. However, there are examples which show that the consultancy sector is operating well to provide career opportunities and professional career development.

Agrovista UK

Agrovista is an example of one of the niche consultancy companies that has grown out of the changes in ADAS service provision. It was formed in 2001 and provides specialist agronomy and crop protection products to British agriculture. The company's turnover grew by 38% between 2003 and 2007, and its 2007 financial report emphasises its investment in high-level skills:

"The company continued to invest heavily in research..... and staff skills training."

"The company recognises the need to invest heavily in trainees for succession and has just finalised a 5 year plan to bring into the business in excess of 20 graduates."

BIAC (British Institute of Agricultural Consultants)

BIAC has seen "strong green shoots of recovery and over the last 3 years there has been an upsurge in committed professional and free thinking young people joining BIAC as full members. They want to be part of a developing, wide ranging and professional industry that is based on land occupation. They see the opportunities and are prepared to take an entrepreneurial attitude in growing their businesses and work for themselves or their employers".

From response to RASE New Blood project (June 2009), available at: http://www.rase.org.uk/about_RASE/news/latest_news/NewBloodReport.pdf

Attracting 'new blood' versus up-skilling of the existing workforce

A3.34. Employer demand for high-skilled individuals can manifest itself both in changing recruitment needs (i.e. creating new jobs which need higher skilled individuals than previously were needed), or in the recognition of the need to provide additional training to existing staff, to help them develop high-level components to their roles, or move into high value-adding activities for the business. The challenge identified in the Leitch Review of Skills is that 70% of the UK's 2030 workforce has already left compulsory education, and the contraction of some employment sectors can mean that the influx of new people may be low.

The Training Challenge

> Improving the skills of young people, while essential, cannot be the sole solution to achieving world class skills. Improvements in attainment of young people can only deliver a small part of what is necessary because they comprise a small proportion of the overall workforce. Demographic change means that there will be smaller numbers of young people flowing into the workforce towards 2020.
>
> More than 70 per cent of the 2020 working age population are already over the age of 16. As the global economy changes and working lives lengthen with population ageing, adults will increasingly need to update their skills in the workforce. There is a pressing need to raise the rates of skills improvements among adults – the UK cannot reach a world class ambition by 2020 without this.
>
> From: Leitch Review of Skills, available at:
> http://www.hm-treasury.gov.uk/leitch_review_index.htm

A3.35. The Curry report found greater implementation of new techniques and technologies amongst new farmers (i.e. often recently trained younger farmers), but other reports have highlighted the slow uptake of new farmers into the industry. This potentially means that there is less appreciation and uptake of new technologies by the farming industry and therefore a reduced demand on the need for new high-skilled entrants compared to other sectors.

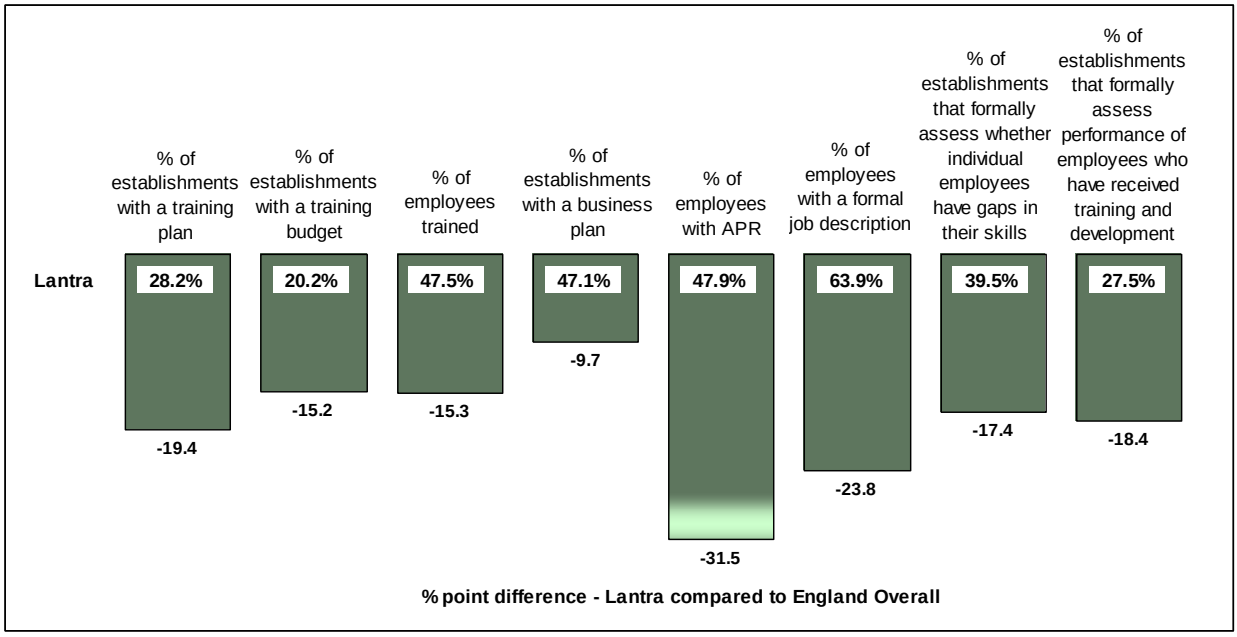
A3.36. Government funding schemes such as Train-to-Gain are intended to help employers access support for the training of their existing workforce in skills areas identified by the Sector Skills Councils (SSCs). Data from Lantra indicates that the investment in training in the agricultural sector is one of the highest but whether this data captures the necessary up-skilling required to implement new R&D is unclear, as discussed in more detail in Annex 8.

Overview of current employer training activity: Lantra

A3.37. Data from Lantra show that nearly half of employees within sector businesses undertook some form of training in the last year. Over a quarter of businesses were found to have a training plan and one in five businesses have a training budget. The sector has, on average, 11 days training per trainee compared to 16 for England overall.

A3.38. The diagram below compares the performance of Lantra's sector in eight training indicators against the average for all sectors. Compared to England, Lantra's sector scores lower across all eight measures.

Lantra's sector compared to all Sectors (England only)



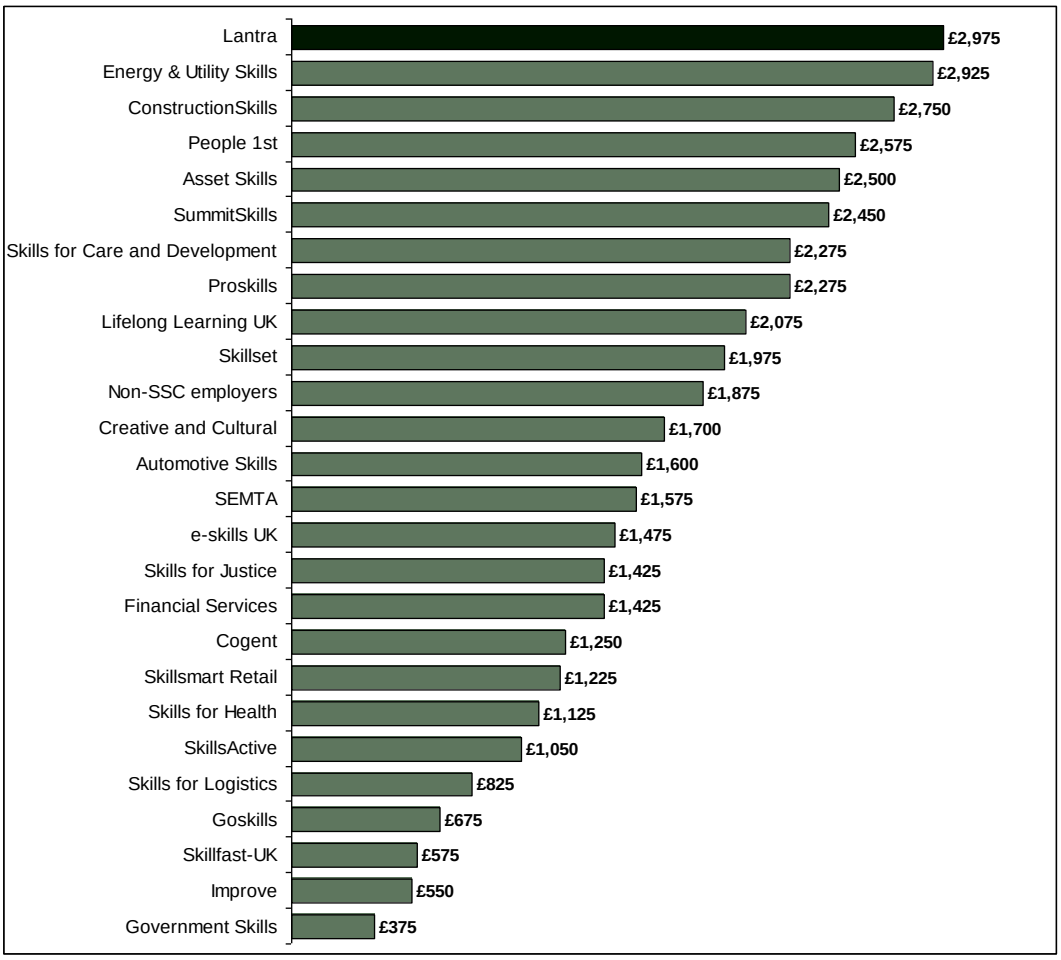
Source: National Employer Skills Survey 2007

A3.39. Research[6] into training and business size demonstrates a correlation between whether a business has a training plan or training budget, and the size of the business. The research concludes that the smaller the size of the business, the less likely they are to have a training plan and budget. For example, looking at all sectors, a quarter of businesses with two to four employees had a training plan compared to nine out of ten businesses with over 250 staff. Although the Lantra sector would appear to fall short regarding training indicators, it is likely that this is to do with the large number of micro-businesses and sole traders within the sector.

A3.40. Although only a fifth of businesses with Lantra's footprint have a training budget, Lantra spends the most per employee on training than any Sector Skills Council, as shown below:

[6] UKCES: Skills For the Workplace: Employer Perspectives 2008

Training Spend Per Employee by Sector Skills Council (England)



Source: National Employer Skills Survey 2007

A3.41. This rather paradoxical finding is the result of a relationship between micro businesses with two to four staff, and cost per trainee. Further data from Lantra shows that the cost of training per trainee for micro-businesses is disproportionately high at around £6,000 per trainee. This may be due to small businesses not benefiting from economies of scale.

A3.42. Awareness of the Train to Gain scheme amongst sector businesses, however, also appears to be low – which results in a low take-up of qualifications via Train To Gain. Lantra's Training Needs Survey 2009 indicated that only half of employers surveyed were aware of Train to Gain and only 14% had been approached by a Train To Gain broker. Data from the LSC and Lantra shows that only 167 agricultural qualifications were delivered through Train to Gain funding in 2007/08.

Skills gaps

A3.43. Surveys of employers show that in agriculture 4% of the workforce is reported to have a skills gap, in food manufacturing it is 7% - and the average across the economy as a whole is 6%. This suggests that the level of skills gaps in the industry are low. However, whilst this could be seen as a positive thing, it may indicate there is a lack of demand for skills from employers – i.e. they may not be innovating and seeking to move into higher value-added activities. In other words, the extent of reported skills gaps will again be a form of 'derived demand' linked to whether a business has an innovation-led strategy and is actively seeking to develop higher value-adding

activities, processes, etc. Therefore, low reported skills gaps may themsleves be a sign of 'under demand'.

R&D spend in agri-food and its impact on skills provision and demand

A3.44. The R&D spend by a sector is a key driver of demand for individuals with very high level skills. The demand for highly-skilled individuals is, ultimately, a derived demand from the extent of business and public sector investment in activities (i.e. R&D) which create employment opportunities for highly skilled individuals to make their expertise available to an employer or employers.

A3.45. The impact of changes in Defra's funding of applied research on the availability of employment opportunities for high-skilled individuals in this area was cited by a number of respondents to the BBSRC/HEFCE Study of Land-Based Facilities and Resources[7]. Some respondents felt that changes in public funding for translational research itself impacts on the level of demand for high-skilled individuals who would undertake that work.

Strategically Important Land-based Facilities (LBFs)

The shortlisted LBFs typically show a research income from a range of funders, though there are some instances where an LBF was identified as reliant on single source funding. Examples here include willow breeding activities, which rely on germplasm provided by the National Willows Collection (which were reliant on – recently ceased – Defra core funding), whilst others have noted the potential impacts of a decline in core Defra funding as having an impact on specific research programmes (e.g. bee health at Rothamsted Research). This could represent a potential risk to the research funders through loss of capability – especially for LBFs which show low replaceability and require consistency of funding; and especially for plant and crop science, where continuous funding over a period of time is required for breeding and field trial experiments.

Source: BBSRC/HEFCE Study of Land-Based Facilities and Resources, Arthur D Little (May 2009) available at: http://www.bbsrc.ac.uk/organisation/policies/reviews/operational/0905_landbased_facilities_report.html (page 94)

A3.46. There is a perception that public R&D funding in agriculture has decreased in the UK, when in fact this only applied to Defra research funding. BBSRC funding on agriculture and food research (of which 47% is applied research) has increased at a greater level than decreases in Defra spend (see table below). DfID will double their expenditure on Agriculture to £400M over the next 5 years (2009-2014). This recent increased investment in agricultural research for development has also been mirrored by a number of international and philanthropic research funding organisations. For example, since 2006 the Bill and Melinda Gates Foundation has funded more than $1.2 billion of agricultural development grants, 33% of which has been spent on science and technology projects. UK agricultural research scientists have received a number of these grants.

[7] http://www.bbsrc.ac.uk/organisation/policies/reviews/operational/0905_landbased_facilities_report

	Defra R&D funding into Sustainable Farming	Defra R&D funding into Animal Health and Welfare	Total Defra agricultural R&D spending	Total BBSRC spend on Agri- Food	Defra + BBSRC
	£ million	£ million	£ million	£ million	£ million
2007/08	29	39	68	185	253
2006/07	34	41	75	171	246
2005/06	38	40	78	150	228
2004/05	38	40	78	138	216
2003/04	39	36	75	129	204
2002/03	40	41	81	132	213
2001/02	41	41	82		

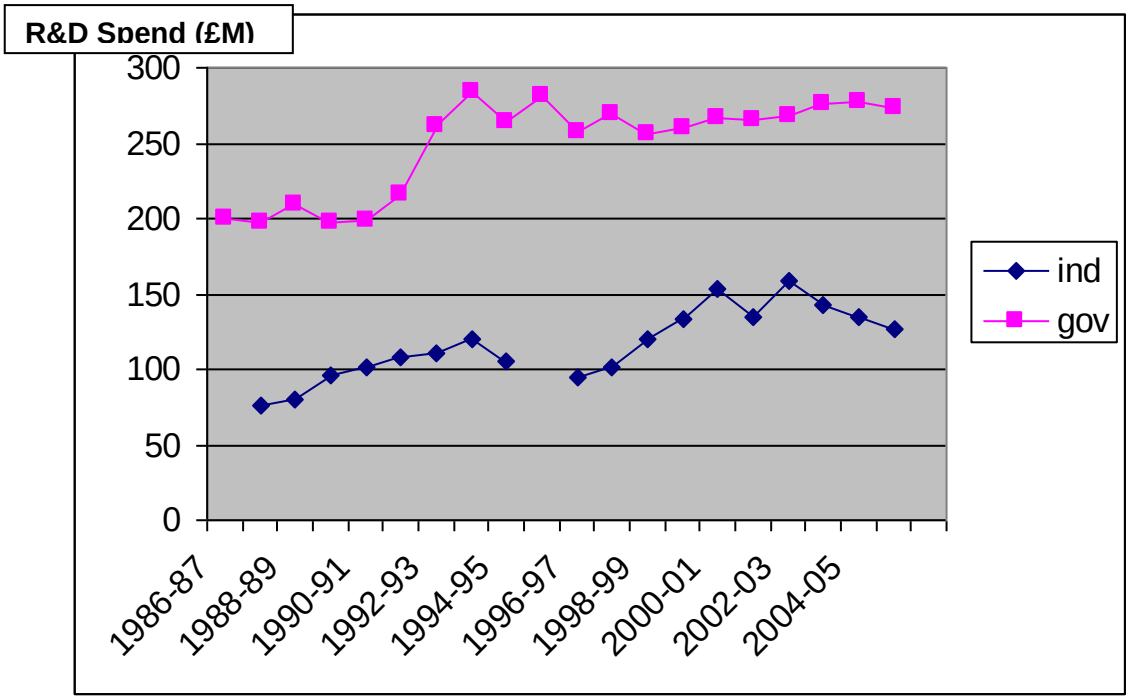
A3.47. However, it is the case that spend by the private sector in the UK on agri-food research is low overall, with R&D accounting for only 0.24% of total agri-food industry expenditure across the EU in 2004. Additionally, this R&D expenditure is concentrated in the bigger multinational companies.

A3.48. The equivalent R&D expenditure for the agri-food sector in the US is 0.35% and in Australia is 0.40%, while Japan is the highest at 1.21% - very low compared to the highest UK investors in pharmaceuticals (33.8%) and aerospace (17%). This low R&D investment is both potentially due to tight profit margins in this sector stifling innovation and in traditionally heavy reliance on the public sector to provide R&D investment.

A3.49. The Barnes review[8] encouraged a move away from near market public R&D spend by the state, and encouraged industry to fund this area directly. This led to the closure of some specific industry focussed schemes within Defra, though others such as LINK (funded by a number of government partners) continued until 2009, when Defra monies were refocused to the Technology Strategy Board, though LINK continues in BBSRC. From the government 'SET Statistics' it can be seen that for Agriculture there has been a cash-terms increase in both industry and Government R&D spend, though recently industry spend has started to drop. Whether this generic review is appropriate in the agri-food context is outside the scope of this report.

[8] *Report on a review of expenditure by the agricultural departments on research and development* (April 1988). The review was led by a senior MAFF official, Mr C J A Barnes.

Graph showing Business Expenditure versus Government Expenditure on Agricultural R&D:



A3.50. There are a number of current initiatives involved in seeking to increase investment in the uptake of new agricultural research and development, which in turn should increase demand for high-skilled people. These are discussed in Annexes 4 and 5.

A3.51. With all these complexities in the sector it is attractive to suggest that an over-supply across all potential skills areas would up-skill the workforce. This has been identified as an impractical and very expensive top-down solution and relies on the ability of government to accurately predict required demand from industry, which it cannot do. This approach also divorces industry from the skills agenda, benefiting neither providers of training nor the link between providers and users; this is essential to effectively improve translation of research into the field. However, it is also important to realise that the demand led drivers are not the only pressure on suppliers, which have other more significant influences such as the RAE.

Annex 4. Niche skills

A4.1. ‘Under demand’ for individuals with specific high-level expertise can also be a feature of ‘niche skill’ areas. These are areas where the number of jobs becoming available for experts every year are very low, but where the expertise that the individuals provide is vital.

A4.2. In May 2009, BBSRC and the Biosciences Federation (BSF; now the Society of Biology following a merge with the Institute of Biology) ran a public consultation on niche areas of research expertise that were strategically important for the UK, but were already vulnerable or were likely to become so. The term ‘niche skills’ was used to indicate that the focus of the consultation was on the problems faced by specialist areas of expertise where the numbers of experts needed may be relatively small, but where they provide a vital contribution to the UK’s ongoing available expertise.

A4.3. A consultation questionnaire was developed jointly with BSF. The questions were designed to ask respondents to provide concrete evidence to support the contention that an area of research expertise was (or was becoming) vulnerable, and also to explain the strategic importance of the UK retaining this expertise. The questionnaire also sought to ask about any action that was already being taken to address the difficulties, and what action BBSRC should take to help.

A4.4. The responses to the consultation were considered by the BBSRC Bioscience Skills and Careers Strategy Panel (BSC), who made a number of recommendations to BBSRC[9].

A4.5. The responses often demonstrated how complex and interconnected the issues are that give rise to a vulnerability in the supply of expertise. For example, a ‘skills shortage’ may seem to concern a shortage of individuals being trained in a specialist area, i.e. a ‘supply side’ difficulty. However, on further investigation, the issue may relate to a shortage of employment opportunities for individuals with the expertise in question.

A4.6. Universities, research institutes and commercial employers may have a very low turnover of staff in certain specialist areas, or posts may be declining because of changes in external funding or commercial priorities. This in turn can send messages back up the skills ‘supply chain’ and influence the decisions that students make about specialising in particular areas.

A4.7. The mix of factors that are causing a particular vulnerability in an area of expertise are individual to that area, but a number of common themes emerged, including issues around:

- Career structures for specialists
- Employment opportunities in the research base
- Changes in public funding for research
- Public and science community perceptions
- Student interest and demand
- Employer demand

[9] http://www.bbsrc.ac.uk/organisation/policies/reviews/consultations/0905_bioscience_research_skills.html

- High cost of training
- Research Assessment Exercise

A4.8. A range of views were expressed relating to strategically important and vulnerable 'niche' research skills in the UK. Niche skill shortages were reported in the following broad areas:

Whole animal physiology

A4.9. Areas mentioned in the consultation included whole animal physiology (*in vivo* skills including the handling of both laboratory and large animals), pathology and toxicology. A lack of skills was reported at the undergraduate and postgraduate levels.

Industrial Biotechnologies

A4.10. Areas included bioprocessing, pharmaceuticals and drug development (including *in vivo* work), fermentation and flavour science. This covers all aspects of production from lab-based R&D to larger-scale manufacturing, formulation and delivery.

A4.11. Generally the shortages were reported at the masters and PhD postgraduate levels, with some areas also reporting a need for more training at the undergraduate and postdoctoral levels.

Plant and Agricultural Sciences

A4.12. A number of distinct areas were identified under this heading, including: plant physiology; plant breeding; plant pathology and pest management; soil science; and horticulture. Further details of these areas are given in the text box below.

Systematics and Taxonomy

A4.13. This area covered systematics and taxonomy for all major taxonomic groups, but with particular emphasis on microbes (including fungi), algae and plants.

A4.14. A number of other areas were mentioned in the consultation, but were not given as high a priority by BSC as those mentioned above. In some cases the evidence provided for the strategic importance or the vulnerability of an area was less strong.

A4.15. Some areas were mentioned that concerned broader areas of expertise, but which did not appear to suffer from the same difficulties as 'niche' areas. Such areas included:

- epidemiology;
- mathematical skills, data management and informatics;
- science communication;
- glycobiology, quantitative biochemistry and analytical chemistry.

Niche skills in plant and agricultural sciences

Responses to the BBSRC and BSF niche skills consultation were received in a number of broad research areas, including a significant number of areas relating to plant and agricultural sciences and in particular: plant physiology; plant breeding; plant pathology and pest management; soil science; and horticulture.

Plant physiology – respondents who cited plant physiology as a 'niche' research area described an ageing population of plant physiology specialists with difficulties in recruiting into this field. Respondents reported a decline in student demand for courses involving plant physiology as a cause of vulnerability of the subject.

Plant breeding – plant breeding was reported as a vulnerable research area within the UK, with a current shortage of qualified plant breeders and a lack of relevant research that transfers basic plant science to crops. Respondents reported a lack of interest from students in the area, resulting in recruitment difficulties for fully trained breeders. In addition, issues around the current strategic focus on molecular disciplines were blamed as one of the causes for the vulnerability.

Plant pathology and pest management – respondents who cited plant pathology and pest management as 'niche' research areas described a shortage in the number of specialist research groups in the UK, with a significant number of experts reaching retirement age. A lack of provision of postgraduate training, due to both the small number of specialist groups, and due to the impact of the Research Assessment Exercise on funding for applied research, were cited as possible causes.

Soil science – respondents described both a lack of specialist soil science jobs being available in the commercial sector in the UK, and a lack of UK trained soil science specialists available to carry out such roles. A lack of adequate funding for research and training, and inadequate links with industry, were described as causes for this vulnerability.

Horticulture – there was a reported lack of horticulture specialists in the UK, with the area being seen as an unattractive career choice dominated by specialists approaching retirement age; a shortage in the number of postgraduate students being trained in the area was described, along with a lack of adequate promotion of the area.

A4.16. However, even with areas of high-level expertise in relatively niche areas, the story can be quite mixed. For example, the British Society for Plant Pathology reports a quite healthy state for its professionals:

Plant Pathology

In plant pathology the number of students graduating with a higher degree and entering employment in the discipline has increased over the last 30 years. This is due to an increase within individual organisations and not as a result of more employers. Though the demand for these skills has increased the exact nature of the skills required has changed moving from applied to more molecular skills.

From: *Report on a Skills Audit*, undertaken for The British Society for Plant Pathology (November 2007), available at: http://www.bspp.org.uk/society/skills_audit_results.php

Annex 5. Supply of High-level Skills

A5.1. This section considers the 'supply side' of high-level skills in terms of new graduates available to move into employment. It must be remembered, however, that a large proportion of the 2030 workforce has already left full-time education, and that the up-skilling of the existing workforce will also be vital to enable the industry to meet current challenges and remain competitive. Nevertheless, the flow of high-calibre new entrants into an industry is important for its long-term success, and this section explores student perceptions and application trends, numbers of students qualifying and their career destinations.

Perceptions of careers in Agriculture

A5.2. A recent report from RASE includes reflections on the perception of Agricultural careers. This provides important context for understanding the attractiveness of the sector to students. One contributor to the RASE report saw clear evidence of a change in the traditional perception of work in the sector as low pay and low skilled:

Perceptions of careers in Agriculture

The following is an extract from the contribution by Richard Clarke - Chairman of Waldersey Farms Ltd, a large scale arable operation in East Anglia and Vice Chairman of the Institute of Agricultural Management:

"Traditionally farming was a low pay sector. Well things have moved on and we now have a much reduced work force utilising advanced equipment and facilities generating outputs per capita which compare favourably with industrial counterparts. Remuneration in farming is reflecting the skills and expertise of the workers. What's more, the normal forces of supply and demand are playing their part – the reality now is of an industry which may be limited in its production capabilities by the availability of skilled workers. The low pay myth needs to be laid to rest. I believe public perception of farming may not be quite as poor as many in the industry feel and moreover I see signs of this perception changing. There is a large section of the population who understand rural and farming matters and who are sympathetic to and supportive of the farming sector.

They and many, many others are becoming increasingly aware of the way major retailers have managed to keep food prices down for the British public by squeezing farmers and growers. All this has happened with the open support of a government which appears to value price more than provenance. But our world is changing. Food supply has become a huge global issue, in but a few months we have seen the era of cheap food recede. For some in the world even the availability of basic commodities has become critical. Suddenly farming and issues of food production are being recognised as of vital importance. So timing on the issue of attracting new entrants is good, there is a window of opportunity to set the record straight and start to bring in the new blood on which the future of the farming depends. Let us be clear that there is no "quick fix" to bringing bright and energetic young people in to the industry, the process must be long term, well planned and co-ordinated with strong and effective management.

Young people entering the industry at whatever level need to have a view of career progression, a difficult matter for an industry made up of many relatively small businesses. Ongoing learning and skills training is essential in order to utilise rapidly advancing technology and processes, to maintain quality and assurance and not least to maintain the financial efficiency of the business. Improving knowledge and skills means more profit!"

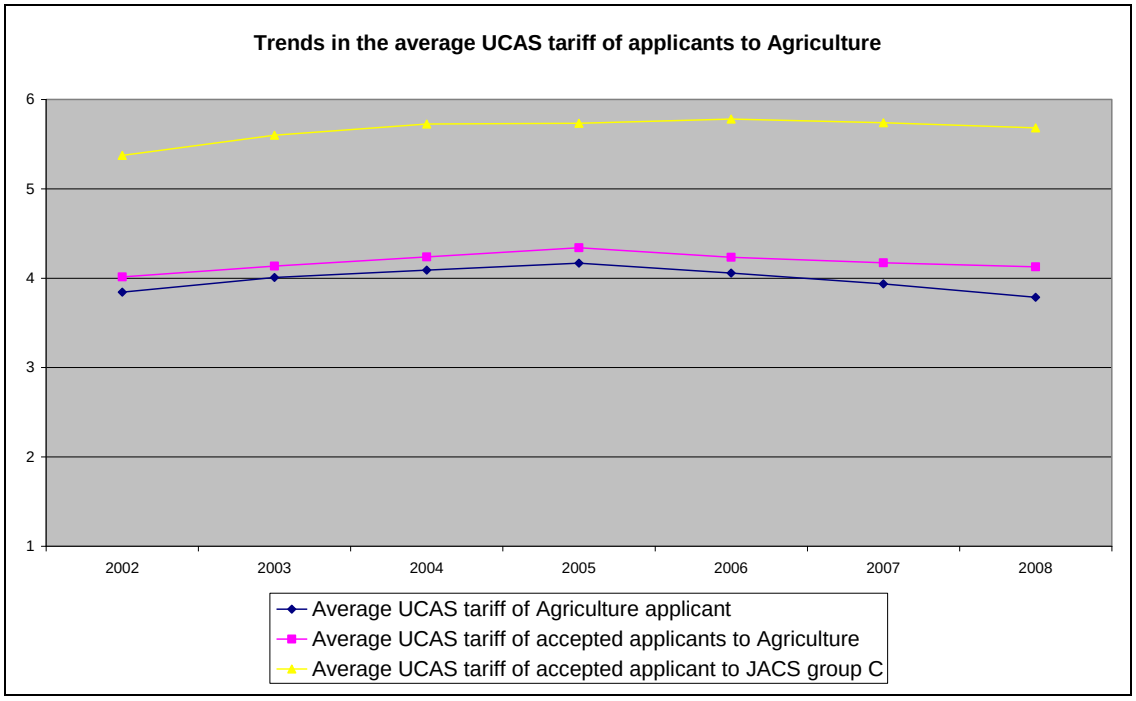
A5.3. Public and student perception of the sector as professional and high-skilled will be vital to ensuring a healthy flow of new entrants.

UCAS data indicating student interest and quality of applicants

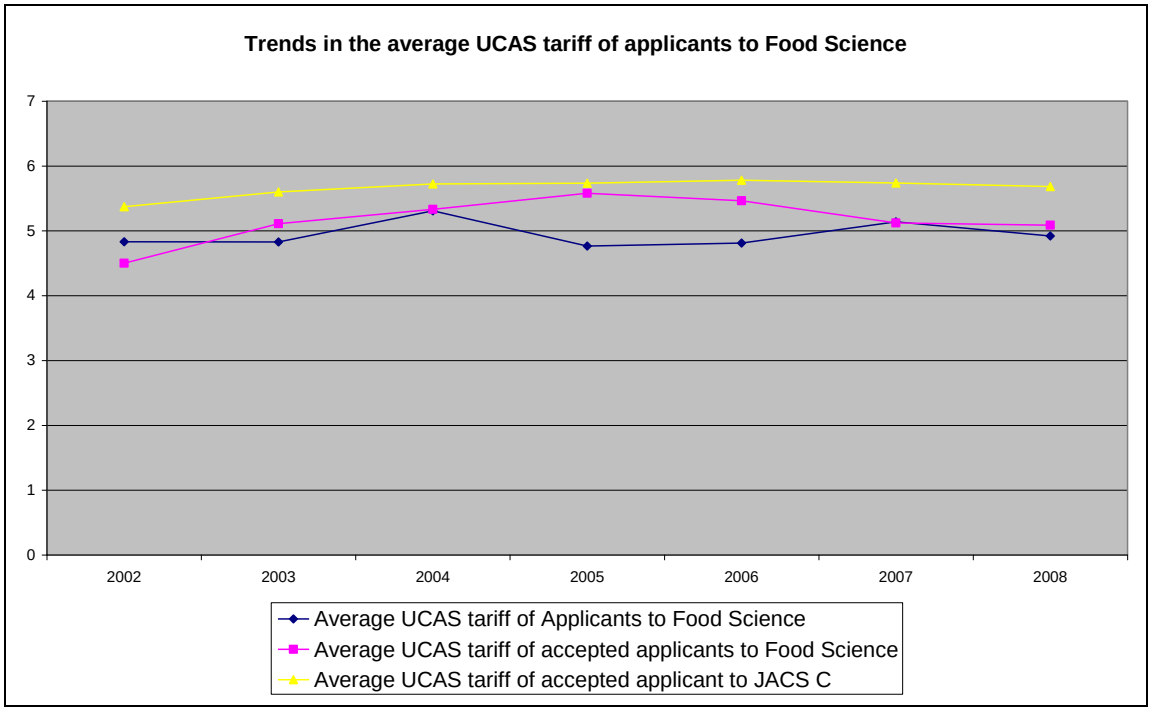
A5.4. UCAS data on applications to agriculture and food science degrees can provide information on student perceptions. Analysis of this data reveals that applications to undergraduate courses classified as Agriculture (JACS classification D4) or Forestry (JACS D5) have been steady since 2002, and that there has been a shift away from applications to HND courses towards degree courses in Agriculture. The number of accepted applicants to Agricultural Sciences (JACS D7), however, has declined from just below 100 in 2002 to only 40 in 2008.

A5.5. Numbers of accepted applications to Food Science (JACS D6) have increased from 250 in 2002 to over 350 in 2008, with a peak of over 450 in 2005 and 2006. The majority of accepted applications to Food Science are to degree courses.

A5.6. The **quality** of applicants, as judged by UCAS tariff, to Agriculture, Forestry and Food Science has remained steady over the period 2002-2008. However, the average quality of applicants and students accepted onto Agriculture, Agricultural Sciences and Forestry courses is consistently and significantly lower than those accepted onto Biological Sciences courses (JACS Code C).



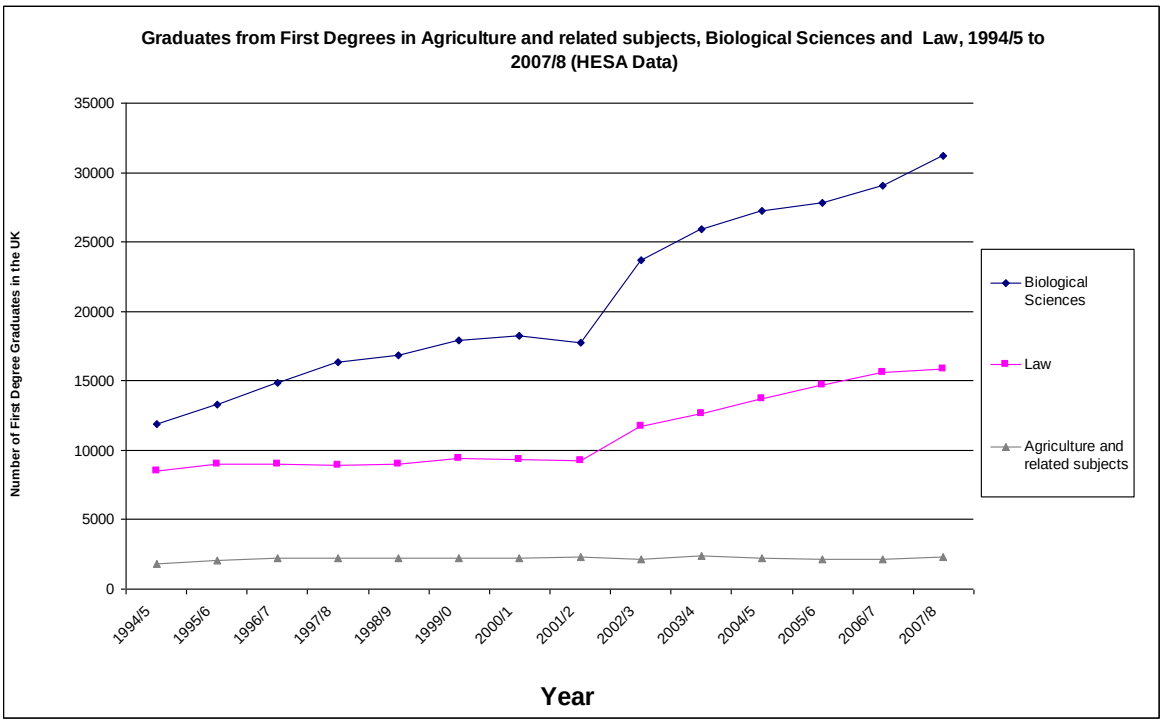
A5.7. However, trends in the average UCAS tariff of applicants to Food Science showed a much closer level compared to Biological Science applicants:



A5.8. Further details of trends in UCAS applications for Agriculture and related courses, including explanations of JACS classifications and further breakdowns, are given in Appendix 1.

Data on student numbers and degrees

A5.9. In the time available for the report, it has not been possible to undertake an exhaustive analysis of data on graduates from Higher Education. The following graph indicates that numbers of students qualifying in Agriculture and related subjects has been stable in recent years – but at a comparatively low level, and certainly not experiencing the same growth in student numbers which is seen more broadly:

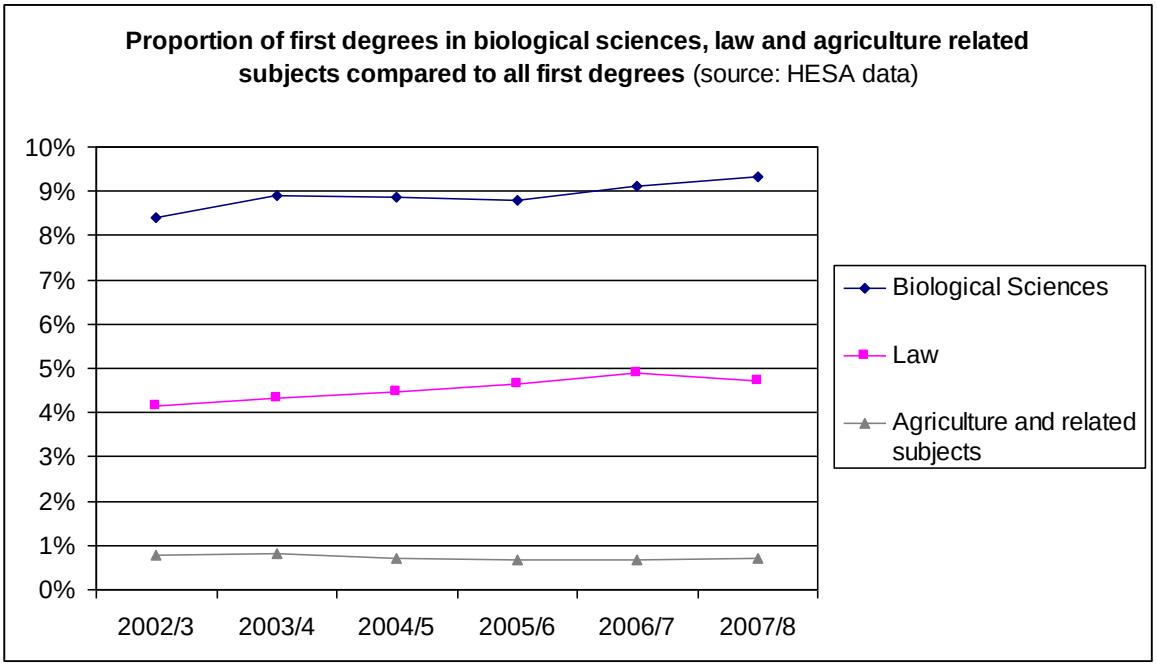


A5.10. The graph above shows trends in the number of graduates from first degrees in the UK since 1994/5: Agriculture and related sciences compared to Biological Sciences and Law. Law is chosen to provide a comparator for a quite different profession (Source : HESA data).

A5.11. Actual numbers of agriculture students are shown in the table below (source: HESA) and show that numbers of undergraduates are fluctuating in the period 2002/03 to 2007/08, with an overall increase of 12%:

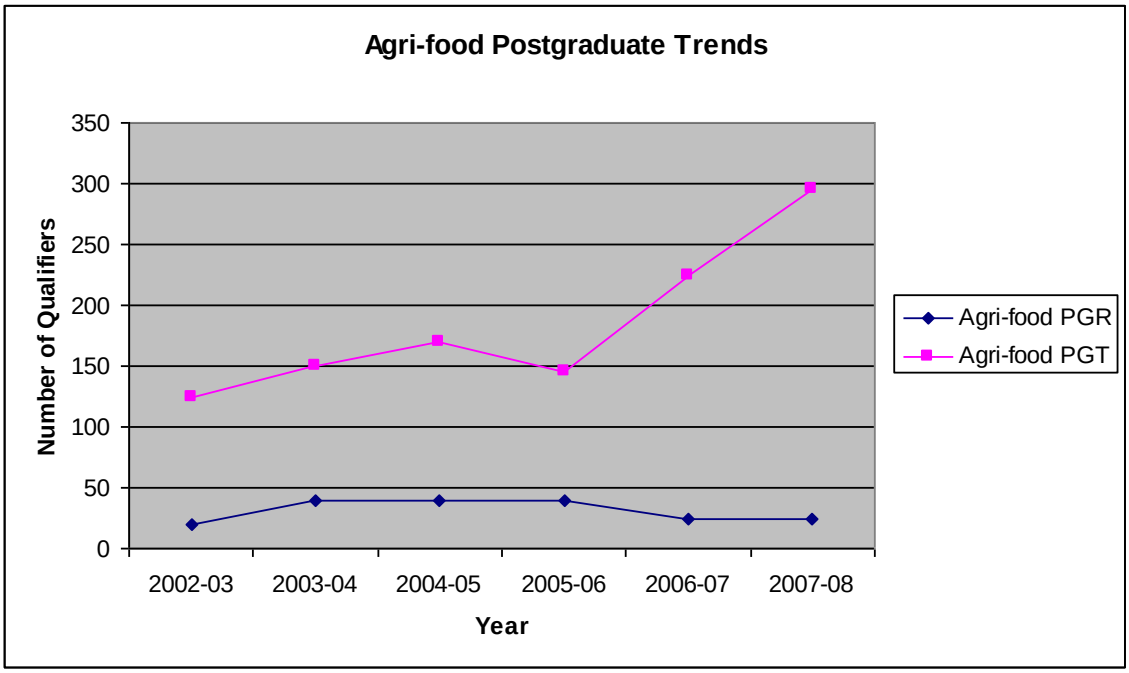
Year	Number of first degrees in Agriculture and related sciences
2002/3	2155
2003/4	2415
2004/5	2225
2005/6	2140
2006/7	2185
2007/8	2410

A5.12. Further investigation of the HESA data indicates that there has been an 18% increase in the total number of all undergraduate first degrees, from 282,000 in 2002/03 to 335,000 in 2007/08. The graph below shows the proportion of biological sciences, law and agriculture-related first degrees relative to all subjects. This demonstrates that despite the significant rise in numbers of biological sciences and law students between 02/03 and 07/08, these represent only a small relative increase in students in these areas – and there is a relatively steady number of students studying agriculture and related subjects.



A5.13. There is some evidence of growth in the number of students taking taught postgraduate courses; however, in agriculture and food disciplines, further analysis would be required to understand whether this growth is due to increases in numbers of international students. HESA identifies that there are a significant number of overseas students from developed and developing countries studying at UK universities – particularly at postgraduate level. The international student market is

extremely competitive and the ability of UK universities to attract overseas students is extremely positive. Food security is a global concern, and international students on agriculture courses in the UK take their new skills and understanding back to their home countries to help develop their local agri-food industries, this issue is discussed in more detail in Annex 9.



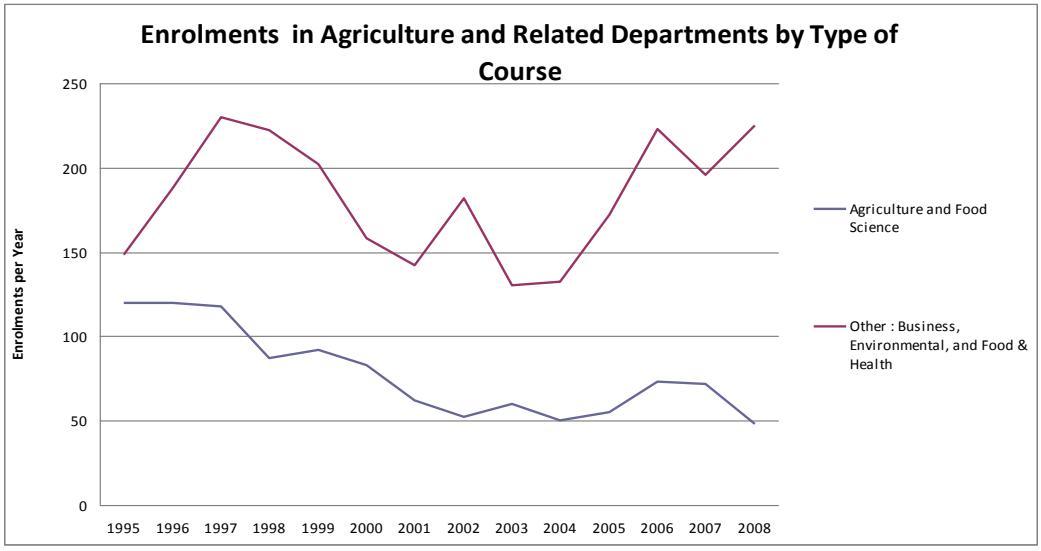
Source: HESA

A5.14. It is also important to note that many degree courses in biological sciences will include modules on cutting edge research relevant to agriculture and food sciences, for example, plant biology, animal genetics, etc, and that students may be choosing degree courses which leave their options more open, compared to degrees which appear more 'vocational'.

A5.15. Extensive further research would be needed to understand more precisely the changes in the number of students leaving higher education with scientific training (e.g. at module level) relevant to agriculture and food.

Case Study: University of Reading

Reading's undergraduate provision in Agriculture and Food has been mapped onto one of four categories – Agriculture and Food Science, Business, Environmental and Food & Health. The chart below shows a significant gap in student interest in courses relating to agriculture and food compared to those with a stronger business focus.



Although Reading hosts a food department and one of the four 'surviving' university agriculture departments, the range of courses provided has changed. Examples of relevant taught programmes withdrawn due to lack of student demand over this period include:

BSc courses: Agricultural Botany; Crop Protection; Soil Science; Agricultural Economics; Biotechnology (food processing related)
Masters courses: Tropical Agricultural Development (Animal Production); Technology of Crop Protection; Crop Physiology; Dairy Science; Grass and Forage Science; Plant Breeding and Crop Improvement; Veterinary Epidemiology; Veterinary Laboratory Management; Food Biotechnology; Livestock Economics and Planning.

Throughout the 1970s and into the early 1980s some 80 students per annum entered Part 1 BSc Agriculture. Combined numbers today entering Part 1 BSc Agriculture and BSc Agricultural Business Management (a new programme introduced around 10 years ago) are around 40-45 per annum. The syllabus of the BSc Agriculture has shifted slightly more towards business over the last two decades. A similar shift in syllabus has occurred in BSc Animal Science: the predecessor of this programme was largely concerned with farm animals, whereas today it is largely concerned with companion animals. Both syllabus changes are the result of student feedback and demand.

RAE Funding and its impact on provision of high-level skills

A5.16. Student demand for courses is an important factor for universities and colleagues in the provision of higher education in a particular area, however, public funding for research undertaken by staff involved in that provision is also crucial.

A5.17. HEFCE analysis of the quality and level of research activity in the research base through the RAE 2008 found an **increase** in the number of researchers actively involved in Agriculture, Veterinary and Food Science (known as UAO16,) and that this increase was broadly in line with the overall increase in research activity in England (30% as compared with 29%).

A5.18. This was in contrast to the lower increase in activity in biological sciences (9%). However, the percentage of researchers rated 4* or 3* was less than the average for UoA16 (47% as compared with 55%).

A5.19. With regards to RAE 2008, the table below shows the change in volume of activity between the final year of funding informed by RAE 2001 and the first year informed by RAE 2008[10].

Table: Changes in volume of activity between 2008-09 and 2009-10

RAE cross-comparison subject code name	Baseline 2008-09	2009-10	Difference	% difference
Agriculture, Veterinary and Food Science	443	575	133	30%
Biological Sciences	1,492	1,631	139	9%
Total England	28,623	36,813	8,190	29%

A5.20. The table above shows that the growth in volume of activity returned to the RAE in Agriculture, Veterinary and Food Science was higher than average, but Biological Sciences was lower. This growth is potentially misleading, however, as two of BBSRC's research institutes, HRI and IGER, moved into the higher education sector (with University of Warwick and University of Aberystwyth respectively) in this period. Therefore, the figures primarily represent a move of research active staff into the university sector, rather than a genuine substantial increase in the numbers of researchers. This move has not, of course, been at the expense of existing HE agriculture provision, as each Unit of Assessment is not treated as having a separate, delimited, funding quotient.

A5.21. In terms of funding for research, the table below shows a 13% increase in funding for both the Biosciences and Agriculture, Veterinary and Food subjects. As part of Main Panel D, Agriculture, Veterinary and Food Science benefitted from the STEM subject funding protection instructed by government in HEFCE's 2009 grant letter.

Changes in **funding** by cross-comparison group and by main panel, between 2008-09 and 2009-10

RAE cross-comparison subject group*	2008-09 mainstream QR quantum plus best 5star funding	2009-10 mainstream QR quantum	Difference in quantum	Percentage difference in quantum
Biological Sciences	59.7	67.6	7.9	13.2%
Agriculture, Veterinary and Food Science	17.7	20.0	2.3	13.0%
Main Panel D: Biological sciences and related	95.4	109.0	13.6	14.3%

A5.22. This data also, of course, does not distinguish between the different subject areas of agriculture / veterinary science / food science, and further analysis of the submissions would be needed to understand the changes at subject level. However, the RAE sub-

[10] To compare volume, HEFCE has matched subjects across the exercises, where necessary aggregating subject groups to allow comparison. In this comparison we have not used submitted volume (all cat A staff regardless of whether they are funded or not) but eligible volume – this varies to a greater degree than submitted volume as it includes the effects of the quality profile.

panel's report[11] provides a more nuanced view of issues within its broad subject remit. Overall, the panel was positive about the state of research in all three areas:

RAE Sub-Panel 16; Agriculture, Veterinary and Food Science

General Analysis
Many submissions had a majority of outputs that were assessed as being of world-leading or internationally excellent quality. There was evidence of integration of research groupings within most submissions. Submissions, particularly from larger institutions, demonstrated good alignment between training, income generation, meeting beneficiary needs and exploiting innovation. **Significant capital and human resource investment had been undertaken across the assessment period.** Overall, the breadth and integration of submissions suggested that institutions were well-placed to respond to challenges and opportunities within the sector and to develop multi-disciplinary programmes that would build effectively on basic biological knowledge.

Agricultural Science
The overall number of submissions was similar to 2001. The size of submissions varied widely. We felt that this variation had led to useful diversity and distinctiveness but recognised that small- and medium-sized entities needed to develop appropriate strategies and investment plans to foster collaboration and maintain sustainability. This was not apparent in all cases.

The quality of outputs was high with almost 40% of the outputs scored as of internationally excellent or world-leading quality. This was enhanced by good evidence for broad-based income generation, **good training delivery** and close links to the beneficiary community. **Investment in facilities** and new staff was significant but not evenly spread across submissions. There was evidence from strategic statements and from some outputs that the sector was **responding well to key challenges** relating to sustainability, climate change mitigation and adaptation, and alternative land use. Although the balance of intra and interdisciplinary work remains weighted towards the former, there is evidence from programmes like *The Rural Economy and Land Use Programme* (RELU) that useful and appropriate integration is occurring. The sector has made **good use of technologies** developed elsewhere and there was evidence of awareness of the opportunities to deliver integrated economic and policy outputs which will be important for future developments, for example through the Living With Environmental Change (LWEC) partnership.

Food Science
The number of submissions was reduced by three compared with 2001. The sub-panel felt that, in general, the individual submissions were well focussed. A diverse spread of research was submitted, reflecting the important multidisciplinary nature of the subject, and both applied and fundamental research featured in the world-leading outputs.

The **quality of outputs was high** with almost half the outputs rated as being of

[11] http://www.rae.ac.uk/pubs/2009/ov/ (go to link for Panel D)

world-leading or internationally excellent quality. Areas of particular strength included:

- fundamental aspects of food microbiology in relation to the control of foodborne disease along the food chain;
- human nutrition (both applied and fundamental aspects) in relation to diet and health;
- food macromolecules and their relationship with functionality and food quality;
- molecular and perceptual aspects of taste and flavour;
- role of pre- and probiotics in diet and health.

Research Excellence Framework (REF)

A5.23. HEFCE are currently developing proposals for a successor to the RAE, the REF. In doing so, they are seeking to enhance the way in which the economic and social impact of research impact is assessed. They have so far developed a proposed approach to assessing impact through informal consultation with a range of stakeholders from the higher education sector, research users, Research Councils and other funders, and expert advice.

A5.24. The assessment of research impact will focus on impacts achieved during the assessment period underpinned by high quality research (which may have been undertaken over a longer period). They will propose that submissions for assessment should include three main elements:

- a number of case studies illustrating the research driven contribution to economic, social, public policy, cultural or quality of life impacts
- a statement (made in a standard format) summarising the full range of impacts for the submission as a whole
- some supporting quantitative indicators.

A5.25. This element in the assessment process is largely new and comparatively untried. For this reason, and given that the timetable for implementing the overall REF is tight, HEFCE plan to run a pilot exercise to test and inform the further development of their approach, which will run from autumn 2009 to mid-2010.

Departmental closures and the impact on provision of high-level skills

A5.26. A paper[12] describing the development of the Agricultural Research Modellers' Group from its founding in 1970 to 2008 shows that the number of departments of Agriculture in British Universities has dropped dramatically from 11 in 1971 to just four in 2008 (Newcastle, Nottingham, Reading and Aberystwyth).

A5.27. In 2004 Llewellyn[13] reported that the land-based HE sector has seen a declining trend in recruitment since around 1997/98, with this part of the HE sector seeing more diversification, rationalisation and mergers than many others. However, because the providers have been relatively small, and spread thinly across the UK, the

[12] France 2008: "The agricultural research modellers' group: past, present and future"
[13] 'An Assessment of Undergraduate Agricultural Student Numbers in the UK' - David Llewellyn January 2004

reorganisation had received only sporadic attention. The major changes in land-based HE provision over the last decade are summarised in the following table:

Asymmetrical Horizontal Mergers		
University of Plymouth	Seale Hayne Agricultural College	1992
University of Wales, Aberystwyth	Welsh Agricultural College	1995
Imperial College London	Wye College	2000
Transfers of Provision		
School of Agriculture and Food Science, Queen's University, Belfast	Outcome of DARD review awaited	Ongoing
Major Rationalisation		
Scottish Agricultural College		Ongoing
FE provision in Wales (affecting the supply of HE students)		Ongoing
Other Changes		
Royal Agricultural College	Move from 'private' to 'public' HE	2000
University of Edinburgh	Closure of undergraduate agriculture provision	2003
Cranfield University	Closure of undergraduate provision in agricultural engineering	2002
FE provision of HE in England	Closure of HND courses in at least 4 major providers	2000-2003

Mergers and acquisitions in the UK land-based HE sector 1992-2003. Source: Llewellyn 2004.

A5.28. Since this table was produced, Seale Hayne and Wye have been closed. However, care should be taken when interpreting evidence of closures and mergers. The closure of Agriculture departments, or their merging with other departments and concentration of activity in centres of excellence, is not necessarily a bad thing because merged departments can be more flexible in terms of succession planning and the modernisation or updating of courses.

A5.29. It is important to also remember that UK universities are just one type of research organisation in the UK undertaking agri-food research:

IATC/UKCDS Agri-food Science Directory

The IATC/UKCDS Agri-food Science Directory lists 280 groups/organisations who have staff who are actively involved in research on agri-food science topics in the UK, half of which are university departments demonstrating the diversity of organisations that have relevant skills to contribute to the global food security agenda.

A5.30. A recent report to the Gatsby Charitable Foundation on the update of plant sciences in the UK indicated that reorganisation and restructuring of biological sciences degrees in Universities had not led to a reduction in the amount of plant sciences being taught to undergraduates, and that there has not been a recent decline in the overall provision of plant sciences at either the undergraduate or postgraduate levels; nor that there is a current shortage of suitably qualified staff for teaching and research.

Case Study: Report for the Gatsby Charitable Foundation on the update of plant sciences in the UK

The following sections are extracts from the recent report 'The Uptake of Plant Sciences in the UK: A Research Project For the Gatsby Charitable Foundation' By The Centre for Education and Industry, University of Warwick, February 2009[14]:

1.2.2 Re-organisation and re-structuring of provision in biological sciences in some universities has led to changes in the way plant science is provided in undergraduate degree programmes and may tend to make the plant science less 'visible'. However, this also helps to secure the position of plant science, creating and maintaining viable courses, and can form part of a strategic view of the development of a more integrated model for biological sciences.

1.2.3 Despite the decline in provision of separately identified degree programmes noted above, and fluctuations in individual institutions, this research has not detected any significant decline over the past ten years in undergraduate plant science provision overall (in terms of availability of opportunity for students to study plant science within degree programmes) in the universities included in the sample.

1.2.4 The evidence from this research does not suggest any detectable decline in postgraduate work in plant sciences in the past ten years, although the proportion of PhDs in plant science has remained relatively low compared to other branches of biological sciences. Also, most respondents in this research did not report difficulty in recruiting postgraduate students where studentships were available. However, some respondents did report difficulty in securing funding support for postgraduate work in plant sciences e.g. where plant science staff were in a minority within a department, school or faculty, they were in a weak competitive position in securing funding and studentships.

1.2.5 The evidence from this research did not suggest there was a current shortage of suitably qualified staff for teaching and researching plant science at undergraduate and postgraduate levels. Also, with isolated exceptions, there did not currently appear to be significant difficulty in recruiting new staff.

HEFCE funding for teaching in agriculture and food science

A5.31. HEFCE is not aware of any evidence to suggest that agriculture and food science are disadvantaged within the HEFCE funding formula. If anything, there may be some perceived advantage due to ELQ exemption and specialist institution funding within its current teaching funding allocations, and the STEM ring-fence applied to research funding this year.

A5.32. Rather than a disadvantage HEFCE have noted that agriculture and food science may be viewed by some to receive advantages within the funding system compared to other subjects due to two factors:

[14] http://www2.warwick.ac.uk/fac/soc/cei/news/finalprintversiongatsbyplantsciencereport.pdf

A5.33. At the time the government announced the withdrawal of funding for equivalent and lower qualifications (ELQs), land-based studies were identified as a strategically important and vulnerable subject. HEFCE have, therefore, provided an allocation to mitigate the effect of this funding change in these subject areas.

A5.34. Two small and specialist institutions with agriculture and food provision – Harper Adams and the Royal Agricultural College amongst others – receive exceptional funding to reflect two factors: (i) their engagement in activities which produce additional public value over and above that produced by other institutions not in receipt of the funding; (ii) additional costs incurred due to the specialist nature of the institutions which could not be met from other funding streams.

A5.35. HEFCE determines its price groups on the basis of evidence of costs incurred, currently derived from HESA, but in due course to be informed by TRAC (Transparent Approach to Costing) for teaching. This evidence places courses relating to agriculture and food science in price group B alongside other science subjects, thereby receiving a weighting of 1.7 within their funding formula (£6,710 per FTE student in 2009/10).[15]

A5.36. HEFCE plans in due course to review their price groups, drawing upon the latest TRAC data. There is no evidence from TRAC at this point to suggest that the subjects currently included within price group B are disadvantaged within the funding system or should receive a greater share of the available resource.[16] They plan to consult with the sector further on the application of TRAC T to price groups over the course of the next year.

A5.37. HEFCE's Strategically Important Subject Advisory Group, chaired by Peter Saraga, former Managing Director of Philips Research Labs UK and former HEFCE Board member, plays a key role in identifying strategically important subjects and the principles on which HEFCE should base its intervention.[17]

A5.38. The strategically important subjects advisory group designated land-based studies (LBS) as vulnerable in 2005. HEFCE completed a review of LBS in April 2007, chaired by Professor Maggie Gill, which found no immediate threat to the sustainability of LBS provision in England. In response to this, the HEFCE board agreed that the subject should no longer be deemed vulnerable, though like many subjects it should still be classified as strategically important.

A5.39. Acting on key recommendations of the review, the wish to develop employer engagement activities in the sector, and a strong partnership-based bid, HEFCE announced in July 2008 a £4.5 million package, designed to provide new services to land-based businesses, including work-based learning, training and continuing professional development.[18]

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[15] See Annex H of the HEFCE circular at http://www.hefce.ac.uk/pubs/hefce/2008/08_37/

[16] TRAC T data is available at http://www.hefce.ac.uk/learning/funding/price/#review and we expect to publish an update later in 2009.

[17] A brief guide outlining HEFCE support for and approach towards strategically important and vulnerable subjects is available on the web at: http://www.hefce.ac.uk/AboutUs/sis/group/

[18] Further information available at: http://www.hefce.ac.uk/AboutUs/sis/land.htm and the REEDNet case study at paragraph 5.10

A5.40. The report did designate that this situation should be kept under review, and there have been clear and significant shifts in government policy and in the wider agri-food landscape since its publication; a view supported by the reports chair:

Comment from the Chair of Land-based studies review

The HEFCE report on Land-based subjects identified certain interventions to maintain the skills base in land-based studies, but supported the removal of land-based studies from the vulnerable subjects list. However it was also acknowledged that scientific policy challenges are fast moving and that it may be appropriate at a later date to review this position. The food price spike in 2008 and the recognition of likely future price volatility, food is now receiving considerable attention at a strategic level within the UK government and Devolved Administrations. I support an update review of the wider provision of Agri-food skills especially in the context of its importance relative to subjects receiving STEM status and thus consideration of an increase in associated funding.

Maggie Gill, chair of land-based studies review.

Annex 6. Mismatch Between Supply and Demand?

A6.1. This section now turns to the issue of whether, on the basis of the previous considerations of demand (skills gaps or skills shortages) and supply (qualifications or factors impacting on skills providers), there is evidence of a mismatch.

A6.2. Again, due to time constraints, the Sub-Group has had to make use of existing data. A more finely-grained analysis of a any mismatch between employer demand and skills provision would need to consider other factors such as wage inflation, overtime working, reports of hard-to-fill vacancies and skills shortage vacancies, etc, which were are not available here..

First destinations of Agriculture graduates

A6.3. Data on student destinations can provide a useful insight into the demands for graduates with particular high-level skills. However, it must be remembered that the numbers of new graduates entering employment in the sector is only a minor part of the demand for high-level skills in a sector, which will also include employer demand for the up-skilling of the current workforce.

A6.4. The HESA 'Destination of Leavers from Higher Education' surveys provide data on the immediate employment destinations of students. Longitudinal surveys are also periodically undertaken and the most recent, published in September 2009, looks at the employment of graduates from the 2004/05 cohort, 3.5 years after graduation.

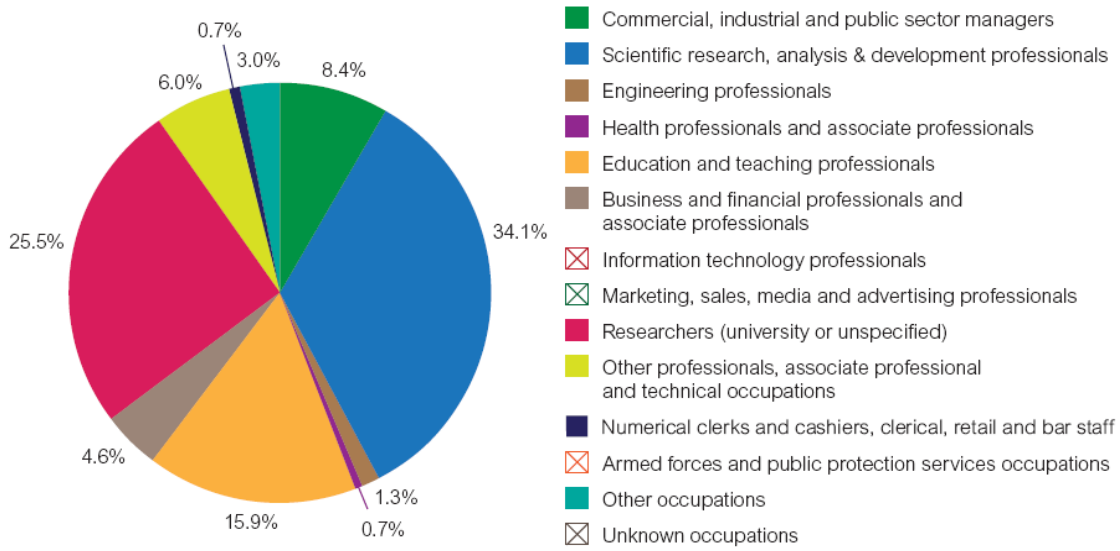
A6.5. The survey shows that at the early survey stage, 46.9% of graduates from agriculture and related subjects were in a non-graduate occupation (compared to average of 27.7% across all subjects), and that after 3.5 years, 31% were still in non-graduate occupations (compared to 18.9% for all subjects). Graduates from agriculture and related subjects had the lowest proportion of employment in graduate occupations of any subject grouping.[19]

A6.6. The Vitae report 'What do researchers do? First destinations of doctoral graduates by subject'[20] provides an analysis of a study of 250 UK-domiciled Agriculture **PhD graduates** (5% of the Biological Sciences cohort) and shows that:

- The education sector, largely higher education, absorbed the most respondents employed in the UK (51%), rather than the commercial sector (17%).
- Research roles were the dominant occupations: analysis of SOCs (Standard Occupational Classifications) shows that research occupations accounted for a total of 60% of agriculture respondents employed in the UK (with 28% in research staff roles in HE). These are lower than the biosciences discipline averages (64% and 36% respectively), but above those for respondents in all subject areas (35% and 23%).
- Education and teaching professional roles accounted for 16%, well above the average across Biological Sciences subjects (9%), though below the average for respondents across all disciplines (22%).

[19] See: Destinations of Leavers from Higher Education Institutions, Longitudinal Survey of the 2004/05 Cohort: Key Findings Report, http://www.hesa.ac.uk/dox/dlhe_longitudinal/0405/Long_DLHE_0405_WEB.pdf
[20] See: http://www.vitae.ac.uk/policy-practice/107611/What-do-researchers-do-2009.html

Figure 1: Types of work entered into by UK-domiciled PhD respondents employed in the UK, graduating in 2003–2007 in agriculture, based on Standard Occupational Classifications (SOC) returned in the DLHE surveys



(Source: Vitae 2009 report 'What do researchers do?')

A6.7. The reasons why students choose to pursue a particular career or not once they have graduated will, of course, be very varied. Students will be influenced by information available to them about pay and employment conditions, as well as opportunities for career progression. Employers are in a market to attract high-calibre students into their sectors and need to ensure that the career opportunities they offer remain competitive compared to other employment sectors.

A6.8. Where there are hard-to-fill vacancies, employers effectively are competing to recruit people in competition with other careers, and this can lead to a rise in salaries. An increase in salaries in turn sends a 'demand signal' back down the skills supply chain, stimulating interest in the job role.

A6.9. Where salaries are advertised below average graduate starting salaries, employers are likely to be relying on the jobs being attractive to individuals for other reasons (e.g. quality of life or career prospects) – see, for example, the salary levels described for Field Trials Officers below. However, evidence of salaries rising faster (or not) than comparable roles in other sectors is itself often taken as evidence of a skills shortage (or not).

Field Trials Officer

Field trials officers develop and manage research trials in the field or laboratory. Depending on their experience, they can be involved with the entire process of planning trials or oversee one particular stage of the research procedure.

By liaising with scientists and matching their requirements with the trial site or laboratory, trials officers play a key role in making large-scale scientific research happen.

The results of research trials are used to inform development decisions in agriculture. Analysis of these results can form a report or presentation. This is not currently present in all positions but is a developing trend being requested by clients.

Work Conditions

Range of typical starting salaries: £16,000 - £19,000 (salary data collected Sep 07).

Entry Requirements

Relevant degree subjects include life and medical sciences and agricultural and horticultural sciences. In particular, the following degree subjects may improve your chances:

- biology/biological science;
- botany/plant science;
- agriculture;
- crop science;
- horticulture.

From: Prospects / Agcas occupational profile, available at: http://www.prospects.ac.uk/downloads/occprofiles/profile_pdfs/S1_Field_trials_officer.pdf (Emphasis added)

A6.10. At a broad level, therefore, the Sub-Group found no clear evidence of an overall supply-side shortage for high-level skills, and evidence that in some sectors that there are more high-skilled people than there are jobs available.

A6.11. It is likely that some perceptions of a shortage of 'skills' by professional societies and bodies are based on an understanding of the *need* for specialist expertise for the long-term success of the sector, but which reflect, more accurately, a shortage of jobs employing people to use high-level expertise, with the result that key areas of expertise are disappearing from the sector. In other words, the perceived shortage of expertise may in part actually be a *real* '**under demand'** for it – i.e. a low level across the sector of employers willing to invest in retaining or creating roles for people with high-level expertise.

A6.12. In specific cases, where employers are concerned to ensure the supply of high-quality graduates, there is evidence of the use of student bursaries. Food Industry scholarships are received, for example, from food retailers:

Food industry / retailer	Total annual contribution
Northern Foods	£30,000
GlaxoSmithKline Nutritional Healthcare	£6,600
Sainsbury Scholarship	£7,250
British Soft Drinks Federation	£4,000
Other Scholarships	Occasional scholarships usually around £1000
Reading Sixth Form Summer School	£9600

Food Industry Scholarships at the University of Reading in 2009

Northern Foods

10 students per year (selected by application form) receive £1000 for each taught year of their course. Same offer to Leeds and Nottingham. Has been running for the past 2 years and was originally set up to run for 3-5 years. There is no tie-in to placements or graduate recruitment.

Total contribution pa= £30,000

GlaxoSmithKline Nutritional Healthcare

2 students per year receive £1100 for each taught year at Reading**.** Scholarship goes to the two students with the highest A level science points. No tie-in with placements or graduate recruitment.

Total contribution pa= £6,600

Sainsbury Scholarship

The three top students (based on Part 1 exam results) receive £500, £300 and £150 prize respectively, plus a guaranteed place on a selection centre for a placement. Students selected for a placement receive £3000 for their second year. Following a successful placement they receive a further £3000 for the final year, plus a job offer. They then receive a £300 golden handshake when they join the company. This is offered to 5 universities, Reading, Nottingham, Leeds, Queens and Surrey. Note also that Surrey this year have announced they are closing their Food Science programme and will concentrate on Nutrition and Dietetics only.

Total contribution = £7,250

British Soft Drinks Federation

Two students receive £1000 each for Part 2 and Part 3. Students selected by the Department – criteria such as student effort, financial need etc are used to select them. This is offered to Reading students only.

Total contribution= £4,000

Other Scholarships

There are occasional scholarships for students in the final year who have been offered a graduate post following a successful placement. These are usually around £1000.

Reading Sixth Form Summer School

Student sponsorship is currently £320 per head. This year Reading received the following:

Tesco – 10 students
M&S – 6 students
Northern Foods – 5 students

GlaxoSmithKline – 2 students
Sainsbury – 3 students
Waitrose – 2 students
Asda – 2 students

Total sponsorship =£9600

The Nottingham Summer School

For 14 years plus – similar amounts. This year it was funded from IGD money. Next year they are likely to be looking for industry funding.

A6.13. However, alongside possible under-demand at sector level, there are still clear areas of niche expertise where recruitment difficulties are the result of a supply-side failure. These are niche areas of expertise which are strategically important for companies and the public research base, but where the turnover of staff is low, meaning that there is little attraction for students to specialise in this area. These areas raise particular training challenges for organisations relying on the specialist skills in question.

A6.14. Evidence from the BBSRC/HEFCE Study of Land-Based Facilities and Resources (May 2009) also shows considerable variation in the extent to which research organisations with strategically important facilities use them for training, or are engaged in succession planning to ensure that new specialists are trained-up to replace retiring staff. The failure of an organisation, public or private, to plan ahead to ensure that it will have the expertise it needs when a key member of staff retires constitutes, arguably, an unacceptable risk to its long-term sustainability.

A6.15. The failure to invest in the training of new staff, or the failure to adopt a business model which accounts for the need for investment in replacement staff ahead of the retirement of key experts, is also a form of 'demand-failure' from the organisation as an employer. The organisation expects to be able to find a highly qualified individual off the shelf, rather than having in place a long-term strategy for investment in its human resources, which in turn will provide employment opportunities and career ideas for the next generation.

A6.16. This approach may be due to the existence in the past of distinctive funding streams which acted as a 'proxy demand', attracting high-calibre individuals into careers in agricultural science. One example that is often cited is the ending of the MAFF Studentship scheme.

Case study: MAFF studentships

The MAFF Postgraduate Studentship scheme primarily funded PhDs in agriculture-related science and agricultural economics. Projects were selected by academic panel and they were not directly connected to the rest of the R&D Programme.

The scheme was set up in the 1940s and did not incur a large annual spend: around £1.3-1.5m per year on MSc and PhD studentships in a variety of UK universities. Around 50 new PhDs and 25 MSc's were funded each year, with allowances paid to students, with the former MAFF financing around 150+ students in any one year.

The scheme was phased out in the late 1990s following scrutiny of Departmental funding, on the basis that supporting studentships in this way was not a core

MAFF activity and more within the remit of Research Councils.

The closure of the scheme was received with external criticism, particularly where university departments felt that the research councils did not fund such applied topics; since then the gap has been filled to a limited extent by Universities themselves (e.g. Reading, Nottingham) and levy sectors (HGCA, PCL). Noticeably, PhDs funded solely or jointly by levy bodies are closely associated with ongoing projects or priorities.

A6.17. However, the BBSRC/HEFCE Study provided clear examples of how strategically important research facilities were investing in staff resource and training to ensure the continuity of available expertise.

IAH Pirbright – Insectaries: Arbovirology programme

The programme of work within Arbovirology is designed to provide information on certain internationally important arboviruses that pose a threat to animal health and welfare, and trade, in the UK and elsewhere. In recent years work has focussed primarily on bluetongue virus and to a lesser extent on African horse sickness virus and other Orbiviruses, and has utilized a multidisciplinary approach that has proved highly effective.

Over the last 5 years Arbovirology has won research and reference laboratory grants to a value of well over £8,000,000. Many of these have enhanced our high international research standing as collaborations have included partners in around 20 overseas countries. In addition we have had 12 successful PhD studentships and 4 MSc studentships.

Over the last 3-5 years Arbovirology staffing has increased from approximately 9 to over 20, with appropriate increases in funding to support the extra staff.

Extract from IAH submission to BBSRC/HEFCE *Study of Land-Based Facilities and Resources,* Arthur D Little (May 2009) available at: http://www.bbsrc.ac.uk/organisation/policies/reviews/operational/0905_landbased_facilities_report.html

A6.18. The general evidence would appear to indicate that there is a need to raise demand for high-level skills by helping employers understand the benefits that high-skilled and specialist individuals can provide to a business, while also ensuring that the need businesses have for niche areas of expertise are communicated to training providers.

A6.19. One key aspect to changing the supply to meet demand is the time lag new demand signals take to result in modification of supply. There was not extensive data to identify this but conceptually to generate new PhD in a niche area may require several years when combining training time with the time required to modify the supply provision. It is therefore important that the industry up-skills existing workforce to meet immediate demands in addition to horizon scanning to identify future needs and conveying these needs to the supply chain.

A6.20. Mechanisms for achieving these outcomes are considered in the next section. It looks at current efforts to tackle the issues identified, and ways in which current solutions could be expanded or strengthened.

Annex 7. Examples from industry on in-house skills activities and niche skills gap

A7.1. A survey was conducted by IGD on recruitment and skills gaps in PIC member companies, which include major food retail, manufacturing, wholesale, and foodservice companies.

A7.2. The results are based on responses from eight major food and drink companies, including retail, foodservice, wholesale and manufacturing. The summary below provides aggregated, average and anonymised results from the survey. Given the small sample size, the summary should be interpreted only as examples of industrial skills issues, and not necessarily representative of the sector as a whole, which comprises thousands of individual companies of a wide range of sizes. It should also be noted that not all respondents recruited into each job function outlined in the survey.

A7.3. In addition, Appendix 1 includes a summary or food and drink manufacturing from the sector skills council Improve.

Summary of results from eight responses to the IGD survey on recruitment/skills gaps in PIC member companies

1. Current vacancies

Job functions	**a) Aggregated number of vacancies in the last 12 months**			**b) Av. vacancies as % of full complement in this skill area**	**c) Av. time taken to fill a vacancy (in *weeks*)**	**d) Main channels through which vacancies are filled**	**e) Av. length of service in role (in *years*)**
	Graduate level	Post-graduate level	Total				
Food science	31	1	32	13	14	Internal moves, agencies	8
Food technology	71	39	110	16	13	Graduate programmes, plus as above	7
Food safety	7	19	26	19	8	"	6
Nutrition	1	3	4	5	12	"	7
Dietetics	0	1	1	25	7	"	-
Packaging technology	9	3	12	20	17	"	7
Agriculture/ agronomy	5	2	7	19	12	"	5

Column a) provides aggregate numbers, columns b)-e) present averages across respondents.

N.B. Some respondents presented aggregate information across food science and technology. In these cases the information has been included under 'food technology'.

2. Main reasons for any delays in filling these advertised positions

The following are anonymised verbatim quotes:

Company A: “For food safety, nutrition, and dietetics positions it takes time for candidates to understand what [company] has to offer them by way of a career. Once we have explained this we don’t generally find too much trouble recruiting”.

Company B: For all but agriculture/agronomy “[company] looks to recruit graduates and post graduates with the skills to be fully effective in role early on. Due to the limited provision of appropriate degree courses within UK, this reduces the pool of candidates available. To address this [company] has built close relationships with universities in UK, Italy and Germany who offer Food or Packaging Sciences, in order to build industrial relevance and skills into the programmes and build relationships with candidates”.

Company B: For agriculture/agronomy “limited numbers of graduates with appropriate combination of technical and commercial acumen needed for procurement”.

Company D: for food science/technology “reasons for delay in filling roles include: location of company’s sites, requirements to do extensive UK travel, requirement for technical expertise plus leadership skills”.

Company E: for food technology “Breadth of the roles – these positions are increasingly more complex and require a greater breadth of skills and broad business understanding from candidates”.

Company E: for nutrition/dietetics “the challenge with roles within nutrition and dietetics is that we do not have a large number of positions in these areas, but require our product technologists to have an understanding of this. The challenge is therefore in attracting candidates from these areas into our food technology roles”.

Company E: for packaging technology “we are increasingly finding that even our suppliers are struggling for resource in this area as it becomes a larger issue. The challenge is in making the opportunities attractive to potential candidates. We have recently had some successful graduate placements within this team with feedback suggesting there are more to these roles than candidates may first think. Our challenge is to work with candidates to demonstrate this”.

Company F: “no difference”.

Company G: “searching for specialist type skills takes longer and matching with renumeration packages can take time”.

Company H: “Not enough qualified people!”.

3. Any *additional* incentives offered when recruiting into the job functions

The following are anonymised verbatim quotes:

Company A: None

Company B: “[company] provides support to universities offering courses in [all but agriculture/agronomy] the UK and Italy. This includes sponsorship or support for post-graduate students completing appropriate masters of PhD research... and industrial placements for 3 graduates per year... These initiatives provide access to and build relationships with future candidates. We have not needed to offer recruitment incentives”.

Company C: None

Company D: None

Company E: “for graduates, an opportunity to travel the world with the company’s suppliers prior to commencing their graduate scheme. Also higher salaries than some other graduate schemes.”

Company E: “for postgraduates/direct hires: “we continuously benchmark our salaries to ensure that we remain competitive in the marketplace. We have a strong corporate total reward strategy which includes the provision of cars for all product technologists. We work hard to develop and maintain relationships with industry bodies including IGD”.

Company F: None

Company G: None

Company H: None

4. Remedial actions required

Company A: None

Company B: Agriculture/agronomy – “looking at giving agronomy training to general commercial/procurement graduates.”

Company C: None

Company D: “Work with [UK agricultural college] to support the development of our employees, including employees on a specific category education programme.”

Company E: Food technology – “In order to build on our attraction campaign and to increase awareness of the scope of careers within the food technology area we have developed partnerships with several key universities, working with the students and staff on food-related degree courses. Activities conducted in partnership with these institutions include:

- Guest lectures
- Sharing research and insights
- Sponsoring students; competitions etc
- Summer and 1 year placements as key recruitment pipelines for the main graduate schemes
- Supporting summer schools at Nottingham and Reading universities
- Giving insight into the opportunities available at [company] for graduates with the degrees in question. This includes taking along an existing graduate to talk about their experiences and to bring this to life.

This is delivered internally via HR and product technology teams”.

Company F: None

Company G: None

Company H: None

5. Other comments

Company B: “Levels of recruitment are predominantly due to growth rather than replacement. Due to the limited candidates in the food sciences, [company] has focused on bringing in graduates and post-graduates in the early stages of their career. Through strong retention in this area we are able to develop capability and promote internally to fill senior roles. New graduate recruits have been taken from Nottingham, Bath, Newcastle, Glasgow and Leeds this year”.

Company C: “The nature of our business... leads us to seek graduate level recruits

with several years of food manufacturing experience. Any additional training tends to go into broadening their category exposure rather than anything that could be termed remedial"

Company D: "I would stress that 10 vacancies in 12 months is not the norm. We went through a restructure within our Foods NPD department and as a consequence had 7 vacancies".

Company E: "the challenge for all these roles is to help candidates see the broad and lasting impact that these positions have and the value these roles add across our organisation and into society".

Company F: "We're currently not struggling to recruit within any function or role. This may change as we move out of recession. Some of our locations can be more difficult to recruit professionals into, but relocation is offered to all middle managers and above who live more than 30 miles or 1.5 hours journey time"

Appendix 1: Aggregated information on food and drink manufacturing from IMPROVE (sector skills council for food and drink manufacturing).

N.B. The following information covers SOC codes for which data is gathered and available. It covers food and drink manufacturing over the last 12 months.

A1. Current vacancies

<table>
<tr><th rowspan="2">Job functions</th><th colspan="3">a) Av. Number of vacancies in the last 12 months
(if possible please split into graduate level and post-graduate level)</th><th>b) Vacancies as % of full complement in this skill area</th><th>c) Av. Time taken to fill a vacancy (in months)</th><th>d) Main channels through which vacancies are filled</th><th>e) Av. Length of service in role (in years)</th></tr>
<tr><td>Graduate level – including foundation degrees</td><td>Post-graduate level</td><td>Total Vacancies</td><td>9%</td><td></td><td></td><td></td></tr>
<tr><td>Food science
Food technology
Food safety
Nutrition
Dietetics</td><td colspan="2">No. of pure FST roles across the sector = 9,000.
No. of associated professional and technology roles 26,000.</td><td>2,360</td><td>We forecast a need to find 15,000 replacement FST, technology and associate posts by 2017.</td><td>This differs from region and nation to nation dependent on local access to FST graduates and FE/HE institutions</td><td>Internal industry advertising

individual company advertising

Little referral to jobcentres

Specialist agencies</td><td>18% stay 11+ years

27% stay 5-10 years

28% stay 3-5 years

4% stay 1-2 years</td></tr>
<tr><td>Packaging technology</td><td colspan="7">This area has only recently been transferred to Improve and research is only just being carried out (see over page)</td></tr>
</table>

Agriculture/ agronomy	This area is part of the footprint of Lantra, the landbased industries SSC. We only cover farming it if involves on-farm processing.

A2) Main reasons for any delays in filling these advertised positions

Job function	Reasons for delays in filling roles
Food science	Suggestions that previous difficulties in recruiting and retain FSTs is easing due to current economic climate and slight increase in the number of FST courses now available (up by 111 over past 12 months). Also some "fueling" of market due to a number of companies closing – but these latter additions are mainly local in impact eg Serious Foods in Wales going out of business and Memory Lane and Beacon Foods taking on their Technical Team.
Food technology	
Food safety	
Nutrition	
Dietetics	
Packaging technology	

A3) Any *additional* incentives offered when recruiting into the job functions

Job function	Additional incentives offered
Food science	Overall what we have identified from research is the potential for a clear wage spiral amongst experienced FST staff across the sector. The constant shortage, although subject to fluctuation regionally and nationally, remains high and salary levels are creeping up – note the adverts in Food Manufacturer for experienced FST posts at £50k plus.
Food technology	
Food safety	
Nutrition	
Dietetics	
Packaging technology	

Annex 8. Limitations of the data

A8.1. As noted in the introduction, Agri-food research is influenced by the large number of sectors, scientific disciplines and stakeholders involved. This therefore makes it complicated to gather meaningful metrics at a global level, making it critical to disaggregate data into meaningful packets. This issue also highlights the dangers of looking at aggregated data and drawing global conclusions that may not apply to the particular sub-sector; examples of this issue are discussed in more detail below.

A8.2. In this report we have specifically limited the remit to level 4 skills and above, which in addition to employers and appropriate government departments with responsibility across the skill levels fall under the remits of HEFCE, the HEI sector and the research councils. In the recent report from Lantra (A3.22) it is clear that there has been a significant drop in the number of people in the industry; however, the numbers at level 4 and above have not fallen. Similarly from Lantra data (A3.22), industry is predicted to have a shortfall in skills in the future, which has recently been reported by a number of organisations as proof that more investment is needed in Universities in this area. However if you disaggregate this (A3.23) it is clear that the shortfall is actually in Level 3 skills and not Level 4, which is therefore not the responsibility of the HEI sector.

A8.3. There is also an issue of aggregation within “Level 4 skills and above”, which amalgamates degrees, MSc, PhD as high-level. This might be appropriate for employers wanting graduate calibre recruits, but it is not helpful for employers at research organisations who might require PhD and post-doctoral experience and therefore require separation of level 4 and 5, and potentially the separation within level 5 of MSc, PhD and post-doctoral qualifications. None of the demand data here is disaggregated to that level; therefore, it is impossible to comment on the supply/demand issues at, for example, the PhD and post-doctoral levels.

A8.4. When discussing high-level skills in the industry it might be assumed that this applies to Agriculture or other science graduates. However, Lantra data (A3.22) measures the relative skill levels of the workforce and does not try to disaggregate the different degree subjects. As such, the data may potentially include social science or management graduates and this could affect both the supply and demand sides. Therefore, both prediction of future requirements and measurement of current supply do not address the niche skills that individual employers might require.

A8.5. The Joint Academic Classification System (JACS) is used by HESA to sub categorise different academic disciplines. Research funders use the same classifications: codes start with a letter and each number after that demotes a level of division (see example below). Thus using JACS coding it should be possible to identify the supply of agri-food high level skills. For some core disciplines this is possible, for example Biological Sciences (JACS code C) or Medicine and Dentistry (JACS code A). However, with the amalgamation of university departments, degrees are now more cross-disciplinary and many degrees which may have significant agri-food components may now be classified under a more generic heading. Therefore, JACS coding alone cannot be used to classify Agri-food skills accurately.

Use of the JACS coding system
The agri-food industry often comments on the lack of agronomy in undergraduate knowledge. There is not a specific JACS code for agronomy, which requires knowledge of crop, plant and soil science. So where might you find these skills within JACS:

Agriculture is classified at level D4
- Crop science is in a sub-category of this: D412-D415
- Agricultural botany is at D73

Plant science is classified at C2
- Plant genetics is at C41
- Plant biochemistry is C75
- Environmental biology is C150

Soil science might be classified as D750 or F870

Geographical understanding of plants and soil is classified at L720

These skills are not even coded under the same top level category, thus making it impossible to quickly measure data in this area. A complex matrix could be adopted to identify all related codes, but this would assume Universities code to the lowest possible level of sub-division - which they do not always do - and many of these skills will be buried under generic bioscience codes.

A8.6. The Research Assessment Exercise (RAE) measures universities excellence against a number of criteria. In order to separate topics, a number of panels have been set up which cluster academic disciplines. Agriculture is in the same panel as Veterinary Science; this therefore separates it from many of the related areas that fall under the separate Biosciences panel. Though the RAE is in theory designed to measure and not influence HEI behaviour, funding levels are aligned to the RAE so this artificial subject division induces universities to cluster and code their academic disciplines in order to achieve the best RAE results. Veterinary Science has a significant influence on the data for that panel, so this does not give a true picture of Agri-food.

A8.7. The issues discussed in the previous paragraphs flag up an important additional fact, namely that different government organisations gather different data, causing additional effort to the HEI base and the public funders replicating data gathering exercises. Aligning, for example, the specification for research student and income data with those used by HESA would avoid duplication of effort within HEIs.

A8.8. A further issue in the limitation of Agri-food data relates to issues in farming with the designation of job roles within family run farms. Sector data assumes that there is a skilled farmer who employs a farm manager with certain skills and who has a number of farm workers at a lower skills level. This is a linear model extrapolated from other sectors. In reality, on a family run farm the person designated the farmer is often aged over sixty (see A3.25) and is less likely to have formal qualifications; the farm manager may be his son and farm workers often include other family members who may all be qualified with specialist agriculture degrees. The way current data is gathered would not take this into account and therefore might grossly misrepresent the level of skills available across the farm.

A8.9. Demand data also has another limitation when used for future prediction. Forecasts are either based on extrapolation of current trends by identifying attrition and replacement of staff on a like-with-like basis, or based on anecdotal prediction of potential future changes in demand, which is highly subjective. The data presented here from Lantra is based on the former approach; however, the recent report from

the Agri-Skills forum attempted to articulate future demand based on industry increasing the level of qualification they demand. One of the issues identified in this report is that industry is likely to need to up-skill its workforce to tackle more technical aspects of future challenges. This means not replacing like-with-like, but deliberately using attrition as an opportunity to increase the skill level of the workforce (in addition to the necessary CPD of existing staff). If this were to happen at level 3 with an attempt to up-skill to level 4, there would be significant demands on the level 4 supply and potentially a significant unplanned skills shortage. However, this is dependent on industry recognising the need to up-skill via recruitment and to provide the necessary pay and conditions to attract high quality graduates into the sector. There is anecdotal evidence of the need to do this but no evidence that it is actually happening.

A8.10. The issue of skill levels to measure the effectiveness of sectors has another significant flaw in that it does not measure effectiveness to do the job; nor does it take into account on-the-job training, including CPD and any up-skilling the worker has undertaken.

A8.11. Training days per worker are often measured as an indicator of an employer's desire to up-skill their workforce and in land-based sectors this is higher than in other sectors (A3.37). However, what this data does not take into account is the level and nature of training, which can often be focused on technical training such as the use of machinery and transport vehicles. Further disaggregation of the data would be needed to determine whether training days are delivering a higher level of research skills within the workforce.

A8.12. A potential metric or indicator of the R&D health of the Agri-food sector would be to measure skills at an appropriate level of granularity; this will enable greater collaboration between funders, better assessment of potential problems, and reduce the duplication of data sought from funders and provided by HEIs. These metrics could include:

- number of people employed in the business with relevant bioscience degrees and how many of these people are doing jobs requiring said degree;
- number of graduates in the business, including those wider skills such as management;
- number of training days each worker receives that up-skill their knowledge and allow them to undertake or translate new R&D.

Annex 9. International dimensions to UK skills

A9.1. One of the clear changes in modern times is the way in which the supply of skilled labour is now from a global market; this is particularly the case for the recruitment of scientists into the UK from abroad, as the majority of the world's scientifically trained staff speak English. This may result in a potential supply or over supply of high quality recruits from many different countries.

A9.2. Another aspect to international supply is the key role that the UK can have in providing skills for other countries, particularly in the developing world. This can primarily be achieved by using the excellence of the UK training base to provide training and skills to nationals from developing countries; these skills can then be taken home with them. This also has a benefit to UK suppliers of skills who get extra income through additional students on their courses.

A9.3. In relation to the demand side of international skills, there is the potential in a global market for a "brain drain" on the UK supply of skilled workers. Equally, a net demand in the UK might pull in skilled workers from international sources. Although the UK would benefit from the latter situation, it would clearly be inappropriate to deplete key scientists from developing countries to fill UK shortages. It is therefore important to make sure that demand is being filled ethically when sourced from other countries.

A9.4. With current EU employment legislation it is not possible to restrict the movement of EU nationals to and from the UK; therefore, it is important for UK employers to maintain demand in the UK through competitive salaries and attractive employment prospects.

A9.5. The danger in the international aspects to skills is to ignore the effect they have on the metrics. It is often assumed that the net effect of international students in the UK is negligible; in many sectors this may be true, but in agri-food areas there is a strong pull of overseas students to UK courses and if this is not measured appropriately in the metrics the UK supply data might be distorted. Currently there is no separation in the metrics of students from the UK and EU. The following two boxes illustrate the importance of taking international metrics into account:

University of Reading

All MSc's in Agriculture, Policy and Development October 2009 Entry:

Total number of students	102
UK/EU	27 (26%)
Overseas	75 (74%)

This has been typical over the last few years and in some years there have been no UK/EU students.

Harper Adams University College

Proportion of all Postgraduates: 43% UK; 57% Overseas

Number of all postgraduates:

UK	12	
EU	2	(Poland 1, Spain 1)
Global	14	(Botswana 1, China 1, Ecuador 1, Ethiopia 1, Ghana 2, India 2, Nepal 1, Sri Lanka 3, Uganda 2)

A9.6. To determine if the UK is secure in the supply of skilled people in Agri-food, data illustrating the global supply and demand patterns would be needed, including confidential data from industry to determine future expansion plans. There are, however, UK based metrics that can act as an indicator of the health of the sector, especially if monitored over time. These could potentially include (taking into account recommendations in Annex 8):

- number of graduates in the UK in agri-food subjects;
- relative number and proportion of the graduates from the UK, EU, developing countries, or other international countries;
- short and medium term destinations of these graduates; including both whether they stay in the sector, are employed in industry or academia, and in which country they are based;
- as a proxy for potential recruitment demand, data would also be needed from HEI and publicly funded research institutes on the number level of qualification, and origins of applicants to post-doctoral positions.

Annex 10. Working in Partnership to Match Demand and Supply and to Raise Employer Ambition

The need and benefit

A10.1. The Skills Sub-Group has been asked to provide **a view of what success would look like**, and of the most important steps needed achieve this.

A10.2. It is our view that the key route forward in the area of agri-food skills is to develop and support partnerships between the industry, skills providers, researchers and policy makers. **Partnership working** is the key to ensuring that there is a supply of skilled people to match employer demand for niche high-level skills, and to further raise employer demand in order to create employment opportunities for individuals with high-level skills.

A10.3. Partnerships can play a key role in (a) stimulating demand from employers, and (b) ensuring that the provision of training from suppliers (universities, higher education agricultural colleges, research institutes, etc) is well promoted and appropriate to the needs of the sector.

A10.4. Such partnerships lead to a flexible skills system, where providers of high-level skills can respond appropriately to the needs of industry; where industry can access information and support on how to recruit and develop highly skilled people; where there is a supportive dialogue and knowledge exchange between industry and high-level skills providers; and where employers can access information about how investment in high-skill jobs is crucial not just for future business success, but also in order to attract talented and high-skilled individuals to work in the sector.

A10.5. A successful skills landscape would be one where individuals and organisations would:

- have (or have access to) scientifically informed expertise and knowledge needed to understand and develop their component of the sector in the changing and complex world;
- have the necessary skills to run businesses that are efficient, competitive and innovation-led, with due regard to environment sustainability, food safety, etc;
- be able to identify those high-level skills that they needed, but did not have, in order to achieve the above;
- have a routes for acquiring, developing or accessing those skills.

A10.6. Such a skills landscape would be a system in which a ‘virtuous circle’ in skills emerges: highly skilled individuals enable UK businesses to innovate and become more effective, which in turn creates jobs attracting talented individuals into the sector, to use their high-level skills. Such a system would bring great benefits to the agri-food sector at all levels.

A10.7. This report focuses on the development of UK agri-food skills and the UK market place, but food security is a global issue. For example, the UK remains a key global partner in agricultural research for development, both in terms of the diversity and quality of its contribution and with respect to the knowledge and interest of many British scientists in development, which contrasts with agricultural research in some other developed countries. Development assistance in agricultural research is growing rapidly and has been and could be in future a source of support in creating vibrant UK agricultural research groups of critical mass, particularly as agricultural research needs in North and South are converging.

A10.8. Further investigation is required to understand the impact of, and potential for, international demands for UK agri-food research expertise and training, in order to provide recommendations for future international contribution and strategy.

Existing partnerships

A10.9. The role and importance of Higher Education Institutions working in partnership with employers to deliver innovation, and to develop highly skilled people with the expert knowledge to apply new research findings, is well recognised in Government policy:

Delivering higher level skills for the workforce

3.55 In creating the new Department for Innovation, Universities and Skills, we recognised that the UK needs to foster greater and more sustained engagement between universities, colleges and employers in training, skill development and innovation. This implies a culture change within HE as well as FE.

3.56 Many HE institutions have already built up excellent working relationships with employers through their research and enterprise programmes, and the increasing impact of lifelong learning networks. A growing number are developing models for delivering higher level skills in a way that meet the needs of employers and employees. But all HE institutions need to grow their capacity to engage on a large scale with employers, in ways adapted to their different profiles and missions. Those activities should share equal status with research and academic activities. 'Business facing' should be a description with which any higher education institution feels comfortable.

From: World Class Skills: Implementing the Leitch Review of Skills in England (July 2007), available at: http://www.dcsf.gov.uk/skillsstrategy/uploads/documents/World%20Class%20Skills%20FINAL.pdf

A10.10. There are already a number of partnership activities aimed at ensuring that employer needs are met by training providers, and equally helping employers to recognise the value of investing in high-level skills.

REEDNet: The Rural Employer Engagement Development Network

REEDNet's task is to ensure that employers have access to the best higher level training and development for their staff in managerial, professional, technical, sales, advisory and scientific positions.

What we are

REEDNet is the Rural Employer Engagement Development Network. A network of England's land based colleges led by Harper Adams University College in Shropshire and the Royal Agricultural College in Gloucestershire. Harper and the Royal are the sector's two leading university colleges with unrivalled reputations for their industrial training, education, research and consultancy in the sector. REEDNet brings the two colleges together at the heart of a network of all the land-based colleges in England.

REEDNet has government funding through the Higher Education Funding Council for England to support work based training and staff development in the

rural economy.

What we do

REEDNet's task is to stimulate and support the rural economy by a massive expansion of recognised work based qualifications. Over the next three years we aim to support the development of at least 2,000 people working in the sector. To do this we:

• Work with employers to develop and provide programmes for their training needs

• Work with other colleges and training providers to develop work based staff development programmes for industry

• Provide an independent quality framework which ensures that training outcomes are verifiable and relevant

• Distribute funding for development and delivery activity. We have been awarded £4 million of government funding to develop this activity over the next three years.

From: http://www.reednet.org/

A10.11. The important role of specialist agricultural HEIs as a key link in the interpretation of new research findings and their relevance to agricultural practice, and the transmission of new thinking to current and future professionals in the agricultural sector, was noted in the Review of provision for land-based studies (May 2007), commissioned by HEFCE.[21] The specialist agricultural HEIs were found to have different 'knowledge transfer relationships' compared to university agriculture departments, working much more closely with small and local businesses. The review recommended, however, that there needed to be better connection between the universities and the specialist agricultural HEIs in order to more effectively secure knowledge exchange from basic research through to its application and uptake by agricultural professionals.

FE-HE Partnership

The preponderance of micro businesses in the traditional land-based sector means that the industry may sometimes find it difficult to articulate its demands and translate them into activities. SMEs are also in general less able to invest the time, and less likely to have the skills within the business, to engage directly with basic research. In a sector characterised by many small businesses there is therefore a critical need to look closely at how world class research is transferred to large numbers of small businesses. The research intensive universities arguably have neither the resources nor industry contacts to effectively fulfil this role on their own. But to enable more local providers (e.g. FECs) and those which are more vocationally orientated in their engagement with businesses (e.g. both the monotechnics and FECs) to undertake this role, **it is essential that new knowledge is effectively transferred from the**

[21] *Review of provision for land-based studies* (May 2007), available at: http://www.hefce.ac.uk/pubs/rdreports/2007/rd09_07/

research intensive universities to local and regional knowledge transfer projects and programmes. (Paragraph 6.11)

From: *Review of provision for land-based studies* (May 2007), available at: http://www.hefce.ac.uk/pubs/rdreports/2007/rd09_07/

(Emphasis added)

A10.12. The Levy bodies under the AHDB have a crucial role in providing a sector view on the priorities for improvements to agricultural and horticultural competitiveness and sustainability. The Levy bodies are able to invest in innovation and high-level skills on a collective basis in a way which individual small businesses cannot. Their close connections to farmers, growers and other practitioners, such as consultants, means that they have excellent channels of communication; and farmers and growers equally have a vested interest in finding out about what is being done with the levies they pay.

The Importance of AHDB – NFU's Perspective

The relationship between AHDB, and particularly its new Chief Scientist, and BBSRC will be important. Perhaps even more important will be the links between AHDB, private sector funders and providers of research and independent advisers (agronomists, nutritionists etc.). Consultants are having an increasing role in the success of progressive and innovative farm businesses. They could be a highly valuable conduit for translating science into behaviour change on the ground if there was a fully organised and joined-up mechanism for accessing research findings. Combining production-related advice with environmental practice is essential.

From: NFU submission to BBSRC's consultation on food security research (2009): http://www.bbsrc.ac.uk/organisation/policies/reviews/consultations/0905_food_security.html

A10.13. Equally, the AHDB recognises the importance of partnerships between agricultural colleges in the FE and HE sector and the university and research institute base in order to construct networks through which new research can be communicated to practitioners, and the concerns of practitioners communicated to the science community.

Knowledge exchange through life-long learning

The UK still has a good network of agricultural colleges. Whilst many of these moved their focus away from food production to concentrate on environmental and equine issues, they are moving back a little to main stream food production. They offer a very good route to put science into practice. However, they need to be encouraged to adopt more innovative practices to meet the learning needs of the industry (short courses, part-time, off-site etc), to encourage their students to adopt life-long learning strategies and to build greater links with their local farming communities as well as developing routes to stay on top of scientific developments. **Partnerships between agricultural colleges and the science community could also be the feed that scientists need to identify the direction of scientific research and test out ideas in a more practical setting.**

From: The AHDB response to BBSRC's consultation on food security research

(2009):http://www.bbsrc.ac.uk/organisation/policies/reviews/consultations/0905_food_security.html).
(Emphasis added)

A10.14. On the food production side, the Sub-Group heard about excellent communication channels between food manufacturers and universities to ensure that degree programmes meet employer needs for high-level skills. BBSRC's Industrial CASE PhD scheme again allows companies to directly apply for studentship funding (citing an academic partner). Collaborative research training in a strategically important area for the business can help ensure the development of the skills it needs.

Mechanisms to develop and support partnerships

A10.15. A number of funding mechanisms are already in place that support collaborative training and which can enable employers and user-organisations to meet their skills needs. For example, BBSRC CASE studentships can involve a Levy Body partner as well as allowing agri-food businesses with a UK R&D base to direct BBSRC funding to the skills areas that are most important to their business.

A10.16. BBSRC's 'Modular Training for Industry' scheme[22] is also designed to provide pump-priming for postgraduate level courses which are developed to meet identified employer needs. Existing partnerships between research institutes and agricultural professionals, for example, the Rothamsted Research Association, already offer accredited continuing professional development.

The Rothamsted Research Association - "Driving Science to the Field"

The Rothamsted Research Association facilitates interaction and dialogue between researchers and practitioners.

Rothamsted Research Association (RRA) is the member's association of Rothamsted Research (formerly the Institute of Arable Crops Research), comprising the Rothamsted and Broom's Barn sites. Research at Rothamsted started in 1843 and the Institute is renowned internationally for its scientific leadership in many areas of importance to cereals and arable farming. RRA aims to ensure that new scientific knowledge of relevance to agricultural and land-management practices is rapidly transferred in a usable form for commercial, environmental and societal benefit. Members, including farmers, land-owners, consultants, advisors, industry representatives and policy makers get a wide range of advantages.

From: http://www.rothra.org

A10.17. BBSRC also funds Knowledge Transfer Partnerships with the Technology Strategy Board.[23] These provide support to a business seeking to invest in its high-skilled human resources and allow it to access cutting-edge thinking through an academic

[22] For information on BBSRC's MTI scheme, see: http://www.bbsrc.ac.uk/business/training/modular_training.html
[23] For more information on BBSRC's support for Knowledge Transfer Partnerships, see: http://www.bbsrc.ac.uk/business/people_information/knowledge_transfer_partnerships.html

partner. Equally, the KTP provides an unprecedented opportunity for a graduate to understand and develop the application of new ideas in a business context.

A10.18. EU initiatives in this area are also important:

Rural Development Programme for England (RDPE)

The RDPE is a major programme of work under an EU Directive. It is jointly funded by the EU with a budget of **£3.9 billion** for 2007-13. The programme devolves activities to the Regional Development Agencies.

The summary document for the programme (http://www.defra.gov.uk/rural/rdpe/pdf/rdpe-sum.pdf) mentions:

Support for Knowledge Transfer (para. 46):

Knowledge transfer is also an important element in achieving a more competitive and sustainable agricultural, food and forestry sector. In particular, increasing the ability to disseminate knowledge and information about innovative techniques and products is central to the main thrust of support under Axis 1 of the programme: that is, to focus on projects which stimulate transferable outputs rather than long term structures. It is expected, therefore, that this measure will cover a wider range of activities other than formal training course, including:
• seminars;
• business clubs;
• workshops and farm demonstrations;
• support and mentoring;
• technical and management information;
• support for knowledge and technology transfer networks.
(emphasis added)

Activities to assist collaboration (para. 50):

This measure will be used in a way that recognises that collaborative farm management ventures, such as buying groups and labour and machinery rings, allow farm businesses to operate more efficiently through the sharing of labour and machinery, and through purchasing inputs and raw materials more efficiently. **Tailored farm advisory services** that address gaps in existing advisory provisions can help with adaptation and improve overall farm performance. (Emphasis added)

Support for innovation (para. 59):

Many agricultural firms may have problems innovating because of their size. The agricultural and forestry sectors are largely populated by small firms isolated from the services and information sources available to other sectors. Any existing consulting services are expensive, particularly for the small firms that constitute the agricultural and forestry sectors, and as a result the **sectors are unable, without intervention, to invest in the research necessary to achieve innovation**. (Emphasis added)

See: http://www.defra.gov.uk/rural/rdpe/index.htm

A10.19. In order to help facilitate a partnership approach to the provision of high-level skills, BBSRC is planning a new type of funding initiative – the Advanced Training Partnerships scheme – to be launched in 2010 (www.bbsrc.ac.uk/atp). This will

support partnerships between universities, research institutes, specialist agricultural HEIs, levy bodies, professional associations and employers to ensure that high-level training needs are met through a combination of, for example:

- Professional doctorates – e.g. a Doctor of Agriculture
- Postgraduate CPD, e.g. through modular masters courses
- Secondments and Knowledge Transfer exchange mechanisms
- Seminars and schools outreach programmes.

Appendix 1: Further analyses of the UCAS data

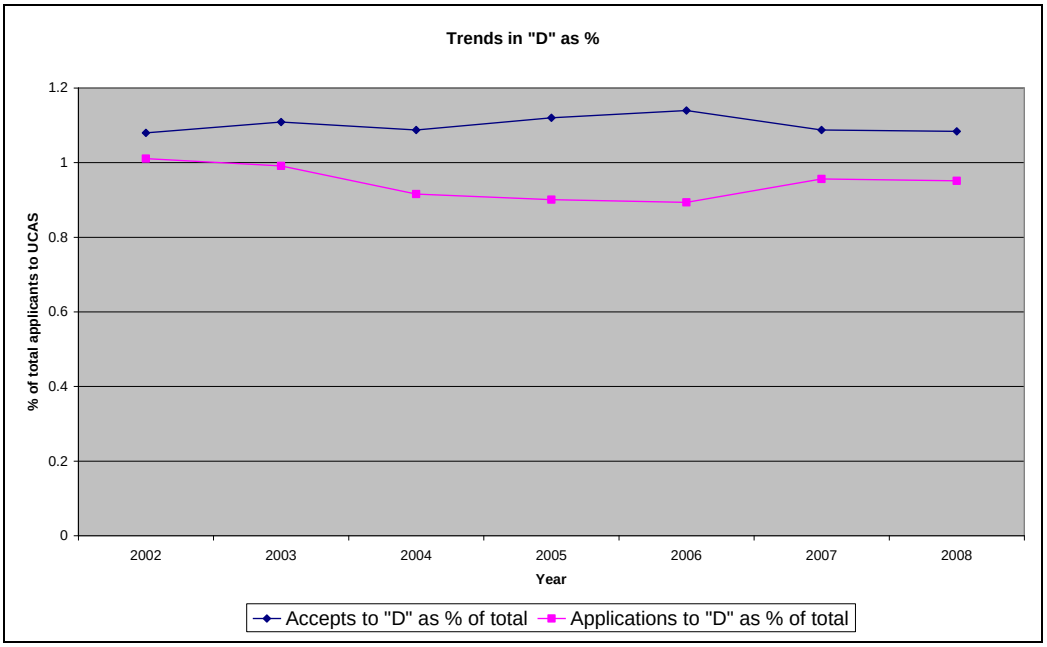
App1.1. The data in this appendix provide further information and analyses on the UCAS data described in Annex 4.

Summary of UCAS applications to Agricultural based courses

JACS Codes:
D: Veterinary Sciences, Agriculture and related subjects
D1: Pre-clinical Veterinary Medicine
D2: Clinical Veterinary Medicine and Dentistry
D3: Animal Science
D4: Agriculture
D5: Forestry
D6: Food and Beverage studies
D7: Agricultural Science
D9: Others in Veterinary Science, Agriculture and related subjects not found elsewhere

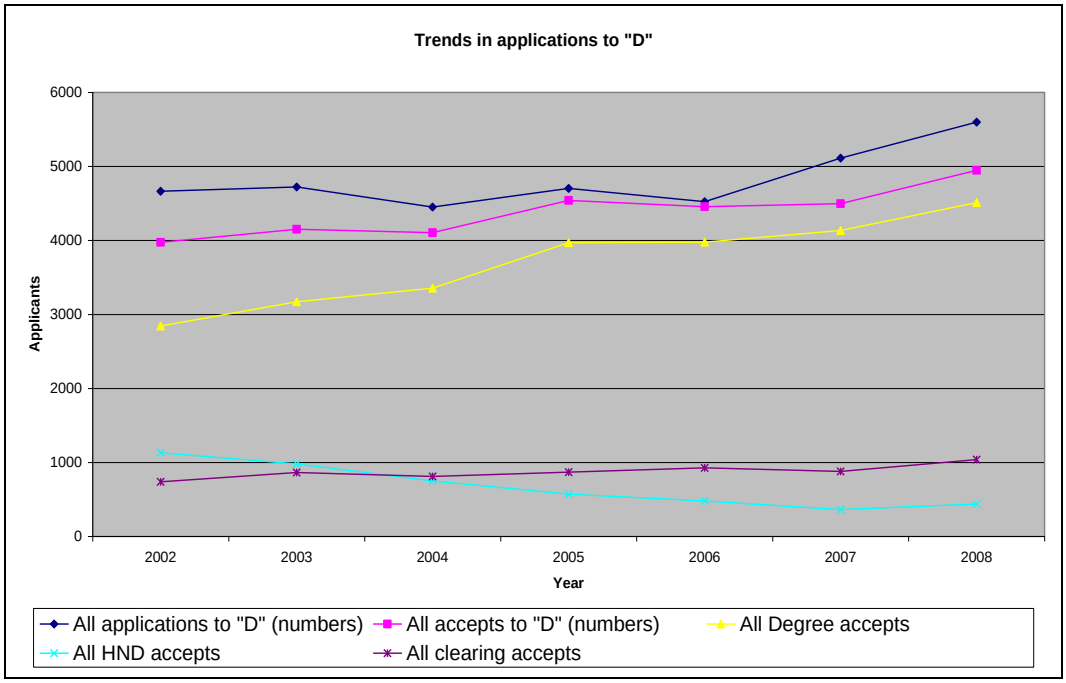
App1.2. In the UCAS system if an applicant has applied for more than 1 course the application is classed as whichever JACS group covers the most of the courses on the application, this is why JACS is referred to as “preferred subject group”. This is why accepts may be higher than applications. For example, in a case where an applicant has applied for 3 courses, 2 of which fall under Biological Science and 1 into Agriculture the application will be classed as an application to group C not group D regardless of which was the preferred course.

App1.3. Graph 1 below shows that the proportion of accepts and applications to Veterinary Science, Agriculture and related subjects is steady.

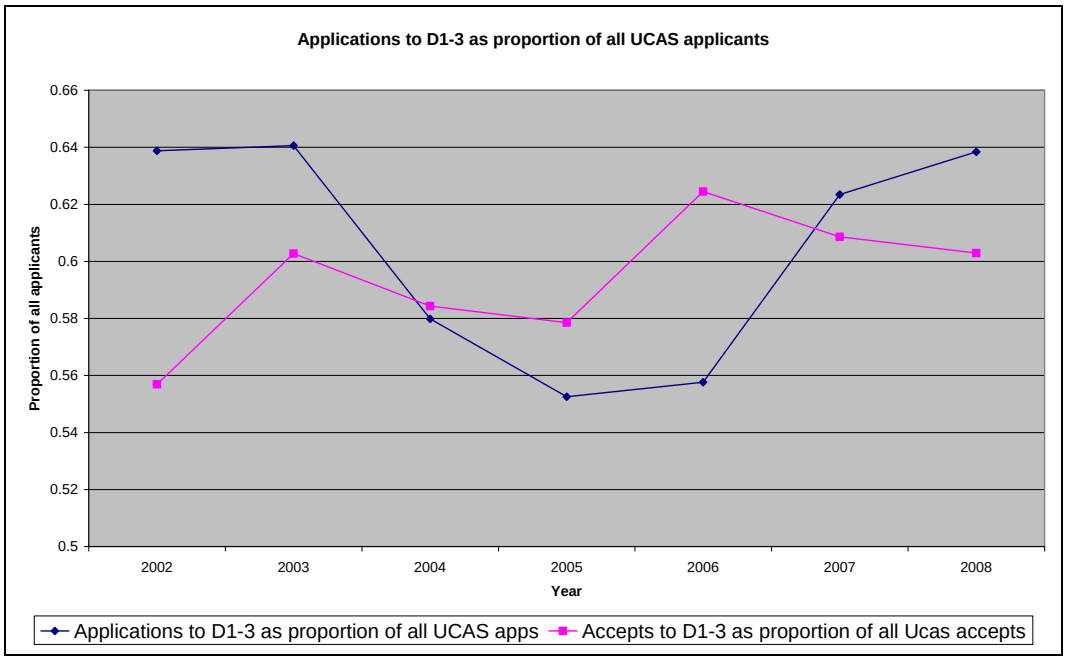


App1.4. Graph 2 below shows that the number of total applications to Veterinary Science, Agriculture and related subjects is increasing. As demonstrated in graphs 4, 5, 7 and 8 this increase is accounted for by an increase in applications to D1-3 whereas applications to D4-D9 remain steady.

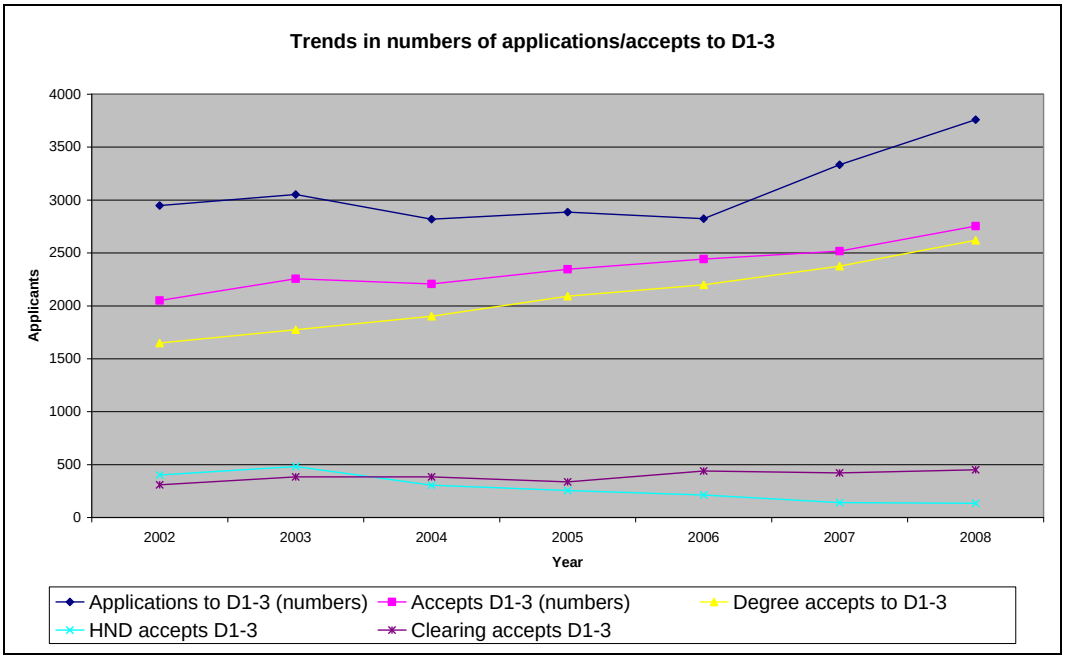
App1.5. There is a general trend towards increased application to degrees and decreased applications to HND's within JACS group D.



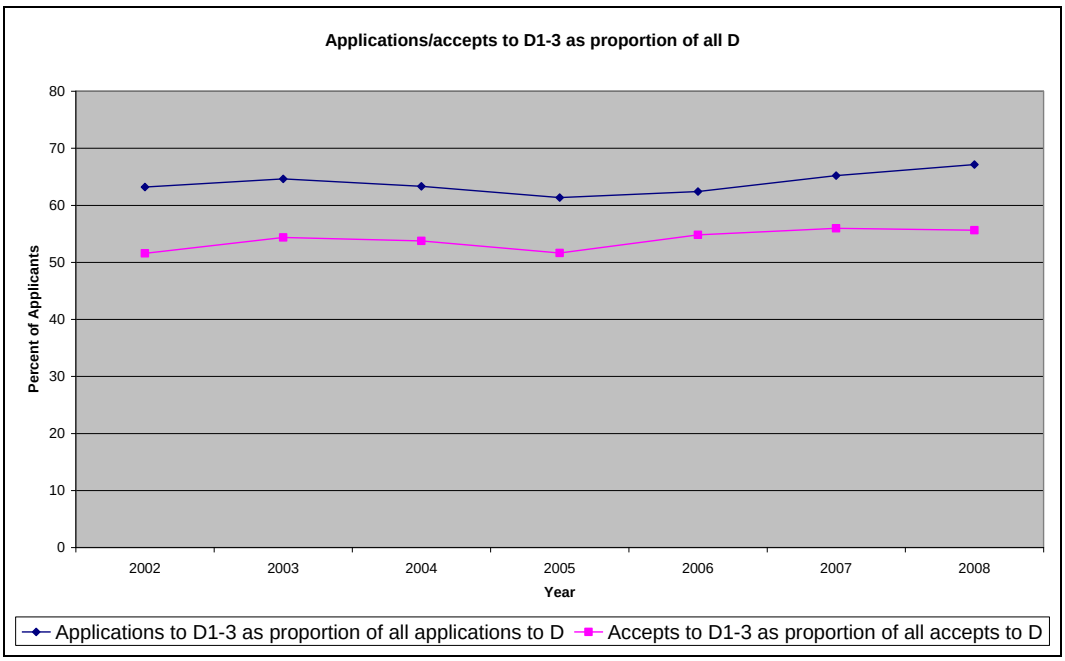
App1.6. Graph 3 below shows that there is a drop in the proportion of applications and accepts to D1-3 in 2004-2007. This is not reflected in the numbers of applicants, which, as demonstrated in graph 4, continue to increase and is probably explained by an increased interest in other courses over these years.



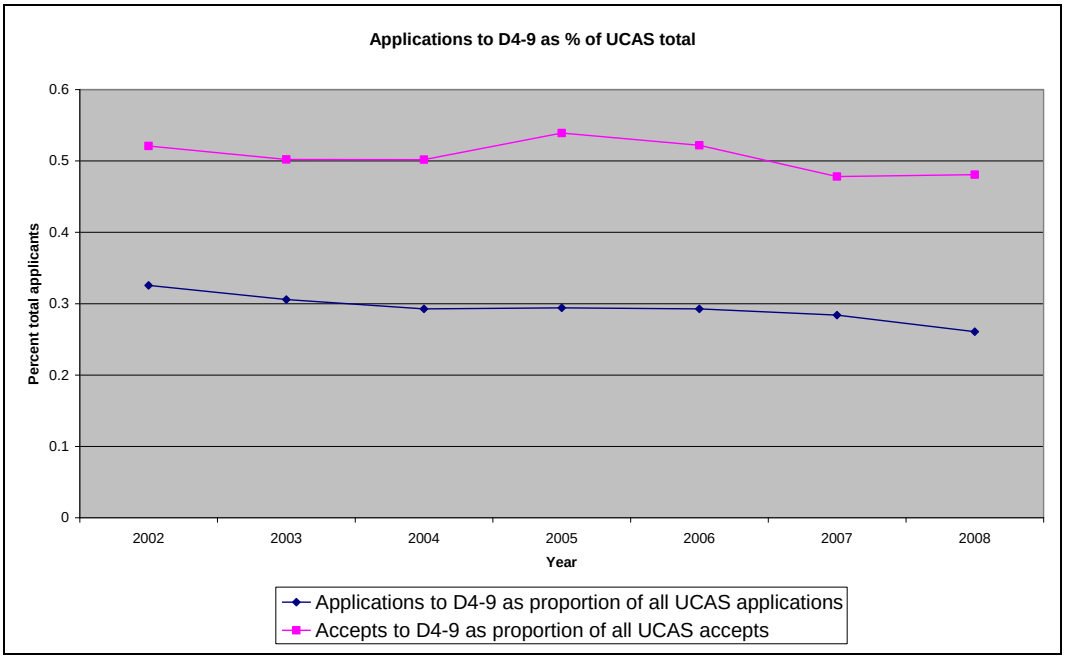
App1.7. Graph 4 below shows that there is an increase in applications to courses covered by D1-3. There is a corresponding increase in degree accepts in D1-3.There is a decrease in HND accepts to D1-3.



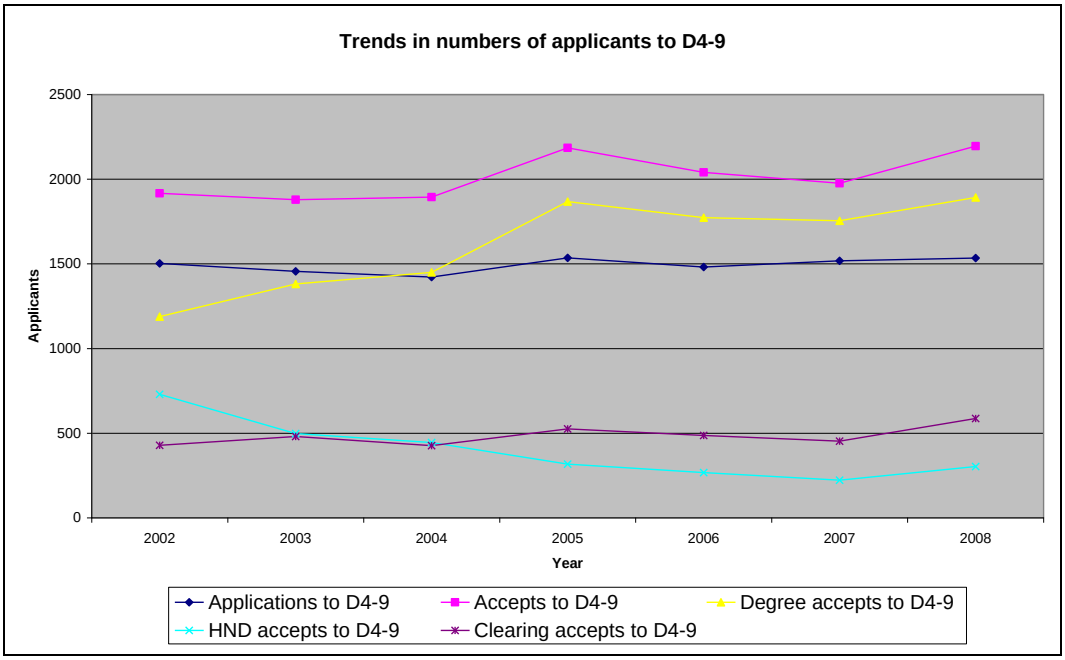
App1.8. Graph 5 below shows that applications to Pre-clinical Veterinary Science, Veterinary Science and Animal Sciences (D1-3) account for approximately 65% of all applications to JACS group D and have remained steady since 2002. Accepts to D1-3 are lower than applications and have also remained steady.



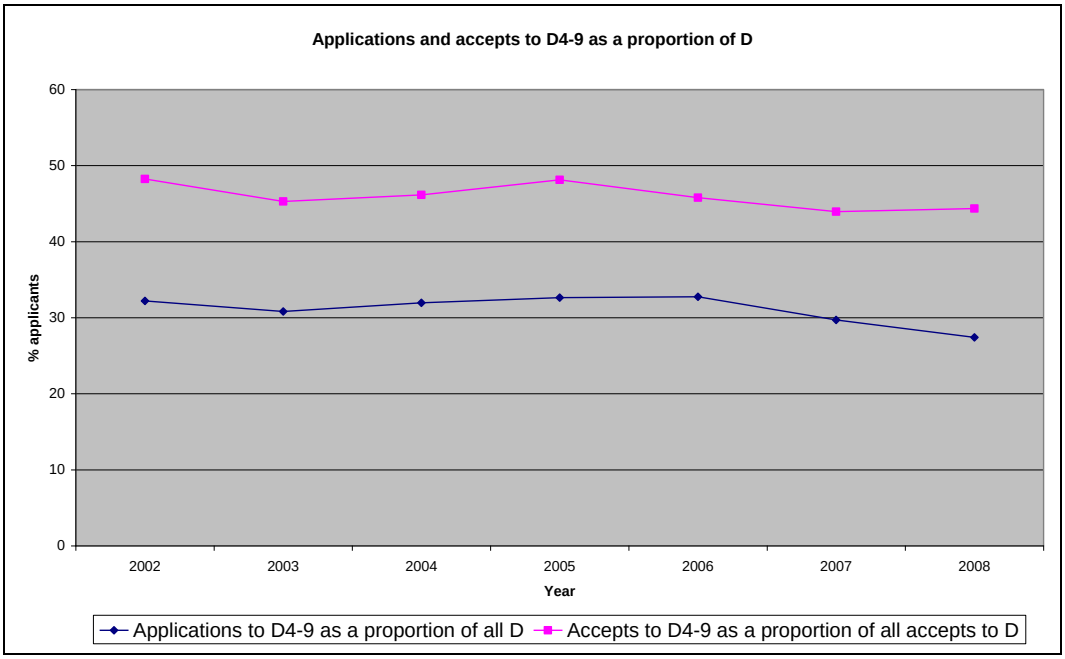
App1.9. Graph 6 below shows that the proportions of applications and accepts to D4-9 are reasonably steady but declining slightly.



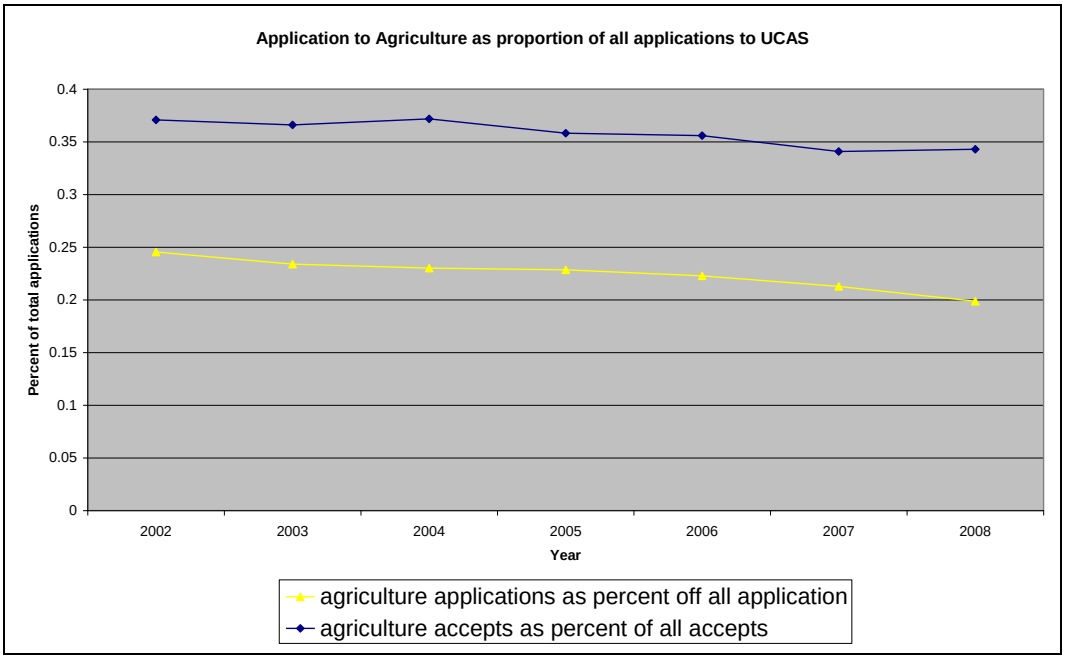
App1.10. Graph 7 below shows that the total numbers of applications and accepts to D4-9 are steady. The number of degree accepts is increasing. The number of HND accepts is decreasing. Indicates a shift, from HND to degree, in type of higher education course offered within JACS lines D4-D9.



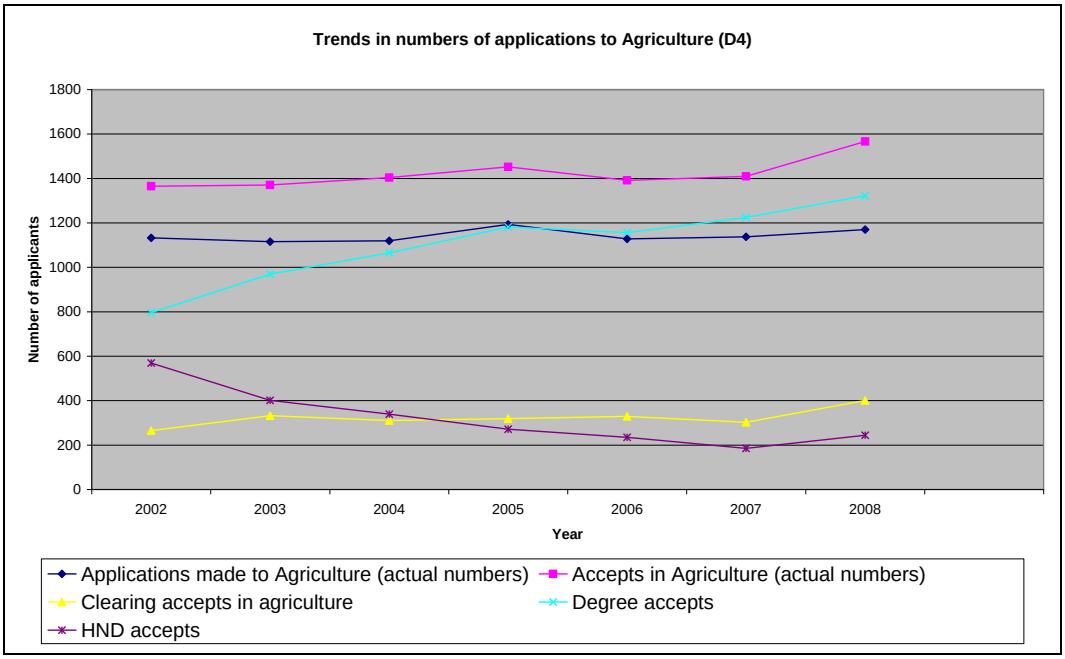
App1.11. Graph 8 below shows that since 2006 there has been a decline of ~5% in the proportion of all applications made to D which are covered by JACS lines D4-D9. There is a corresponding increase in applications made to D1-3, which accounts for the increase in applications to group D.



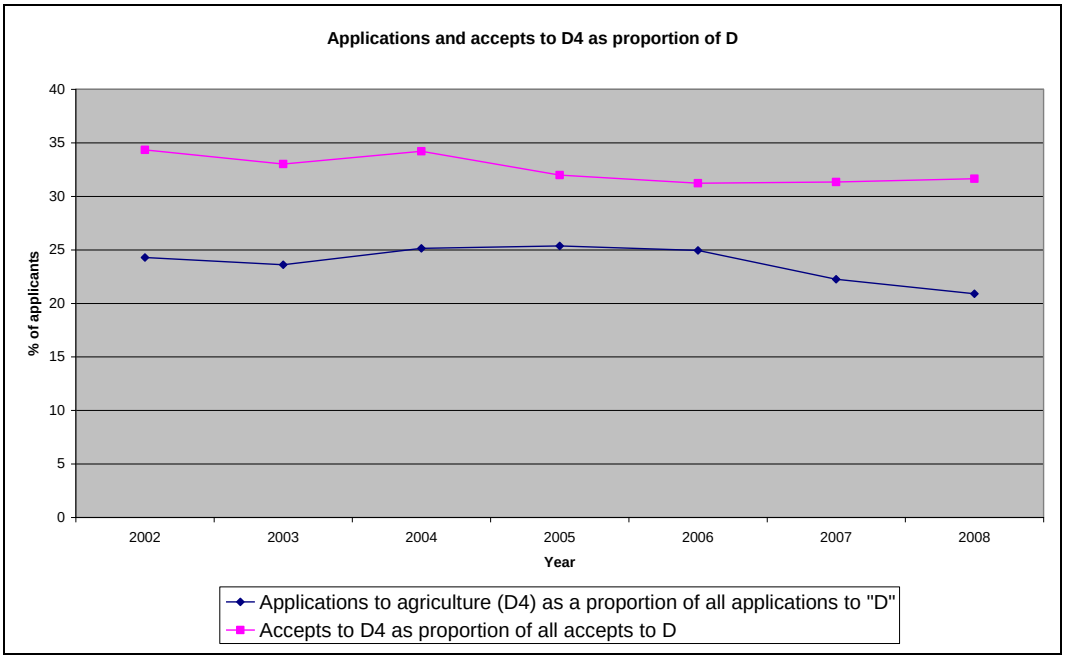
App1.12. Graph 9 below shows that the proportion of applications to Agriculture (D4) is decreasing.



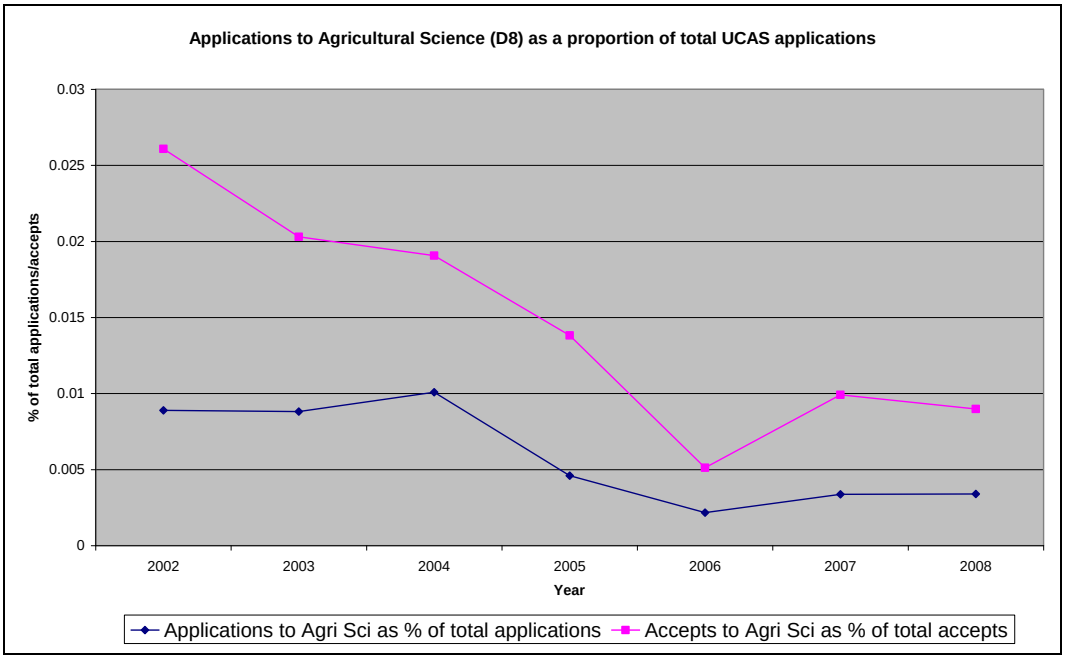
App1.13. Graph 10 below shows that the number of applications made to Agriculture is remaining steady. The number of accepts in Agriculture are increasing. This may be in part due to a corresponding increase in the number of clearing accepts to Agriculture. Degree accepts in Agriculture are increasing while the number of HND accepts is decreasing. This indicates a shift in the type of higher education course on offer in Agriculture (D4).



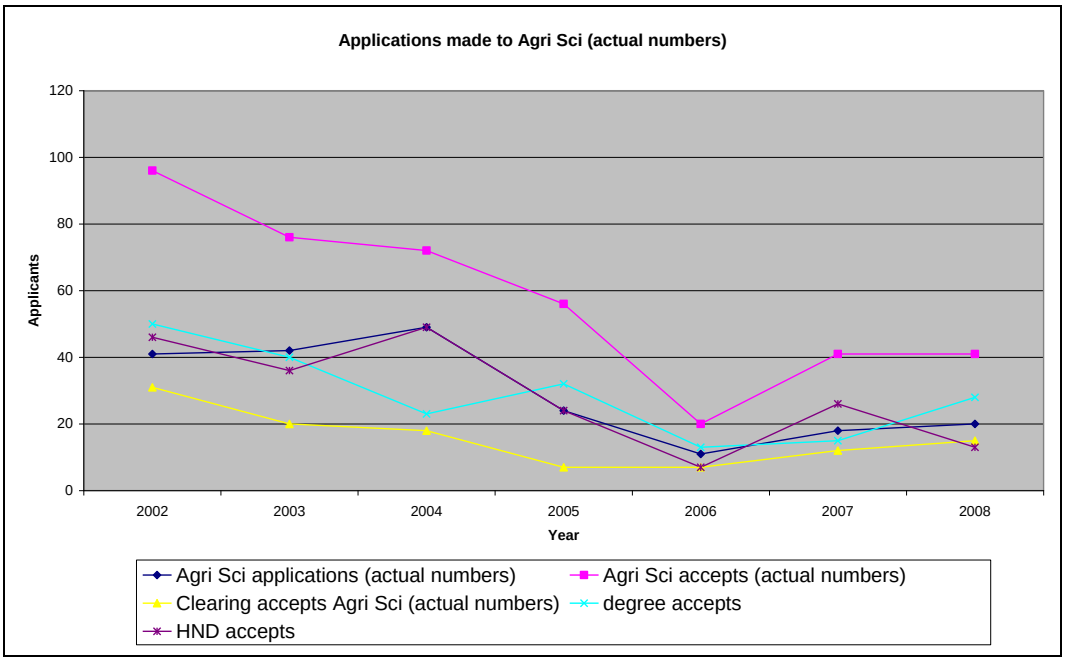
App1.14. Graph 11 below shows that applications to Agriculture (D4) as a proportion of total applications to Veterinary Science, Agriculture and related subjects have decreased by almost 5% since 2006. There has not been a corresponding decrease in accepts to agriculture, which may be accounted for by an increase in clearing accepts.



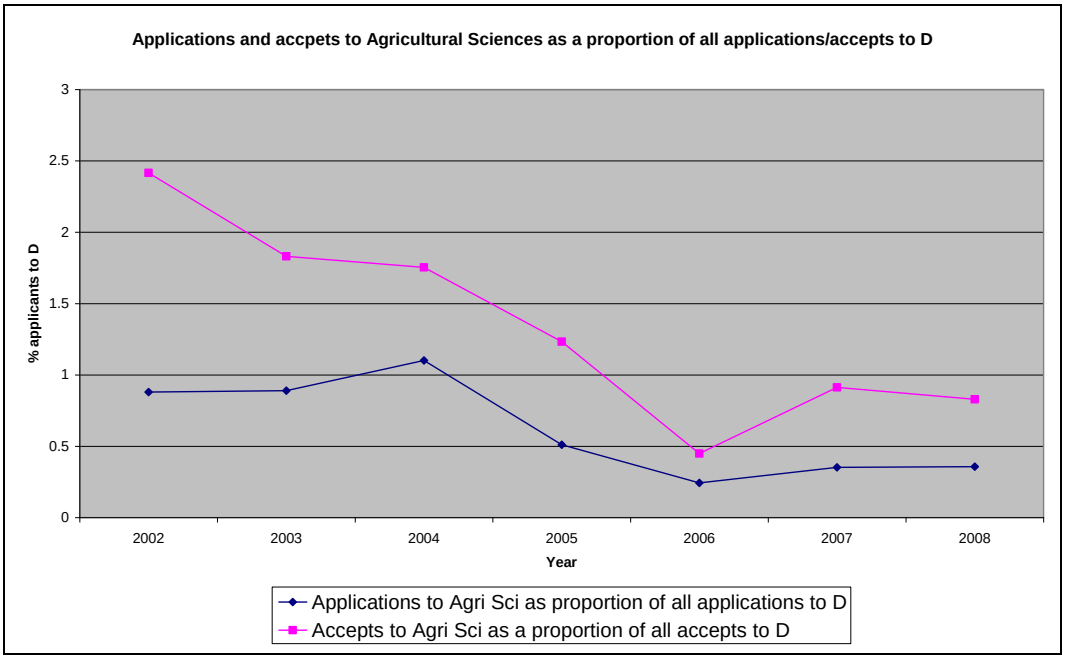
App1.15. Graph 12 below shows that applications to Agricultural Science, as a proportion of total UCAS applications, are decreasing. Proportion of accepts to Agricultural Sciences is decreasing.



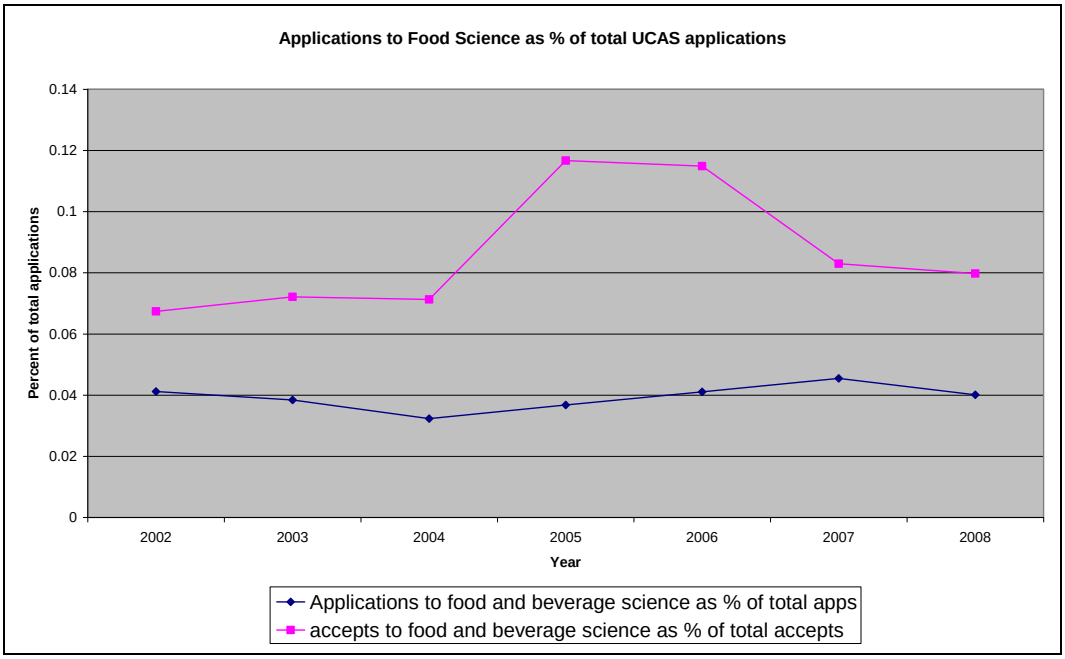
App1.16. Graph 13 below shows that the numbers of applications and accepts to Agricultural Science are down considerably since 2002.



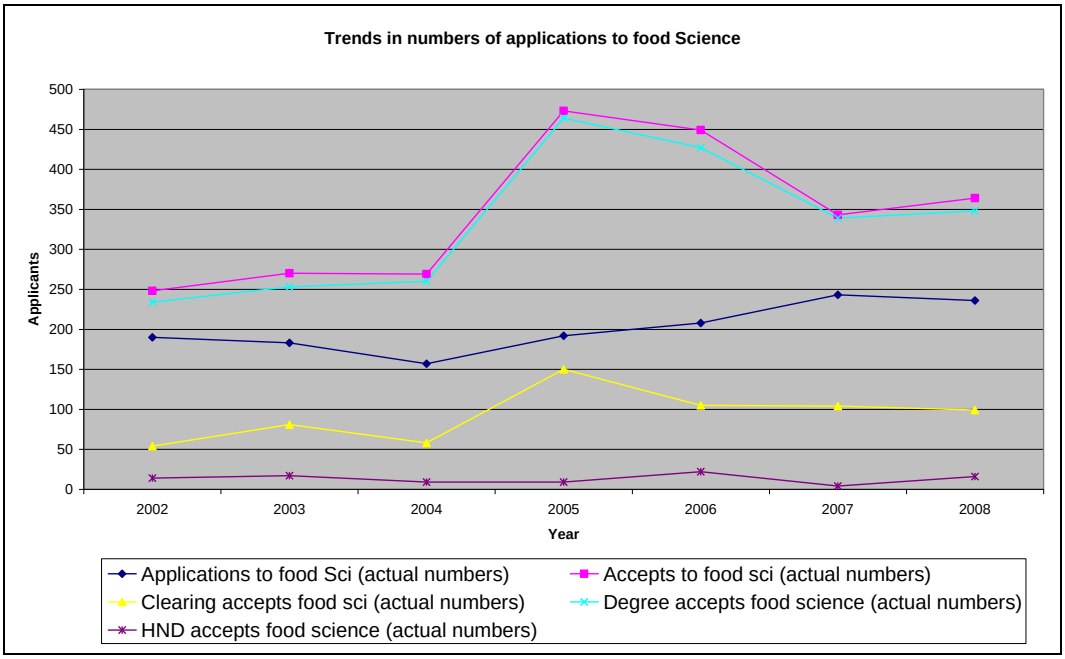
App1.17. Graph 14 below shows that applications to Agricultural Science have always accounted for a very small proportion of total applications to JACS group D. There has been a dramatic decrease in the proportion of applications to group D that are accounted for by applications to Agricultural Sciences since 2002.Accepts to Agricultural Sciences as a proportion of total accepts to D has decreased dramatically.



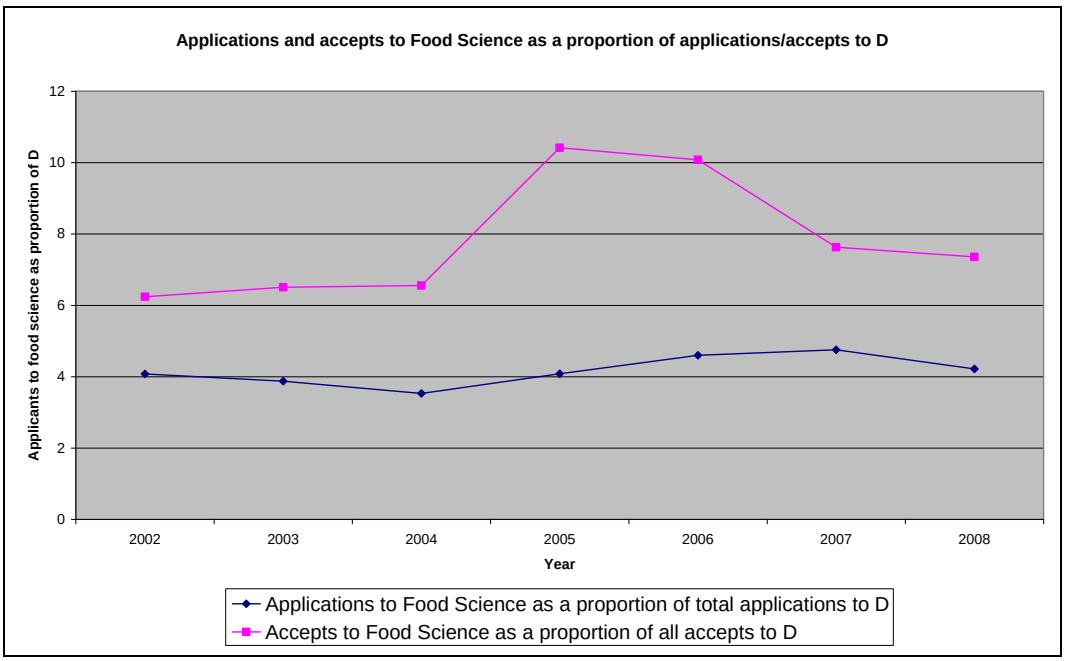
App1.18. Graph 15 below shows that applications to Food Science, as a proportion of all UCAS applications, have remained steady. There has been an increase in accepts to Food Science since 2002. Proportionally there was a large increase in the number of UCAS applications that were made to Food Science in 2005 and 2006.



App1.19. Graph 16 below shows that numbers of applications to Food Science have increased. The majority of these applications are to Degree courses. Accepts and clearing accepts to Food Science have increased since 2002, with a peak in 2005 and 2006.



App1.20. Graph 17 below shows that the proportion of applications to D that are accounted for by Food Science has remained steady. There has been an increase in accepts to Food Science as a proportion of accepts to D with a peak in 2005/2006.



Trends in Applicant quality

Tariff

From 2002 entry, the UCAS Tariff replaced Main qualification in UCAS data.

The UCAS Tariff establishes agreed equivalences between different types of qualifications, and reports achievement for entry to higher education in a numerical format. This allows comparisons between applicants with different types and volumes of achievement. Tariff data are only available for UK applicants.

How the Tariff works

The Tariff helps universities and colleges when deciding on course entry requirements and making conditional offers. Entry requirements and conditional offers that use Tariff points will often require a minimum level of achievement in a specified subject (for example '300 points to include grade A at A level chemistry', or '260 points including SQA Higher grade B in mathematics').

Use of the Tariff may also vary from department to department within any one university or college, and may in some cases be dependent on the programme being offered.

Students can collect Tariff points from a range of different qualifications, eg GCE A level with BTEC Nationals. There is no ceiling to the number of points that can be accumulated.
There is no double counting. Certain qualifications within the Tariff build on qualifications in the same subject. In these cases only the qualification with the higher Tariff score will be counted. This principle applies to:
GCE Advanced Subsidiary level and GCE Advanced level
Scottish Highers and Advanced Highers
Key Skills at level 2, 3 and 4
Speech, drama and music awards at grades 6, 7 and 8.

Tariff points for the Advanced Diploma come from the Progression Diploma score plus the relevant Additional and Specialist Learning (ASL) Tariff points. Please see the appropriate qualification in the Tariff tables to calculate the ASL score.

The Extended Project Tariff points are included within the Tariff points for Progression and Advanced Diplomas. Extended Project points represented in the Tariff only count when the qualification is taken outside of these Diplomas.

Where the Tariff tables refer to specific awarding bodies, only qualifications from these awarding bodies attract Tariff points. Qualifications with a similar title, but from a different qualification awarding body do not attract Tariff points.

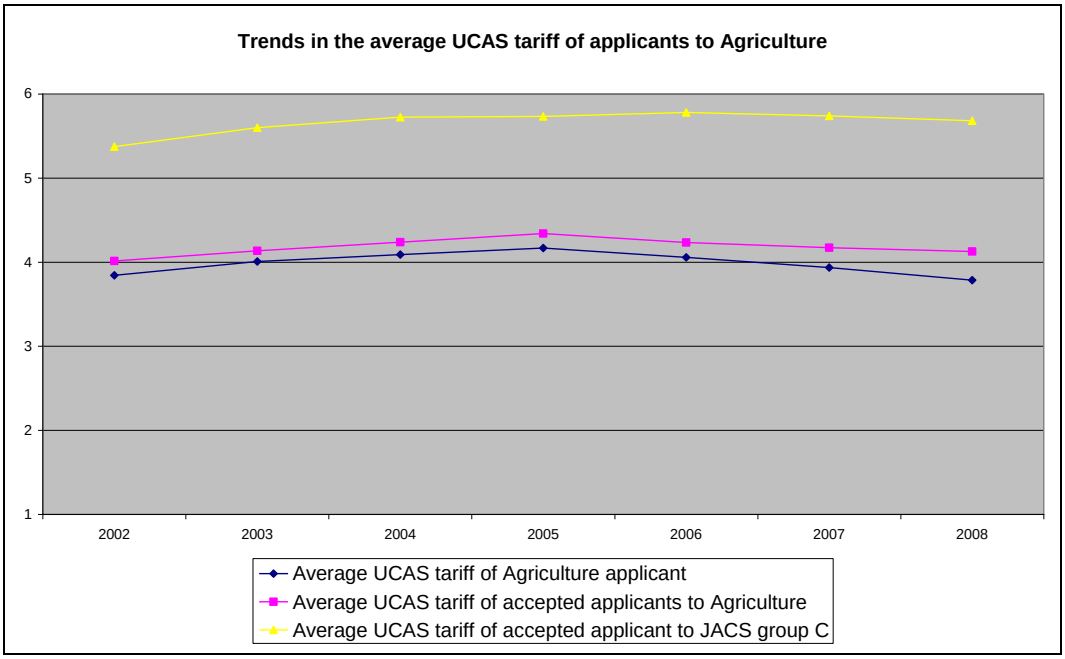
Further information

App1.21. Although Tariff points can be accumulated in a variety of ways, not all of these will necessarily be acceptable for entry to a particular course. The achievement of a points score therefore does not give an automatic entitlement to entry, and many other factors are taken into account in the admissions process.

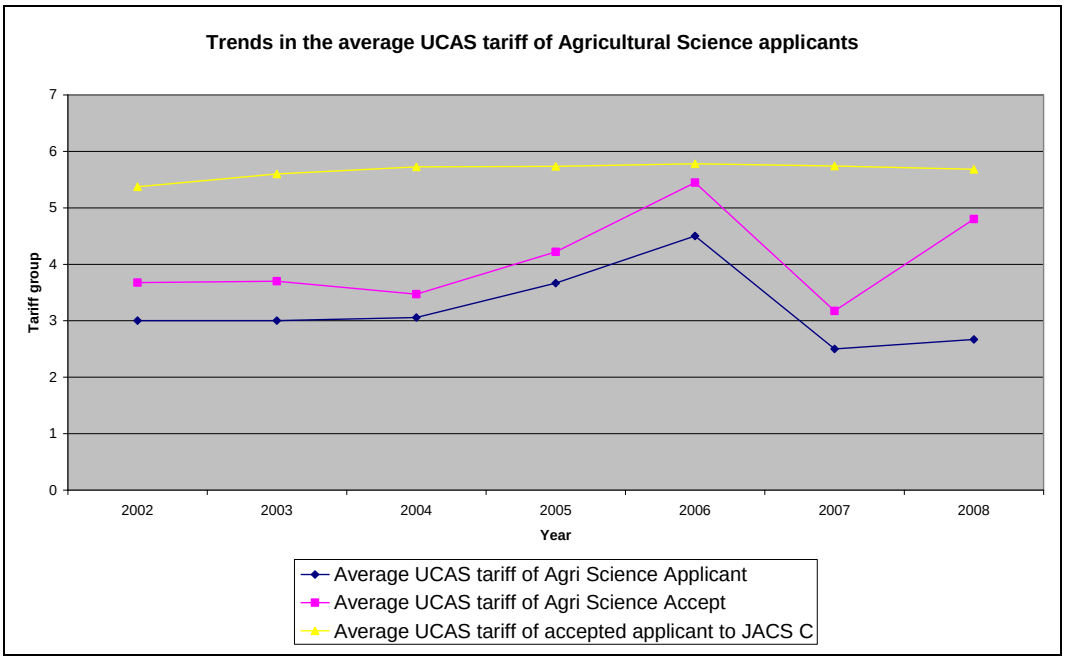
Tariff Categories for analysis

Designated Category for Analysis	Tariff Range Within Category
1	001-079 points
2	080-119 points
3	120-179 points
4	180-239 points
5	240-299 points
6	300-359 points
7	360-419 points
8	420-479 points
9	480-539 points
10	540 plus points

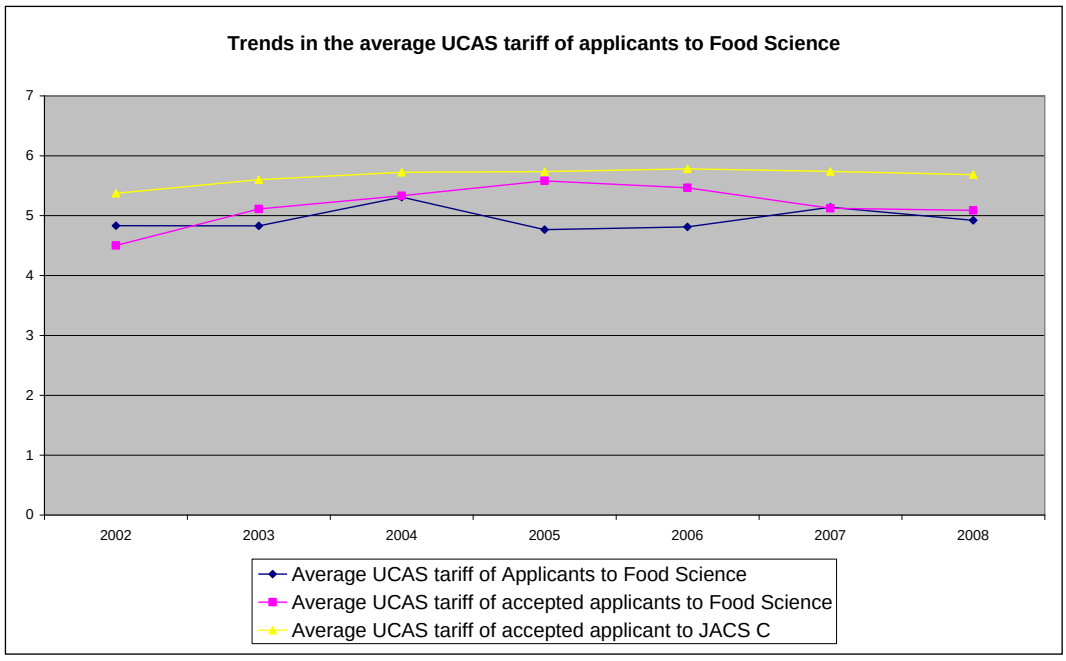
App1.22. Graph 18 below shows that accepted applicant average tariff is consistently higher than applicant tariff. The average UCAS tariff of applicants (and accepted applicants) to Agriculture (D4) peaked to fall into the 180-239 points category in 2005. Since 2005 the average tariff of applicants to Agriculture has declined and fallen into the 120-179 points category for the last 2 years. However, the average tariff of the accepted applicant has declined to a lesser degree and remains within the 180-239 points category.



App1.23. Graph 19 below shows that accepted applicant average tariff is consistently higher than applicant average tariff. Average tariff of applicants to Agricultural Sciences (D7) remained steady (within the 120-179 points category) between 2002 and 2004 and increased between 2004 and 2006. The average tariff of applicants to Agricultural Science peaked in 2006 to fall within the 180-239 points category. The average tariff of accepted applicants to Agricultural Science peaked in 2006 to fall within the 240-299 points category. The average tariff of applicants to Agricultural Science has troughed to fall within the 080-119 points category over the last 2 years.



App1.24. Graph 20 below shows that accepted applicants to Food Science (D6) have a consistently higher average tariff than applicants to Food Science. The average tariff of accepted applicants to Food Science has been within the 240-299 points category since 2002. The average tariff of applicants to Food Science has fluctuated between the 180-239 points to 240-299 points categories since 2002.



App1.25. Graph 21 below shows that since 2002 the average tariff of applicants and accepted applicants to Forestry (D5) has fluctuated between the 120-179 points and 180-239 points categories.