Identifying, Capturing, and Demonstrating the Benefits and Impact of the Babraham Research Campus

Report to:

Babraham Bioscience Technologies Ltd with the Biotechnology and Biological Sciences Research Council and the Babraham Institute.

Cambridge Economic Associates in association with Cambridge Econometrics, Cambridge University Centre for Business Research, Savills and Professor Lisa Hall

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Acknowledgements

Babraham Biotechnologies (BBT) and their campus partners (the Biotechnology and Biological Sciences Research Council and the Babraham Institute) commissioned a research team led by Cambridge Economic Associates and comprising the Centre for Business Research, Cambridge Econometrics, Savills and Professor Lisa Hall to identify and capture a comprehensive evidence based understanding of the benefits arising from the Babraham Campus. The outputs from the impact assessment will be used to inform the future development of the Campus and the overall contribution it makes to the Cambridge and British economy.

The research team Director has been Professor Peter Tyler, supported by Angela Brennan from CEA. Dr Andy Cosh, Senior Research Associate, directed the research team from the Cambridge University Centre for Business Research (CBR) working with Dr Giorgio Caselli, Research Fellow at the CBR. Ben Gardiner, Director, directed the Cambridge Econometrics input, supported by Shyamoli Patel, project manager from CE, Chris Thoung, and Xinru Lin from CE. The research input from Savills was directed by Mark Powney (Director Planning, Savills) and Ryan McKenzie (Associate Director, Planning and Economics, Savills). The research team has also been supported by Professor Lisa Hall, Professor of Analytical Biotechnology in the Department of Chemical Engineering and Biotechnology at the University of Cambridge.

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CONTENTS

Summary

Objective of the study

Babraham Bioscience Technologies (BBT) and their campus partners (the Biotechnology and Biological Sciences Research Council (BBSRC) and the Babraham Institute (BI)) commissioned a research team led by Cambridge Economic Associates and comprising the Centre for Business Research, Cambridge Econometrics, Savills and Professor Lisa Hall to: ***identify and capture a comprehensive evidence based understanding of the benefits arising from the Babraham Campus. The outputs from the impact assessment will be used to inform the future development of the Campus and the overall contribution it makes to the Cambridge and British economy.***

Key Findings

Augmenting the provision of high technology and commercial floorspace

Babraham Bioscience Technologies (BBT) has the responsibility for developing and managing the Babraham Research Campus on behalf of its shareholders the BBSRC and the Babraham Institute. In addition to the provision of the commercial laboratory and office facilities on site, BBT 'mission is to drive the development of a sustainable, world-leading campus environment which supports and nurtures the development of cutting edge science, capabilities and innovation in an entrepreneurial setting"". BBT's role extends beyond 'campus and property management, to include support of early stage life-science companies through provision of communal laboratories, accelerator programmes such as Accelerate@Babraham, investor and cluster conferencing activities and creating a highly connected community".

The evidence indicates that the Babraham Research Campus (BRC) has made a significant contribution to the Cambridgeshire high-technology and commercial property market, providing specialised start up and scale up space, with access to world-class facilities (e.g. laboratory space) and on lease terms tailored to the needs of start-up space. The evidence shows that, combined with world-class biotechnology research via the Babraham Institute, the BRC provides a unique bioscience ecosystem that differentiates it from the many privately funded business parks that rely on purely commercial finance. It provides start-up space designed for start-ups on flexible lease terms, which vary from what a commercial landlord would offer.

The BRC caters to a segment of companies (those in the early stage for incubation and with an ambition to scale to an IPO) that is under-served both in the locale and UK. The uncertain viability and higher risk profile of such companies makes them less attractive as tenants of more commercially oriented science parks. Conversely, such science parks' offerings, of shell and core buildings on long leases, are unfavourable and unappealing to the companies. In that respect, a BBSRC-funded research campus such as the BRC fills what is otherwise a largely unoccupied niche in the UK innovation system. As a publicly funded venture, there would appear to be a market failure that the BRC is helping to address.

The evidence points to the public investment in Babraham helping to overcome a clear market failure the removal of which has led to faster growth in the Life Science sector in Cambridge.

Operational impact of the Campus (Reported in Section 3)

The total gross GVA impact of the operational activities of the Campus on the UK economy has more than tripled over 2011-17, from £80m in 2011/12 to £286m in 2017/18. This is driven by a large increase in the direct GVA impacts over this period from £29m to £120m, and the number of on-site employment increasing by over 90% from about 900 employees in 2011 to 1,700 employees. The direct employment and GVA impact of the Campus accounts for about 40-50% of the total employment and GVA impacts. The indirect and induced impacts from the additional activity generated from supply chains and income effects contribute to the majority of the total GVA impact of the Campus on the UK economy.

Impacts on business (Reported in Section 4)

Companies located on the BRC have achieved remarkable growth over the past years and performed well against companies on other business and science parks in the Cambridge region. The support structure provided by the BRC is a key factor enabling these companies to make an impact in local, national and international ecosystems. The co-location of a vibrant community of start-up and scale-up companies with world-leading academic research from BI, as well as the opportunity for these companies to access a range of state-of-the-art scientific facilities made available by the Institute, are unique features of the BRC that differentiate it from other life sciences campuses in the UK. The track record of Babraham Campus companies to forge exclusive commercial partnerships with global pharma companies as a vehicle for international commercialisation is a significant measure of wider impact.

All of the R&D activity on the BRC is carried out by companies operating in the Life Science sector, with the Campus having one of the highest total R&D spend in Life Science in the entire Cambridge region over the last three years. Overall, R&D spend by companies on the BRC represents 15% of total R&D spend by Life Science companies located on any of the Cambridge Science parks.

Evidence in relation to the investor community (Reported in Section 5)

BRC has played a central role in facilitating the fundraising activity of Campus companies. More than two-thirds of companies consulted on the Campus regard their location on the BRC as being of some degree of importance in facilitating their fundraising. Overall, Campus companies estimated that being located on the Campus had accelerated their fundraising by three months and increased the amount of funds they have been able to raise to date by 10.0%.

Among business and science parks in the Cambridge region, the BRC has the highest amount of funding raised by companies over the past three years. This amount accounts for over a quarter of the total funding that has been raised by companies on business and science parks during that period.

The funds raised by Campus companies during the last three years are concentrated in the Life Science sector, with the BRC alone contributing approximately 47% of total funding raised by Life Science companies operating on business and science parks in the Cambridge region. Collectively, the findings point to the key role that the BRC plays in attracting large commercial investment into the wider Cambridge life science cluster

Evidence on the scale of investment in Campus companies and investor returns (Reported in Section 5)

The evidence from the fourteen companies with established market value suggests that the total market value of the campus companies has risen to over £4.1bn. The values range from £2.6 bn down to less than £5m. The largest fourteen companies in terms of market value have 10 in the range £15m to £99m; 3 between £100m and £500m; and one valued at £2.6bn. These values represent significant potential returns to the investors. The total market value of these largest fourteen companies at £4.1bn represents a 7.2 times return for investors, who have put in £636m in total. This ratio varies between 0.7 and 18.6 across the fourteen.

The question of the scale of the value-added provided to the companies by their location on the BRC Campus is difficult to estimate with precision but estimates suggest a contribution to the growth in value of these companies at £191m – a sizeable achievement.

BRC has attracted a significant amount of commercial investment over the last decade. Overall, the survey of Campus companies shows that they have raised over £1.2bn to date, of which more than £300m funding was received in the last year. There is evidence that the attractiveness of Campus companies among life science and other investors has increased over time.

The analysis suggests that, for the majority of the companies selected, ownership has become more dispersed during the last five years. These results can be taken as evidence that companies on the BRC have been able to attract funding from a wide range of international and leading life-science and technology investors including the IP Group, SV Health Investors, Morningside and Medixci Ventures and many global corporate investors such as Merck Ventures, SROne (GSK), Novartis Ventures and Pfizer Ventures. These investors have supported Campus companies at different stages of their growth, from seed financing to Series B and C rounds and on to IPO.

Fundraising by the largest Campus companies has been facilitated further by the extensive support provided by the University of Cambridge, primarily through Cambridge Enterprise, its commercialisation arm, and Cambridge Innovation Capital, a preferred investor for the University.

Evidence on scientific impact (Reported in Section 6)

According to its mission, the Babraham Institute “undertakes world-leading research into understanding the biology of how our bodies work, including what changes as we age and during disease.” This is in line with the BBSRC Strategic Priority ‘Bioscience for Health’. It is a bioscience research institute engaged in fundamental research with a clear ‘academic’ culture of discovery. A critical expertise is focused on three Institute Strategic Programmes (ISPs) in Immunology, Signalling, and Epigenetics. This is driven by scientific advisory boards and a pragmatic top-down control of the direction of research, with the ability to recruit a critical number of world leading and emerging group leaders with the desired scientific focus, moderated by the freedom in their research to be innovative. The Institute’s research is serviced by world class facilities and core expertise that is an essential component in the make-up and success of BI. The body of new knowledge and innovation, as evidenced by publication, IP agreement and translation (including through Campus Company set up)

combines to create an output and contribution to the understanding of ageing that is greater than the sum of the parts.

Evidence on impact on innovation system (Reported in Section 7)

The contribution of the BRC to the overall Cambridge innovation system was assessed by consulting widely across the Bioscience community. The key findings were:

- The contribution of the Campus in the provision of new start-up and accelerator space was widely acknowledged and it was felt that it was overcoming constraints in the provision of space and facilities;
- Its ability to enhance the flow of funds going into life science companies was considered to be very extensive, particularly in attracting funds from Research Councils;
- The Campus was regarded as providing a strong contribution to the commercialisation of Life Science research, but also the Life Science knowledge base. Enabling entrepreneur driven businesses to form, enabling collaboration and new academic spin-outs were highlighted;
- The Campus was considered to be making a strong contribution to the overall Cambridgeshire sub-region and UK Life Sciences, particularly in generating jobs, enhancing the sector skill base and increasing the global impact and value from UK science;
- When compared with other UK campuses Babraham compared very favourably, particularly in relation to its support Life Science businesses which was most highly rated.

Estimating the additionality of the BRC to business growth (Reported in Section 10)

Additionality was assessed in relation to four main outcomes. These are:

- Providing flexible and affordable “supported” space.
- Accelerating scientific advances.
- Facilitating fundraising.
- Increasing the number of employees.

Campus companies were asked to reflect on how being located on the BRC has benefited their business in relation to each of the four outcomes listed above.

Providing flexible and affordable space

Over 75% of Campus companies considered their location on the BRC as either a very important or critically important factor in helping them access laboratory and office space on flexible and affordable terms. This result reinforces the findings which point to the availability of suitable premises on flexible lease terms as one of the major benefits these companies derive from being located on the Campus.

Accelerating scientific advances

About 88% of survey respondents indicated that being located on the BRC has had some importance in accelerating their scientific advances, with more than half of respondents stating that the their location has been either an important, very important or critically important.

Facilitating fundraising

Four out of five respondents perceive that operating on the BRC has facilitated their fundraising activity. Their location on the Campus is regarded as either a very important or

critically important factor by 12% of respondents, suggesting that the supportive experience provided by the BRC and being at the heart of the Cambridge cluster may have made access to finance by Campus companies easier than it would have been otherwise.

Increasing the number of employees

Approximately two out of three respondents view their location as either a slightly important, important, very important or critically important factor in supporting their employment growth. About a third of respondents do not perceive that being located on the BRC has enabled them to increase the number of employees, though this figure tends to reflect responses from virtual companies with no physical presence on the Campus. Collectively, these results suggest that being located on the BRC has benefited Campus companies' ability to grow and attract talent.

Summary of impact

The results show that both virtuals and other companies feel their location on the BRC has benefited their scientific discovery process and fundraising activity significantly. The estimates of impact are particularly large for virtual companies, which may be explained by the fact that these companies tend to be younger compared with other companies on the Campus. Once virtuals are excluded from the sample, the number of employees is estimated to be 20% larger as a consequence of being located on the BRC than it would be otherwise. Taken together, these findings suggest that being located on the BRC has brought additional value to Campus companies by increasing both the speed and scale of their activity through the provision of flexible and affordable space.

Table E1.Impact of the location on the Babraham Research Campus: virtuals vs. other companies

	Virtual companies Average effect			Other companies Average effect	
	Mean	**Median**		**Mean**	**Median**
Accelerated scientific discovery by	6.5	6	Months	4.6	3
Accelerated fundraising by	5.5	4.5	Months	5.1	3
Increased fundraising to date by	19.5	12.5	%	7.9	10
Increase the number of employees by	4.2	0	%	28.1	20

Number of responses: 25 (6 virtual companies and 19 other companies)

Source: CBR.

Additional GVA and employment associated with the Campus

Additionality is the real increase in social value that would not have occurred in the absence of the intervention being evaluated, where in this case the intervention supported is the Babraham Research Campus. There are benefits to society, and thus an increase in social value, from increased scientific discovery since this will translate into improvements in health and the welfare of people in society in the United Kingdom, but also around the world. Increased quality of life and reduced mortality result. These can be valued. It is also the case that additional activity created on the Campus translates into GVA and employment.

A strict, *narrow* interpretation, of additionality would focus simply on whether the activity would otherwise have occurred with zero (no additionality) representing all of the activity would otherwise have occurred to 100% where all of the activity is totally additional. However, a *broader* interpretation should also include enhancements to quality of outcome and the ability of the intervention to speed things up. The evidence suggests that the BRC has been able to increase both *scale* and *speed* of delivery of the life-science product. It would be very unsurprising if it had not also improved *quality* as well, but that is inherently difficult to assess.

The study provided an assessment of the increase in GVA and employment associated with the Campus for the United Kingdom as a whole over broadly the period 2012-2018. This amounted to an *increase* in gross GVA of £206 million and increased employment of 800. On the basis of the *narrow* measure of additionality based on the views of the businesses on the Campus, *additional* GVA would be of the order of £27 million. Evaluation Guidance varies on how long the GVA might be expected to persist and thus what should be the NPV. Research on the valuation land and property market benefits created or supported by Government intervention has adopted a ten year profile but it is obviously possible to adopt different profiles and adjust the NPV accordingly with a lower option being only five years. Using a ten year profile, which would seem appropriate given that the floorspace on the Campus is expected to continue to provide longer term benefit streams by its very nature, would suggest a NPV of about £198 million assuming discount rate of 6%.

This is the gross increase in GVA and employment and it is normal to allow for any displacement that might be associated with support for companies on the Babraham Campus leading to reduced activity on competing companies elsewhere in the local area and the rest of the United Kingdom. Given the nature of the high technology life science activity taking place on the BRC and considering it with other locations in the sub-region did not suggest that there was a high level of displacement in the standard sense as might be associated with manufacturing activity as an example. There are arguments that it is very low indeed at the local regional level-perhaps 10%. It is also not clear given the nature of the science being developed and its relative uniqueness to the Cambridge location that the displacement increases substantially at the level of the United Kingdom. Perhaps something like 20% might be appropriate. Taking an average of 15% and applying to the gross estimates of impact suggest benefits of around £169 million.

The public sector contribution to the Campus and its development

The BRC has been in public sector ownership since 1948. The switch to its current biological research specialisation of epigenetics, signalling and lymphocyte signalling occurred in 1993 and the move to the provision of more commercially orientated premises to accommodate bioscience companies dates from 1998. The BBSRC have provided grants and of 58.8 million and loans of around £5.6 million.

It is not straight forward to assess the true level of overall public sector support that has underpinned the development of the Campus. A number of issues arise. The public sector has provided grants and loans to encourage the development of research and, in recent years, the economic development potential of the site (as in the case of the grant from the Regional Development Agency in 2002 (EEDA) for £1.95 million). The land is owned by the public sector and as the landowner the public sector could accrue ground rent, but is understood that this has only been at a pepper corn level to-date and there has thus been a level of public subsidy

in this. On the credit side of the account the public sector has seen a very substantial increase in the value of the site compared to when it was used for agriculture and thus its return on the investment should it ever seek to realise it. It is also the case that the increased commercial development of the site has generated increased tax revenue to HM Exchequer.

A further important issue for is the period of time over which the payback from the public sector should be considered. It is to be remembered that part of the rationale for public sector support has been to encourage research that will provide health care benefits. Another part has been to enhance the economic development of the Life-Science sector and the benefits it provides to the Cambridge and United Kingdom economy. In both cases these benefits will emerge over many years. The evidence suggests that the total market value of the campus companies has now risen to over £4.07 bn. These values represent significant potential returns to the investors, but the forward momentum is such that there is likely to be substantial future growth in market value.

If the estimate of net economic impact of £169 million NPV is taken and put alongside the £58.8 million of direct research council grant the Benefit Cost Ratio is around 3 which is impressive. However, this estimate does not value the wider medical and health benefits that are and will continue to benefit society and is subject to the basic assumptions and limitations referred to above that the Campus may have helped increase the value of the companies on the Campus by £191m – a sizeable achievement.

The research confirms the considerable value that can be realised by well targeted public sector investment in this extremely important sector to the future of the British economy and its citizens.

Glossary of Terms

Additionality is a real increase in social value that would not have occurred in the absence of the intervention being appraised.

Benefit Cost Ratio is used in cost benefit analysis to provide an indication of how the benefits to society of an investment relative to its costs. Both benefits and costs can be considered in different ways but the overall idea is to help with assessing value to society.

Deadweight refers to outcomes that would have occurred without the intervention. This is used to determine the difference that can be attributed to an intervention.

Displacement is the degree to which an increase in economic activity promoted by an intervention is offset by reductions in economic activity elsewhere.

Effectiveness is a measure of the extent to which a proposed intervention achieves its objectives.

Evaluation is the systematic assessment of an intervention's design, implementation and outcomes.

Gross Value Added *(*GVA*)* is the measure of the value of goods and services produced in an area, industry or sector of an economy.

Leakage describes the leakage of benefits intended for a recipient group or area into another group or area

Market failure is where, for one reason or another, the market mechanism alone cannot achieve economic efficiency.

Net Present Value (NPV) is a generic term for the sum of a stream of future values (that are already in real prices) that have been discounted (in the Green Book by the social time preference rate) to bring them to today's value.

Outcome refers to the consequences to society of a change in service or policy. For example, improved life expectancy of the population.

Output refers to the change in the level or quality of a service delivered. For example, more cardiovascular operations carried out.

Sensitivity Analysis involves exploring the sensitivity of expected outcomes of an intervention to potential changes in key input variables. It can be used to test the impact of changes in assumptions and should be clearly presented in the results of appraisal

Social Benefits are the total increase in the welfare of society from an economic action – the sum of the benefit to the agent performing the action plus the benefit accruing to society as a result of the action (external benefits).

Social Cost is the total cost to society of an economic activity – the sum of the opportunity costs of the resources used by the agent carrying out the activity, plus any additional costs imposed on society from the activity (external costs).

Social Cost Benefit Analysis quantifies in monetary terms all effects on UK social welfare. Costs to society are given a negative value and benefits to society a positive value. Costs to the public sector are counted as a social welfare cost.

1. The aims and scope of the study

Babraham Bioscience Technologies Ltd and their campus partners (the Biotechnology and Biological Sciences Research Council and the Babraham Institute) commissioned a research team led by Cambridge Economic Associates and comprising The Centre for Business Research, Cambridge Econometrics, Savills and Professor Lisa Hall to identify and capture a comprehensive evidence based understanding of the benefits and impact of the Campus. The outputs from the impact assessment being used to inform the future development of the Campus and the overall contribution it makes to the Cambridge and British economy.

Review objectives

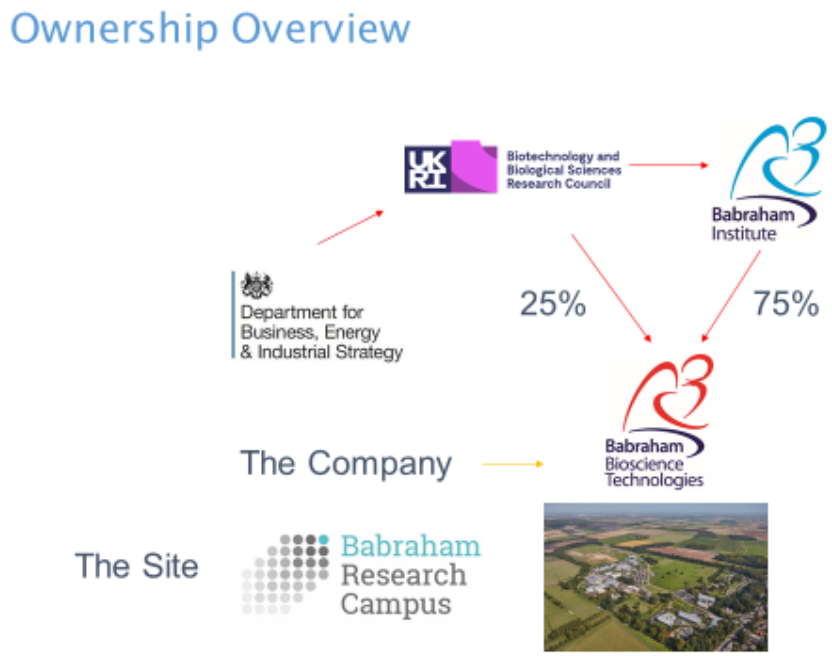
1.1 The BRC was established in 1998 and its aim is to 'support new bioscience companies and catalyse the commercial exploitation of biomedical research'[1]. It offers leading-edge research, incubator, accelerator capabilities and follow-up space in an attractive and accessible location and currently has around 60 start-up and scale up innovative companies located on the Campus.

1.2 Babraham Bioscience Technologies (BBT) is a for-profit organisation with the responsibility of developing and managing the BRC on behalf of its shareholders the BBSRC and the Babraham Institute. In addition to the provision of the commercial laboratory and office facilities on site, BBT 'mission is to drive the development of a sustainable, world-leading campus environment which supports and nurtures the development of cutting edge science, capabilities and innovation in an entrepreneurial setting. "BBT's role extends beyond 'campus and property management, to include support of early stage life-science companies through provision of communal laboratories, accelerator programmes such as Accelerate@Babraham, and investor and cluster conferencing activities. Diagram 1 shows the ownership structure of the Babraham Research Campus

1.3 There has been much interest in assessing the impact of a bioscience research campus on the economy (local and national) and society as a whole. The policy agenda is focused around the recent Government Life Science Industrial Strategy[2] where the emphasis is on building the capacity of local place based initiatives like Babraham to maintain and extend the United Kingdom's world-leading position in bioscience. At the sub-regional level, the activities of the Cambridgeshire and Peterborough Combined Authority and the production of the Cambridgeshire and Peterborough Independent Economic Review (CPIER) emphasise the case for greater fiscal devolution and powers to unlock the delivery of major infrastructure that will assist the growth of high technology based development in the Cambridge Life Science cluster. In this context it is important that the Campus can show the contribution it is currently

[1] The Babraham Research Campus-supporting the UK bioscience industry. BBSRC.
[2] https://www.gov.uk/government/publications/life-sciences-industrial-strategy

making to society and the economy.



1.4 The present study was commissioned by Babraham Bioscience Technologies (BBT) and their campus partners (the Biotechnology and Biological Sciences Research Council (BBSRC) and the Babraham Institute (BI)) commissioned to identify, capture and demonstrate the benefits (economic, societal, people, training and business) and the impact of the *whole* Campus and the role that it plays in the local, national and international innovation landscape, including where research and capabilities support the development of business.

1.5 In meeting this requirement the researchers have identified the activity created by the Campus along the relevant dimensions and how this might increase in the future. However, they have also considered a further important issue. Namely, how much of the activity is generally *additional* to the local economy in that it may not have *existed, or taken longer to occur or been of a lower quality* in the absence of the Campus and in particular the new public investment that was provided since 2012. The activity is additional if the public support provided to the Campus, and in particular that provided since 2012, has overcome market and/ or institutional failures that would otherwise prevent it happening. Of course, it is possible that these market/institutional failures are generic to the whole of the United Kingdom in which case they could have been overcome by public policy support elsewhere. However, if the Cambridge location has attributes that are totally unique to it and not transferable elsewhere, overcoming them in Cambridge provides genuinely additional outcomes to the United

Kingdom economy and society overall.

The Pathways through which the Babraham Research Campus makes an impact.

1.6 Figure 1 summarises the different pathways through which the Babraham Research Campus makes an impact, showing how funding from the private sector, charities and government enables the Campus to deliver benefits;

- that arise from the provision of strategically important infrastructure and the provision of premises that generate economic gain and societal well-being;
- to business and the development of the local life science cluster;
- from the augmentation of the science and knowledge base;
- through the enhancement of skills, education and a number of other labour market impacts;
- to the wider society and communities

Defining the pathways

1.7 The conventional approach impact to is to recognise and quantify the activities, outputs and outcomes associated with the BRC. For each activity it is necessary to consider the 'theory of change', i.e. the specific ways in which the activity brings about change to the people and businesses in the local, regional and national economy. The resources committed to the Campus activities lead to outputs like the development of new buildings, facilities, jobs, training places and many other things. These outputs translate into enhanced societal welfare which can take a number of forms including improvements to health and increased income. The impact is the outcome change attributable to the BRC.

The direct, indirect and induced economic impacts of the activities of the BRC

1.8 There are direct economic impacts that arise from the operation of the Campus and the companies that are based on it. This *direct* economic activity also provides economic opportunities in the companies that supply the Campus and its companies with goods and services. These are referred to as *indirect* effects. People who work in the companies and organisations associated with Campus spend their incomes which creates more jobs and activity in the local and sub-regional economy. These *induced* effects can be very significant, particularly as new businesses and workers move into the region to work on the Campus.

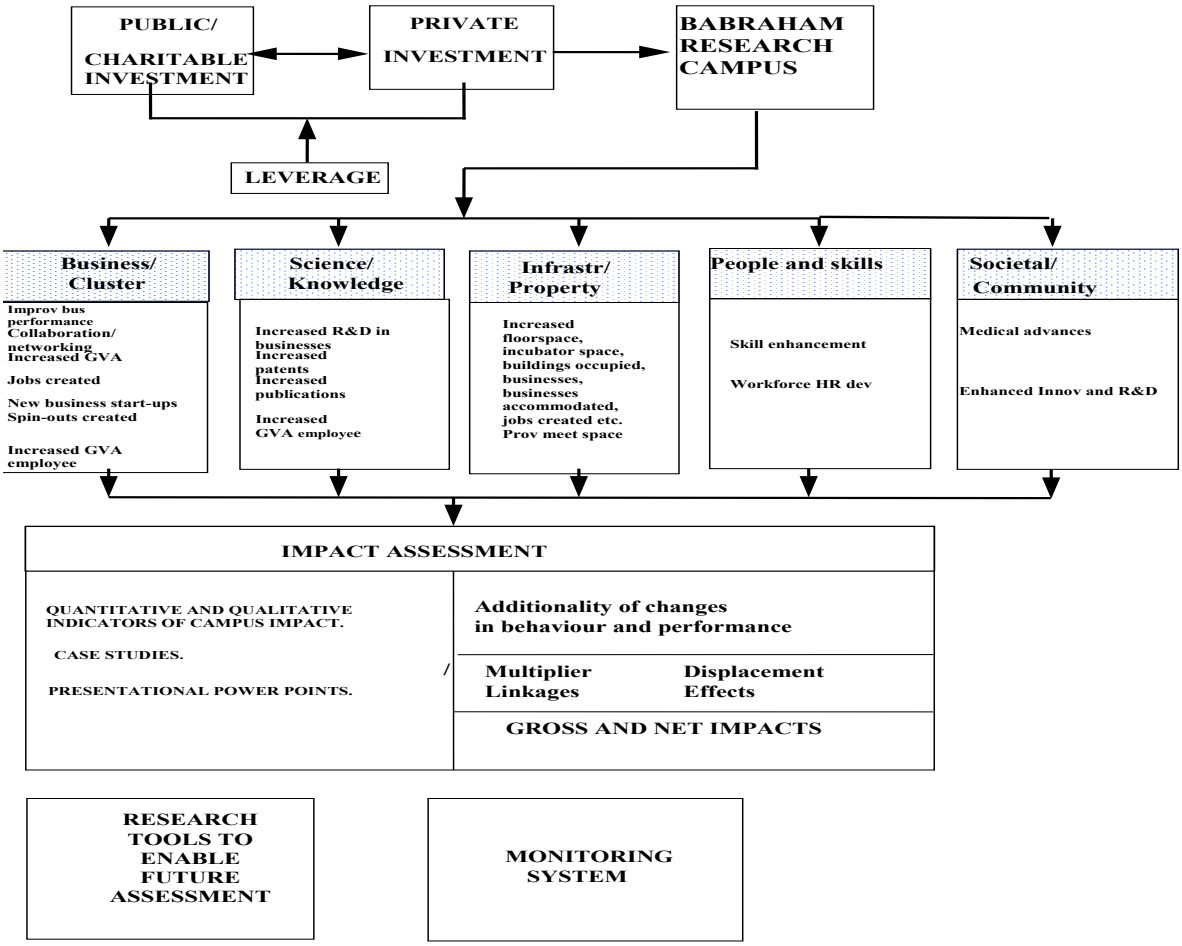
1.9 The direct, indirect and induced economic effects generate gross value added and employment in the Cambridge sub-regional economy. This is additional activity to the local economy unless it represents displaced activity that would otherwise occur elsewhere within it. The more 'unique' the relative advantages of the Campus location compared to elsewhere the higher the level of additionality. As Figure 1.1 shows, the assessment framework recognises the need to distinguish gross and net impacts and thus judgement on the additionality of the benefits created.

The impact of the Campus on the Knowledge, Science and the Life Science cluster and associated innovation system

1.10 Further impacts from the Campus arise from the *wider effects* that result from the commercial exploitation of the science and knowledge base that is possible because of the activities on the Campus that include the accommodation of new business start-ups, the use of the research facilities and the Campus acting as a place that allows networking and collaboration to occur. There are a number of possible ways in which these effects can arise.

1.11 Thus, the research can generate new ideas that may be patented. Companies will exploit the new market opportunities that arise reflected in academic and business spin-outs and increased activity in existing companies. Yet other benefits can arise from the sharing of knowledge and ideas. As the Campus grows it enables more benefits to existing businesses and others in surrounding knowledge based institutes. It will also produce benefits that will arise elsewhere in the United Kingdom and the world. It will thus build the capacity of the overall Cambridge bioscience, ICT and nanotechnology clusters.

Figure 1.1. The Pathways through which the Babraham Research Campus makes an impact.



1.12 We can assess the impact of the Campus in strengthening interactions between the traditional three main components that make up the 'triple helix' of a regional innovation system, namely academia-industry-government. These reflect links between research staff in medical and related Departments in the University and local life-science companies, either in the form of collaboration, funding, and as an employment route for University graduates, or as vehicles for the commercialization of University-based research. Much research in University departments is funded by public bodies such as the Charities and Research Councils and in the Bioscience Impact Report[3] it was argued that it is increasingly being realised that the traditional helix should be augmented by a fourth element which is the funding and institutes provided by major charitable bodes, such as the Wellcome Trust: the reality is thus one of a 'quadruple helix'. The impact of the BRC on all of these interactions should be assessed.

1.13 The framework adopted in the research has been designed to capture the extensive and diverse range of benefits that arise from the activities of the Campus. It has recognised that the impact assessment should be compliant with HM Government Treasury Green Book[4] requirements and thus assess the *additionality* of induced activity wherever possible.

Methodology

1.14 The research methodology had to meet a number of key requirements. Public investment in the Babraham Campus has a long history, dating from the original acquisition of the land and its development by the Agricultural Research Council in 1948. The Babraham Institute focused on agricultural research until the early 1990s when the shift occurred to its current research specialisation in Life Sciences and in particular epigenetics, signalling and lymphocyte signalling. The focus on Life Science research meant that the public sector interest was represented by the Biotechnology and Biological Sciences Research Council (BBSRC), from whom the Babraham Institute (BI) and Babraham Bioscience Technologies Ltd (BBT) lease the Campus.

1.15 Throughout the early part of the new century the Campus was developed and assisted through public sector support and its ownership in the public sector enabled a flexible approach to the letting of space to newly developing life science start-ups. However, the quality of the provision was substantially enhanced in 2011 with the investment by BBSRC of £58.8 million in additional infrastructure.

1.16 As was discussed earlier in this section, a key issue in assessing the benefits realised from the investment by the public sector is the extent to which it has helped to overcome market and/ or institutional failures that would otherwise prevent the provision of space of the kind required by the emerging life science sector in Cambridge. If the public investment has

[3] https://www.phpc.cam.ac.uk/pcu/files/2015/09/CambridgeBioscienceImpact.pdf
[4] https://www.gov.uk/government/publications/the-green-book-appraisal-and-evaluation-in-central-governent

filled an identifiable gap in the market provision then the life science activity that takes place is additional to the Cambridge region. In certain circumstances, as argued earlier, it might even be additional to the United Kingdom. A central requirement of the research methodology was therefore that it should be able to identify the extent of the *land and property market failure and thus confirm whether the rationale for public sector investment was justified.*

1.17 A further requirement of the methodology was to assess the *additionality* associated with the public intervention in the Campus. Additionality is the real increase in social value that would not have occurred in the absence of the intervention being appraised[5]. To assess additionality it was necessary to *compare and benchmark the performance of the Campus, and the businesses on it, using relevant reference and control groups.*

1.18 The research team also considered the conceptual and measurement issues involved necessitated a detailed, in-depth, analysis of the companies on the Campus drawing on the expertise of the Cambridge Centre for Research.

Applying the methodology

1.19 To assess the impact of the Babraham Research Campus has required a considerable amount of evidence to be collected and analysed. Some of this has been available from established government data sources and some from the data and modelling systems that the consultants have developed over the years. This includes the Cambridge Econometrics Local Economy Data Base of the UK and regions, the Cambridge Centre for Business Research company database and cluster mapping system and data accessible by Savills from CoStar. Other data has come from BRC records but a further substantial amount has been collected by the consultants.

1.20 The survey of companies located on the BRC was undertaken between May and July 2019. The survey instrument used a combination of open-ended and closed-ended questions to allow for greater participation in the study. To achieve a higher response rate, each questionnaire was also pre-completed with information that the research team had been able to gather from public sources. It was designed by the research team with feedback from BBT and BBSRC, and circulated to Campus companies by BBT. A copy of the questionnaire is included in Annex 3 Appendix A.

1.21 The sample selected for the survey included all of the tenants, virtuals and communal lab users that were on site as at April 2019 and operated in the life sciences sector. It excludes organisations that, despite being located on the Campus belong to sectors other than life sciences (e.g. NORR Consultants, the BRC's architects). This led to 46 of the approximately 60 companies that are currently on site to be included in the sample.

[5] HM Treasury Green Book.
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/685903/The_Green_Book.pdf

1.22 The consultants also assembled a considerable body of evidence on the Campus provided by those responsible for monitoring and tracking the performance of the Campus. These included Ms Nicola Kinsey (Director of Business Operations), Ms Becky Paxton, Chief Financial Officer, Ms Jackie Draper (Finance Manager), Dr Karolina Zapadka (Head of Babraham Accelerator), Dr Simon Cook (Head of Knowledge Exchange and Commercialisation) and Dr Hayley McCulloch (Public Engagement and Knowledge Exchange Manager) and Caroline Glover (Grants Officer, BI).

1.23 The consultants have also undertaken surveys and interviews with a wide range of stakeholders in the local and regional economy, but also elsewhere in the United Kingdom. These surveys have been targeted on the Bioscience research community, University and other relevant Knowledge Based Institutes, Venture capitalists and public and charitable funding organisations, representatives from local and central government, relevant support industries and local community. In-depth case studies were also undertaken.

1.24 A key focus has been to assess the performance of the Campus over time and to compare performance using data from the local business cluster data base and local property market data.

Report Structure.

1.25 This Report begins in Section two by describing the development of the Babraham Research Campus and then moves in Section three to provide estimates of the direct, indirect and induced economic impacts of the Campus before moving in Section four to assess the wider business impacts and associated public and commercial investment contribution. Section five provides evidence on the scale of investment in Campus companies and the views of investors about the Campus as a location for high-technology investment. Section six provides an assessment of the contribution of the Campus to the advancement of science, knowledge and societal health. Section seven reviews the impact of the Campus on the development of the Cambridgeshire innovation system. Section eight considers the impact on the Cambridgeshire property market. Evidence from case studies based on Campus companies is reviewed in Section nine.

1.26 Section ten brings together the over total impact of the Campus and considers questions of additionality. Section eleven considers how the development of the Campus should be monitoring and assessment framework in the future and also reviews key issues that should be considered in shaping future strategy. Annexes provide supporting material that informed the overall impact assessment of the Campus.

2. The Babraham Research Campus.

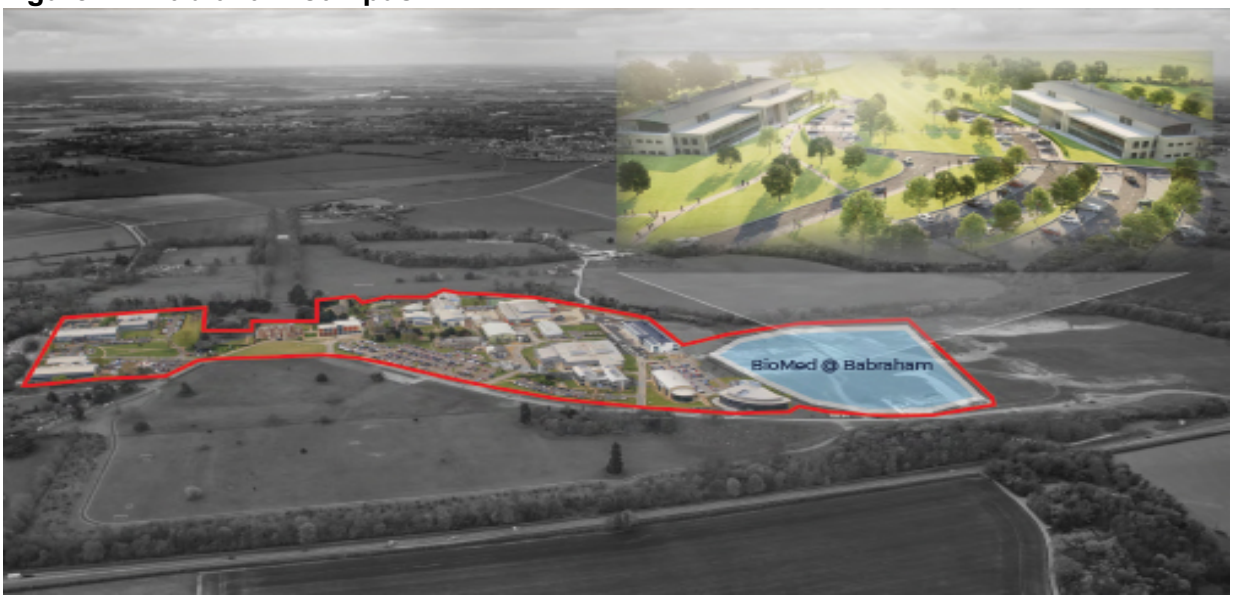
History, Location and Development Context

2.1 The Babraham Research Campus (BRC) is located on over 430 acres (174 Hectares) in a parkland environment, approximately 10km south-east of Cambridge. BRC was initially occupied and developed by the Agricultural Research Council in 1948, who developed the campus's first research and laboratory facilities in the 1950s. In 1993 the 'The Babraham Institute' phased out agricultural research, and adopted its current biological research specialisation of epigenetics, signalling and lymphocyte signalling. The freehold owner of the campus is the Biotechnology and Biological Sciences Research Council (BBSRC), who lease the campus to the Babraham Institute (BI) and Babraham Bioscience Technologies Ltd (BBT).

2.2 The BRC co-locates the Babraham Institute with bioscience businesses, at various stages of their business lifecycle, promoting links between academia and business. The BRC provides approximately 190,000 sq. of research facilities, services and commercial space, available on flexible terms for start-up and more established businesses seeking to scale up their operations.

2.3 Tenants must be developing technologies or products of relevance to human healthcare and the pharmaceutical sector. Priority is given to companies whose science is synergistic to the Babraham Institute, however this is not a requirement. The BRC's existing development will grow by a further 108,000 sq. in 2019, with additional scale up research space being developed by BioMed (Figure 3.1 below). Spread across two buildings the new facilities will provide a campus to attract established corporate tenants. Furthermore, it provides space for businesses who have scaled up their operations, and require larger office tenancies than the start-up and scale up space found in the BRC.

Figure 2.1 Babraham Campus



Source: Babraham Research Campus

2.4 The BRC has seen development of its campus since 1998. Table 3.1 below outlines the key campus development and funding milestones:

Table 2.1 – Timeline of development and funding milestones

Year	Timeline of key events and milestones
1998	• Refurbishment of 405 and 406 (approximately 15,000 sq.ft). • Babraham Bioincubator is established.
2001	• Babraham Bioincubator is fully occupied.
2002	• BBT are granted planning permission for two further bio-incubator buildings.
2004	• The bio-incubation facilities on the campus houses 21 companies.
2006	• Development of Minerva building (approximately 20,000 sq.ft).
2007	• Development of Meditrina building (approximately 20,000 sq.ft).
2010	• Development of Maia building (approximately 8,500 sq.ft).
2011	• BBSRC receives £58.8 m for investment in the Babraham Research Campus. This funds a number of additional buildings, infrastructure and utilities.
2012	• Development of Monetta (approximately 17,500 sq.ft), funded by the BBSRC grant.
2013	• Change in the management of buildings 501, 530, 301 and 580 (adds approximately 30,000 sq.ft). • Building 580 funded by the BBSRC grant. • Development of Jonas Webb building (approximately 14,500 sq.ft), funded by the BBSRC grant.
2014	• Development of Eddeva building (approximately 20,000 sq.ft). • Development of Bennett building (approximately 20,000 sq.ft), funded by the BBSRC grant.
2017	• Development of Imperial College London (ICL) (approximately 49,500 sq.ft). • Development of the Cambridge Building, a 200 capacity tiered lecture theatre, meeting rooms, restaurant and bar.
2018	• Biomed Realty starts construction of 108,000 sq.ft scale up research space for growing bioscience companies.
2019	• Kadans Science Partner acquired B900 (49,000 sq.ft) from Imperial College ThinkSpace.

Source: Babraham Research Campus, 2019

2.5 A number of businesses that started and developed through the BRC have left the campus once they outgrew their premises. This is one source of impact the BRC has on the surrounding property market, producing companies that take-up space in nearby business parks. The BRC have advised that the primary locations for previous BRC start-ups include Granta Park, Chesterford Research Park, Wellcome Genome Campus and Cambridge Science Park.

2.6 Out of the companies that graduated from the Babraham Bioincubator (since 1999), and are tracked by the BRC and still operating (excluding companies that failed, relocated out of the UK or were acquired), 39% relocated to nearby research parks (Granta, Chesterford and

Sanger Centre), while 18% to the Cambridgeshire Science Park in the Northern Research Cluster. The remaining 43% of businesses relocated throughout the Southern Cambridgeshire submarket, Cambridge Periphery and elsewhere within the UK.

Positioning Babraham in the wider Cambridgeshire Property Market

2.7 The Babraham Research Campus (BRC) has made a significant contribution to the Cambridgeshire property market, providing specialised start up and scale up space, with access to world-class facilities (e.g. laboratory space) and on lease terms tailored to the needs of start-up space.

2.8 Combined with world-class biotechnology research via the Babraham Institute, the BRC provides a unique bioscience ecosystem that differentiates it from the many privately funded business parks that rely on purely commercial finance. It provides a mix start-up space designed for start-ups on flexible lease terms, which vary from what a commercial landlord would offer. Start up space within the BRC is designed to support early stage life-science ventures by providing laboratory and office space in units of circa 600 sq.ft and above on short-term flexible lease terms. The following BRC buildings provide this type of space.

- Meditrina: 20,000 sq. of laboratory and office accommodation, divided into 20 units of circa 1,000 sq. each and let as individual or multiple units.
- Maia: Small laboratory and office units from circa 570 sq.
- Moneta: Units of circa 600 sq. available as individual or multiple units.
- Minerva: 20,000 sq. providing ideal grow-on space, designed to provide highly flexible chemistry and molecular biology laboratory and office space.
- Building 580: 10,000 sq. of scientific and technical services facilities, offering core science services to the Babraham Institute and the campus.

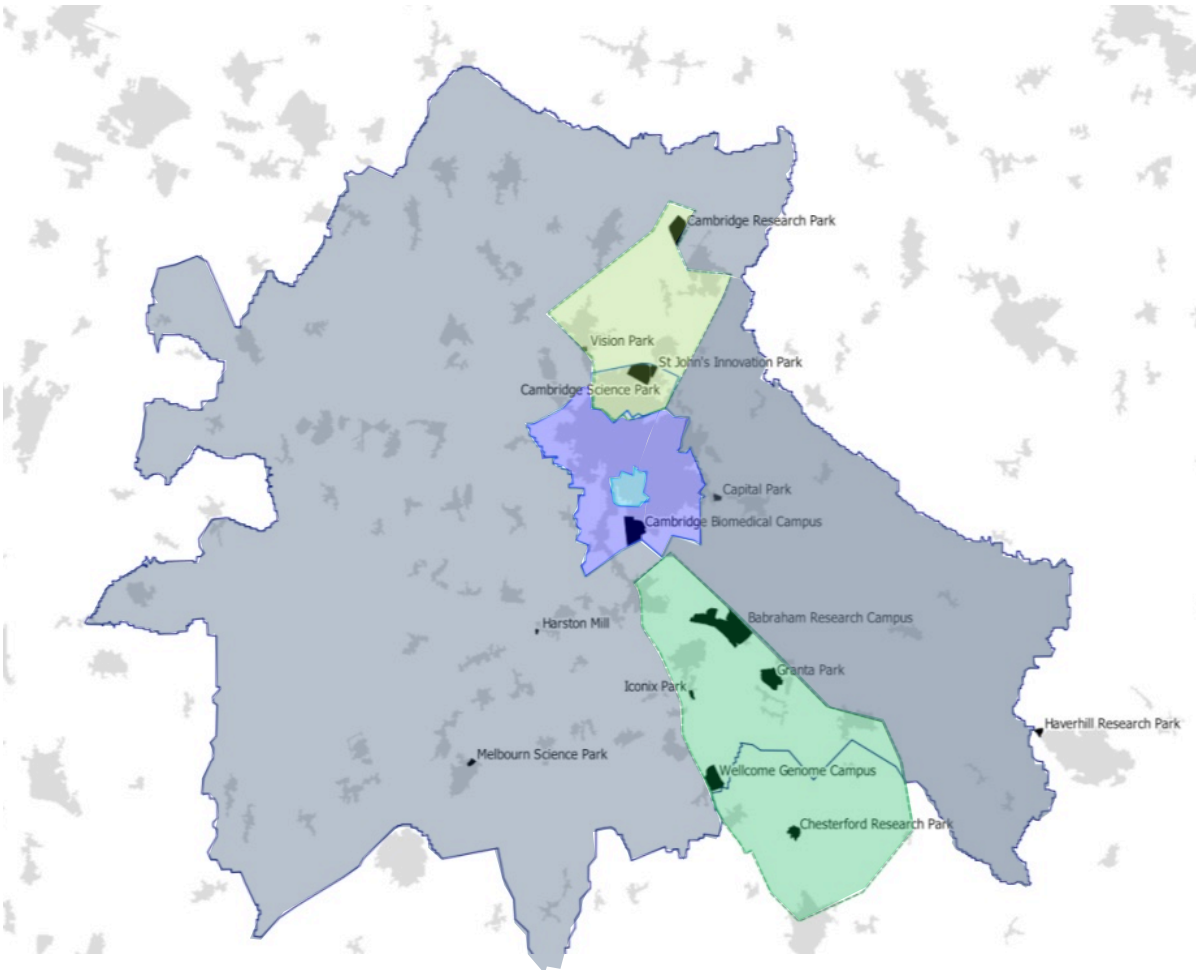
2.9 In addition to the BRC, other research parks play a key role in anchoring the research clusters within Cambridge and providing start-up space to businesses developing technologies or products relevant to human healthcare and the pharmaceutical sector. These research parks sit within different Cambridgeshire office / R&D submarkets that provide a range of space to different businesses. These include:

- **Cambridge Prime Central,** comprising of a consolidated urban centre, Cambridge Train Station, amenity and retail services and the majority of the areas housing stock and A grade office space at the centre of the Central Business District.
- **City Centre Periphery** immediately surrounds the Cambridge Prime Central submarket, containing Cambridge University Campus, Cambridge International Airport and a number of key business parks such as the Cambridge Biomedical Campus.
- **South Cambridgeshire** market is the non-urban component of the Cambridge office market, and is comprised of town centres and greenfield research campuses and business parks, and provides a counterfactual benchmark to identify the uplift associated with the BRC.

2.10 To differentiate these markets further it is possible to identify a Southern and Northern Research Cluster, comprised of:

- **Southern Research Cluster**, including the BRC, Wellcome Genome, Iconix Park, Granta and Chesterford. This Southern Cluster is the BRC Property Market Area (PMA), and benefits from the development of early stage R&D start-up space, lab and scale-up space at BRC.
- **Northern Research Cluster**, including Cambridge Research Park, Vision Park, Cambridge Science Park and St Johns Innovation Park.

Figure 2.2: E1 – Office / R&D Clusters



Source: Savills 2019

3. The Direct, Indirect and Induced Economic Impacts of the Campus

Introduction

3.1 The companies on the Campus contribute to the UK economy through its operational activities. The financial expenditures of companies on the Campus create expenditure and income effects in the wider economy. The following expenditures of companies were analysed in detail in order to quantify the operational economic impacts of the Campus on the UK economy:

- Payments to other organisations for goods and services – such payments generate receipts to other UK organisations, which in turn generate a requirement for inputs further up the supply chains.
- Wages and salaries paid to staff – this represents income, some of which will be spent on goods and services in the UK, which in turn also generates further rounds of spending.

3.2 Both cases reflect the 'multiplier effect' by which an initial set of purchases generates further purchases elsewhere in the economy to support production. By focusing on expenditure, this part of the research measures the economic impact of the Campus from the 'demand-side'. It does not take account of 'supply-side' effects that might improve UK productivity and competitiveness, such as capital expenditure and investment in skills and R&D. These effects are addressed in other, more qualitative, parts of the research.

3.3 This analysis seeks to measure the gross economic impact of the Campus through its operational activities. The study does not measure the opportunity cost of what would have happened had the campus not existed in order to estimate the net impact of the Campus. These issues of additionality are discussed more qualitative in other parts of the research.

Input output tool

3.4 An input-output (I-O) analysis approach was used to quantify the above impacts. An I-O tool was built that captured:

- Supply-chain effects: the Type I, or indirect impacts from economic activity generated by supplying companies.
- Income effects: the induced impacts from companies paying wages and salaries to workers who then spend that income in the economy, which in turn creates more jobs and activity in the local and regional economy. These induced effects can be very significant, particularly as new businesses and workers move into the region to work on the Campus. The combined indirect and induced effects make up the Type II (Keynesian multiplier)

impacts.

3.5 In the context of this analysis we classify:

- The direct impact as the monetary value of spending by companies on the campus on goods and services (which are provided by suppliers).
- Indirect impacts as those generated when suppliers of goods and services must themselves purchase inputs from other sectors of the economy.
- Induced impacts from people working in sectors where the direct and indirect impacts take place going on to spend their wages and salaries on consumer products and services, such as food and drink, shopping, healthcare, education and entertainment.

3.6 The I-O economic impact tool is an Excel-based tool based on the 2015 UK Input-Output table produced by the Office of National Statistics (ONS), which captures the output linkages between 129 sectors and between different agents in the UK economy and the rest of the world. The tool estimates the three different types of economic impacts (direct, indirect and induced) on gross output, GVA and employment.

Direct impact

3.7 The direct impacts are based on company's financial expenditure data from BBT, BI and the Cambridge University Centre for Business Research. BBT provided data for all companies on the Campus, including Babraham Institute, non-tenants[6] and virtual users who use the Campus facilities from 2011-2017[7]. BBT's data captures any expenditure that companies make through BBT. Table 3.1 provides a description of the types of BBT data used to capture companies' direct impact.

[6] Non-tenants are companies that have purchased services from BBT, but have had no formal contract in place for a tenancy or use of the virtual services. Examples of this are companies that may use BBT's meeting room facilities.

[7] BBT's financial year runs from 1st April to 31st March. At the time of undertaking this work, BBT provided data on the current 2018-19 financial year to date, but as it was still ongoing, the data was not complete and has therefore not been used in the analysis.

Table 3.1 Description of BBT direct impact data

Expenditure	Description
Alterations	Minor and major work carried out in construction-related activities (e.g. shelving, refitting, dilapidations works)
Consumables	Purchase of, for example, stationery, laboratory storage etc.
Design and Build Income	Captures BI's contract with BBT to design and build two of its scientific buildings
Equipment Income	Use of facilities and equipment provided on the Campus
Fixed Asset Equipment Proceeds	Proceeds from the sale of fixed assets
Fixed Asset Investment Proceeds	Covers M&A fees received from Aitua Limited and Discerna Limited
Fixed Asset L&B Proceeds	Surrender of part of the lease BBT held for the Babraham Research Campus back to BBSRC
Housekeeping	Covers a range of activities, including: use of equipment, security screening, training courses, building insurance etc.
Interest Received	Interests received by BBT
Investments Income	Covers investment income received by BBT from Babraham Group companies including Aitua Limited and Discerna Limited
KEC (Knowledge Exchange and Commercialisation) Income	Commercialisation activities carried out by BBT for BI
Meeting rooms	Rent from hiring out meeting rooms
Rent	Rent from the building
Service charges	Covers catering, security, IT infrastructure, landscaping maintenance, pest control, waste services
TDL (Technology Development Laboratory) Income	Experiments carried out by contracted scientists for early stage companies (TDL is no longer active)
Utilities	Electricity, gas, water, heating and cooling
Vet Services	Veterinary services
Virtual & Lab Users	Covers a range of activities, including: subscription charges for virtual and laboratory users, use of facilities in certain laboratories for part time bench space users, membership charges for tenants etc.
Waste	General and chemical waste storage and clearing

3.8 BI provided data on the income it received from external companies and BI itself for commercial work undertaken by the Institute's scientific services from 2013-2017. The Cambridge University Centre for Business Research provided estimates of the global turnover, R&D expenditure and salaries of the tenants on the Campus from 2011-2017 (see Table 3.2).

Table 3.2. Description of additional financial expenditure data from BI and CBR

BI's Facility Income	Description
Scientific and Research related income	Covers a range of activities, including: Bioinform Camb[8], Chemistry, Gene Targeting, Antibody Sales, Bioinformatics, BSU, Flow Cytometry, Imaging, Lab Services, Lipidomics, Research agreements, Mass Spec and Sequencing
Management and consulting services	Covers a range of activities, including: consulting services provide by the scientists and Health & Safety officers to external companies, patent costs associated with KEC grants and auditing services.
Vet services	Veterinary services
Health & Safety	Health and safety activities
Flow Training Course	Training provided by BI on flow equipment
CBR's financial data	
Turnover	Turnover of tenants on the Campus. The figures cover the total turnover of a company in a particular financial year including its branches and subsidiaries, if any.
Employment	Total staff hired by the company globally, including its branches and subsidiaries, if any.
R&D expenditure	R&D expenditure of tenants on the Campus. The figures cover the total R&D spend of a company in a particular financial year including its branches and subsidiaries, if any.
Wages & Salaries	Salaries of tenants on the Campus. The figures cover the total salaries paid in a company in a particular financial year including its branches and subsidiaries, if any.

3.9 The above data was classified into an I-O sector (of which there are 129) and used as inputs into the I-O tool to generate estimates of the wider (indirect and induced) operational economic impacts.

Data issues

3.10 The company financial expenditure data provided by BBT was the key dataset analysed to develop the inputs to the I-O tool. The data provided by CBR were then used to augment BBT's data. The key issues we faced with the data are listed below:

- BBT do not hold data on Campus company employee salaries. We therefore made estimates based on CBR's global data on employment and salary for the companies on the Campus. Global salaries were scaled down to estimate salaries spent on employees on the Campus using proportions of how much of a company's employment is based on the Campus.
- The BBT data do not cover all expenditures, only purchases that go through BBT. For example, not all companies on the Campus use IT services from BBT, so data on these expenditures will not be given for these companies. Therefore, the data that BBT provided

[8] The charges for the use of monthly computer clusters. These were separated out in the first year of BBT data, and are included in the general Bioinformatics usage for all other years.

do not capture all direct impacts of all the companies. BBT's data mainly captured non-R&D expenditure (e.g. rent, construction, utilities etc.). A very small proportion of R&D expenditure may be captured for some companies, but it was assumed that this was negligible and an estimate of R&D expenditure by tenant would need to be calculated.

The local R&D expenditure of all tenants in the life-science sector on the Campus were estimated using the global R&D expenditure and employment data provided by CBR, as described in Table 3.2 above. This local R&D expenditure was assumed to capture the remainder of the expenditure of companies on the Campus not captured by the BBT data. The R&D expenditure were disaggregated by I-O sector according to how the Scientific research and development services sector buys inputs from other sectors in the UK I-O table. The expenditure was disaggregated to sectors in the I-O table that are most likely to be affected by R&D activities (see Table 1 in Annex 1 for a list of the sectors included). A further sensitivity analysis was carried out to see what the impact would be on the results if the R&D expenditure were disaggregated to all of the 129 I-O sectors (see Table 2 in Annex 1 for the results).

The CBR global R&D data did not have data for all years and all tenants. The methods used to estimate the global R&D expenditure that were missing from the CBR data are outlined below. Different methods were used depending on the alternative data available for each tenant.

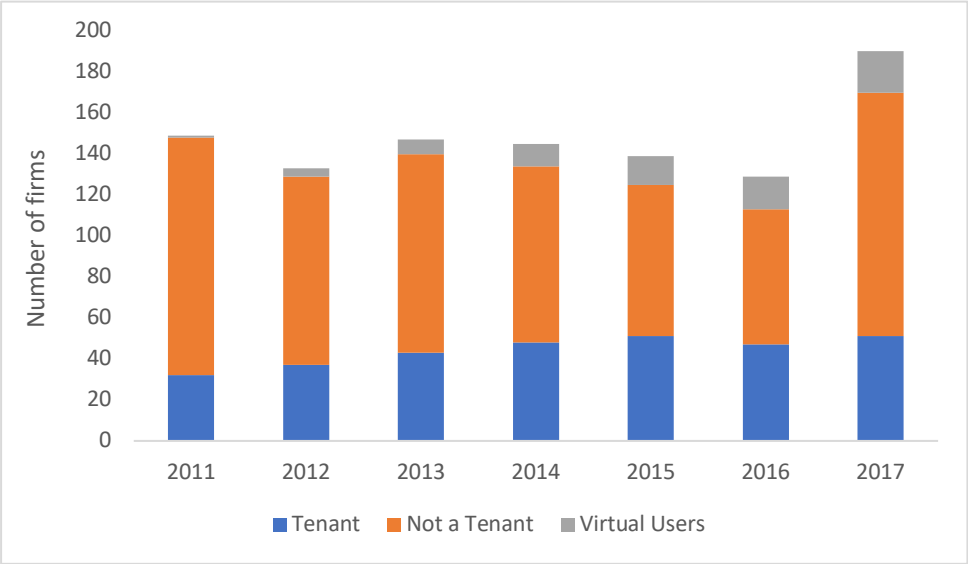
- Turnover or employment growth rates: for tenants with some R&D expenditure data, the missing expenditure data were estimated by applying their turnover or employment growth rates, depending on the data availability and suitability.
- Turnover less salaries: for tenants with no R&D expenditure data, a zero profit condition was assumed, as most of the tenants on the Campus are likely to be making little or no profit. This means that the R&D spend would be equivalent to the tenants' remaining income after paying the salaries.
- Average R&D per employee of tenants of similar size: for tenants with no R&D and turnover data, their expenditure was estimated based on the average R&D per employee of tenants of similar size in terms of employment.

The data provided by CBR are global estimates. The data for some tenants were therefore localised using local-to-global employment shares based on various sources of information including: survey responses from the tenants, floor space data from CBR, and the office/location details provided on the tenants' website. In instances when there were insufficient information, it is assumed that data for tenants with small numbers of employees are treated as local.

Results

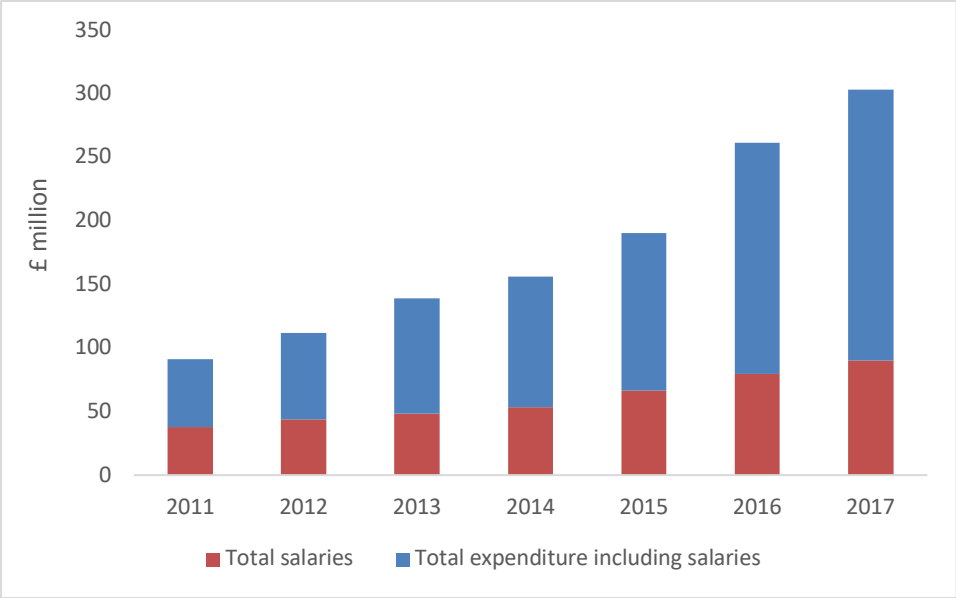
3.11 The I-O tool estimated the direct and indirect impacts the operational activities of the companies on the Campus have had in the UK as a whole over the last seven years. There are 577 companies in total included in the impact study. Of the 577 firms, some have joined after 2011 and some have already graduated and moved off the Campus. Figure 3.1 shows the profile of the companies on the Campus from 2011-17, illustrating the evolution of the Campus over time. On average, 30% of the firms associated with the Campus over 2011-17 are tenants on the Campus, while the majority are non-tenants. The proportion of non-tenants, however, fell from 78% to 63% over the last seven years, while the number of virtual users has increased from 1 user in 2011 to 20 users in 2017.

Figure 3.1 Types of companies on Babraham Research Campus, 2011-2017.



3.12 The operational impact of the Campus is estimated based on the total operational expenditure of the companies associated with the Campus, including the total salaries paid to on-site employees. Figure 3.2 below shows how these expenditures have increased over time, with total expenditure from all companies associated with the Campus increasing from £91.1m in 2011/12 to £303.5m in 2017/18.

Figure 3.2 Evolution of the Campus expenditures from 2011-2017



Operational impact of the Campus

3.13 Table 3.3 presents the total gross economic impacts on the UK economy of the combined expenditure of tenants, non-tenants and virtual users from 2011-2017. In 2017/18, the companies associated with the Campus spent £303.5m on their operational activities, resulting in £119.9m direct GVA impact, which generated an additional £165.7m (indirect and induced) GVA impact of further activity elsewhere in the UK economy. The Campus directly supported 1,720 jobs on site, which, by generating activity elsewhere, supported an additional 2,555 jobs in the wider economy.

3.14 People working in sectors where the direct and indirect impacts took place going on to spend their wages and salaries is estimated to have created a large GVA (induced) impact (£111.4m). The composition of the direct, indirect and induced impacts are similar in the previous years.

Table 3.3 Total UK economic impacts from 2011-2017

	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18
GVA (£m)							
Direct	29.2	37.3	51.2	58.0	69.8	102.3	119.9
Indirect	14.3	18.1	23.3	26.3	31.7	46.1	54.3

Induced	36.1	43.6	52.8	59.0	72.5	96.5	111.4
Total	**79.6**	**99.1**	**127.2**	**143.3**	**173.9**	**244.9**	**285.7**
Employment (FTEs)							
Direct	870	996	1,131	1,211	1,348	1,481	1,717
Indirect	240	304	400	454	543	794	935
Induced	525	634	768	858	1,054	1,402	1,620
Total	**1,636**	**1,934**	**2,298**	**2,523**	**2,945**	**3,678**	**4,271**

3.15 The employment and GVA impacts can be summarised in terms of Type I and Type II multipliers. Type I multipliers captures the ratio of direct and indirect impacts to direct impacts, while Type II multipliers also include induced effects. Table 3.4 shows that this study finds that the operational activities of the Campus has a 1.5 Type I multiplier and 2.4 Type II multiplier. This means that every £1 of direct GVA associated with the Campus, generates an additional £0.50 in the rest of the economy through indirect impacts and an additional £1.40 through indirect and induced impacts. Table 3.4 compares the BRC multipliers with the estimated multipliers in other campus studies[9]. While the nature of each of these campuses are different and their impacts cannot be directly compared, the multipliers provide some comparison of the ability of the campuses to generate additional impacts in the wider economy. The table shows that the BRC has a similar Type I multiplier to the other campuses, but a much stronger Type II multiplier. This highlights that the indirect and induced impacts from every £1 of GVA associated with the BRC are estimated to be much larger than for the other campuses.

Table 3.4 Multipliers in comparator studies

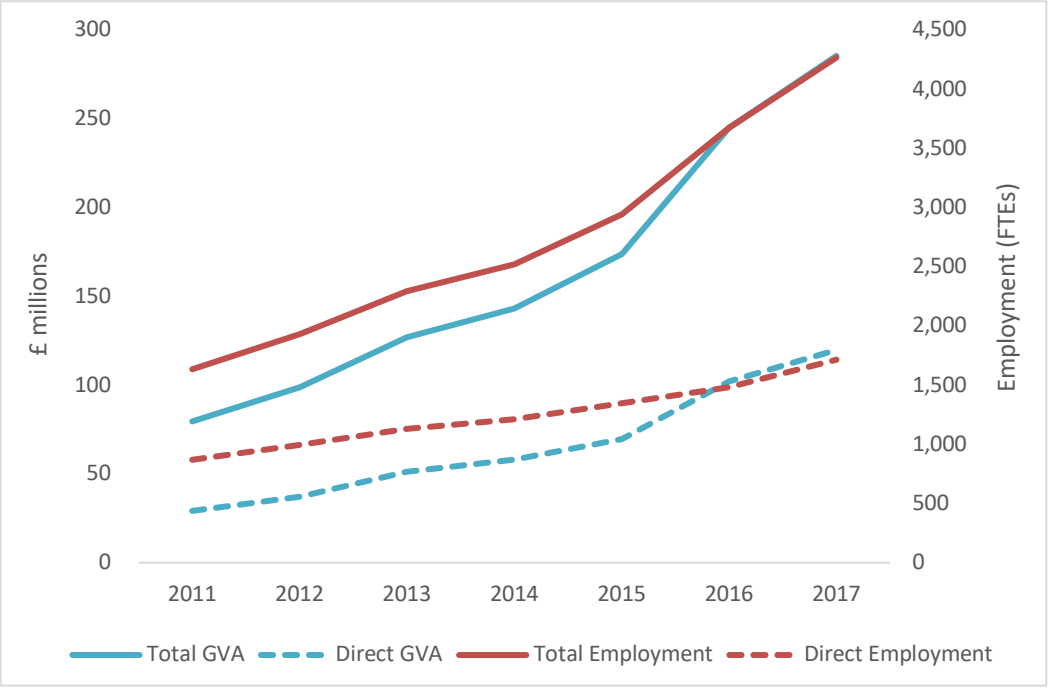
	Type I multiplier	Type II multiplier
Babraham Research Campus (2017/18)	**1.5**	**2.4**
Babraham Institute (2011/12)	1.8	2.2
Sci Tech Daresbury Campus (2014/15)	1.4	1.6
Institute of Biology, Environmental and Rural Sciences (IBERS) (2012/13)	1.2	1.6
John Innes Centre (2011/12)	1.5	1.6
The Roslin Institute (2011/12)	1.5	1.2

3.16 The total gross GVA impact of the operational activities of the Campus on the UK economy has more than tripled over 2011-17, from £80m in 2011/12 to £286m in 2017/18. This is driven by a large increase in the direct GVA impacts over this period from £29m to £120m, and the number of on-site employment increasing by over 90% from 870 employees

[9] See Table 3 in Annex 1 for a comparison of economic impacts in the other studies.

to 1,720 employees. Figure 3.3 shows that the direct employment and GVA impact of the Campus accounts for about 40-50% of the total employment and GVA impacts. The indirect and induced impacts from the additional activity generated from supply chains and income effects contribute to the majority of the total GVA impact of the Campus on the UK economy.

Figure 3.3 Evolution of GVA and Employment impacts over time



3.17 Spending on 'Scientific research and development services' has been the major driver of the GVA impacts on Campus, accounting for more than 40% of the overall direct GVA impact over 2011-17. Another important driver of GVA impacts in most of the years is 'Education services', which accounts for 10% of the total direct GVA impacts. Other sectors that have been estimated to benefit directly from the operations on the Campus include 'Financial services' and 'Computer programming, consultancy and related services', contributing 7% each to the direct GVA impact.

3.18 In 2017/18, a total spending of £303.5m by all the companies associated with the Campus supported 1,720 jobs on site and generated an additional 2,555 (indirect and induced) jobs elsewhere in the economy. 11% (295 jobs) of the indirect and induced jobs were in the 'Retail trade services' sector, an increase from 95 jobs in 2011/12. Another sector that benefited largely through the supply chain and the income impacts is 'Food and beverage serving services', which was estimated to deliver an additional 50 jobs in 2011/12 and 165 jobs in 2017/18. Other sectors that have also been estimated to receive a modest increase in employment from the indirect and induced impacts include 'Services to building and landscapes' (accounting for almost 6% of indirect and induced employment impacts) and 'Employment services' (accounting for 5%).

3.19 As mentioned in the introduction, the analysis estimates the gross economic impact of the Campus through its operational activities on the UK economy. Depending on the extent of the additionality of the Campus, the net impact is likely to be lower. These issues of additionality are discussed more qualitative in other parts of the research in order to better capture the net impact of the Campus.

4. Quantifying Wider Business Impacts

Responses to the survey of Campus companies point to the support structure provided by the BRC as a key factor enabling these companies to make an impact in local, national and international ecosystems. The co-location of a vibrant community of start-up and scale-up companies with world-leading academic research from BI, as well as the opportunity for these companies to access a range of state-of-the-art scientific facilities made available by the Institute, are unique features of the BRC that differentiate it from other life sciences campuses in the UK.
The qualitative and quantitative analysis shows that companies located on the BRC have achieved remarkable growth over the past years and performed well against companies on other business and science parks in the Cambridge region. All of the R&D activity on the BRC is carried out by companies operating in the Life Science sector, with the Campus having one of the highest total R&D spend in Life Science in the entire Cambridge region over the last three years. Overall, R&D spend by companies on the BRC represents 15% of total R&D spend by Life Science companies located on any of the parks.

Introduction

4.1 The aim of this chapter is to assess the impact that companies located on the BRC make at the local, national and international level. Specifically, this component of the work addresses the following objectives:

- To identify the reasons why companies that are currently on site decided to locate on the BRC and the benefits they derive from their location.
- To assess the growth of Campus companies over time.
- To classify and compare Campus companies according to their science.
- To compare Campus companies with those located on other business and science parks in and around Cambridge.
- To establish growth plans and ambitions of Campus companies.
- To determine the key achievements of Campus companies to date, including their impact on skill developments.
- To identify the factors that might make Campus companies move off the BRC and the areas where their activity might be relocated.
- To evaluate the additionality of the BRC to Campus companies.

Methodology

4.2 To assess the impact of Campus companies in local, national and international ecosystems, we used a mixed methodology based on both qualitative and quantitative data.

4.3 A qualitative survey of companies located on the BRC was conducted between May and July 2019. The survey instrument used a combination of open-ended and closed-ended questions to allow for greater participation in the study. To achieve a higher response rate, each questionnaire was also pre-completed with information the research team had been able to gather from public sources. It was designed by the research team with feedback from BBT and BBSRC, and circulated to Campus companies by BBT. A copy of the questionnaire is

included in Annex 3 Appendix A.

4.4 The sample selected for the survey includes all of the tenants, virtuals and communal lab users that were on site as at April 2019 and operated in the life sciences sector. It excludes organisations that, despite being located on the Campus, belong to sectors other than life sciences (e.g. NORR Consultants, the BRC's architects). This led to 46 of the approximately 60 companies that are currently on site to be included in the sample.

4.5 Table 4.1 provides an overview of the companies that were selected for the study. A total of 34 companies returned the questionnaire, which gives a response rate of approximately 74%. This figure is significantly higher than the response rate for previous Annual Tenant Surveys conducted by BBT (approximately one-third). Although we did not obtain the responses to the attitudinal questions for 12 companies, we included these in our analyses as we were able to gather data and detailed information for these companies from a number of public sources.

Table 4.1 Overview of Campus companies selected for the study

Variable	Value
Number of companies selected, of which:	46
(a) Tenants	36
(b) Virtuals	9
(c) Communal lab users	1
Campus companies by science category:	
(a) Drug discovery / development	34.1%
(b) Biological therapeutic discovery platform	18.2%
(c) Founded in in silico design of therapeutics	13.6%
(d) Others	34.1%
Average age of the business (years)	5.8
Total employment worldwide (as at April 2019)	1,010
Funding raised to date (£,000) [as reported by survey participants]	1,249,654
University of Cambridge spin-outs	34.8%
Campus companies using BI science services	60.9%
Number of companies that returned questionnaire	34
Response rate	73.9%

Source: CBR.

4.6 Out of a total of 46 companies, over 75% are tenants – that is, companies that are renting premises on the Campus – while the rest is represented by companies with no physical (virtuals) or permanent (communal lab users) location on site. More than a third of companies located on the BRC engage in drug discovery / development, as shown in greater detail hereinafter. Campus companies have an average age of just below 6 years.

4.7 Overall, the 46 companies selected for the study employ 1,010 people worldwide and claim to have raised over £1.2bn to date. Over a third of these companies are based on

science or technology originating from the University of Cambridge, while almost two-thirds of them interacts with BI by accessing one or more of its scientific facilities.[10]

4.8 A follow-up, concise survey was also sent to Campus companies in July 2019 to gather their views on the additionality of the BRC to their business as well as the impact they make on the development of the local skill base. This survey includes only companies that replied to our main survey and did not indicate that they prefer not to be contacted again. A response rate of approximately 86% was achieved for this survey. A copy of the one-page questionnaire can be found in Annex 3 Appendix B.

4.9 Responses from the two qualitative surveys were combined with information that was made available to us by BBT and BI as part of the study, along with data from the CBR corporate database.

4.10 Data from the CBR corporate database were accessed to carry out novel and in-depth analyses of companies located on the BRC against those on other business and science parks in the Cambridge region. These analyses consider both Cambridge-based companies (i.e. those that have either their primary trading address or their registered office, unless their primary trading address is identified as elsewhere, within a 20 mile radius of the centre of Cambridge) and Cambridge-active companies (i.e. those that have neither their primary trading address nor registered office in the Cambridge area, but do have a trading address in the area) that were located on any of the business and science parks selected for the study as at April 2018. For these companies, data on their sector, global employment, R&D expenditure and fundraising were collected over time and used to conduct the set of analyses presented in Sections 4 and 5.

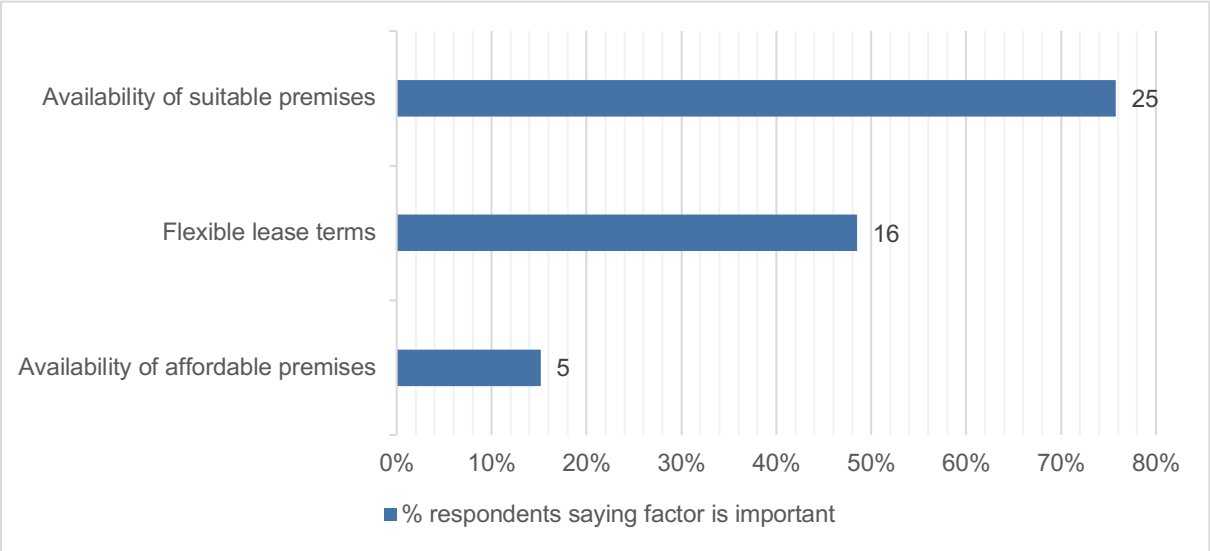
Reasons and benefits of location

4.11 As a co-location of start-up and scale-up companies with world-leading academic research from BI, the BRC offers an enabling environment where these companies can grow and make an impact in local, national and international ecosystems. For this reason, it is important to establish how their location on the BRC is helping Campus companies fulfil their ambitions.

4.12 We asked companies that are currently on site about the reasons that led them to set up on or move to the BRC, distinguishing between property-related, facilities-related and other reasons. Figure 4.1 below shows the list of property-related reasons, as well as the percentage of companies who stated a given reason in their responses, in descending order of importance.

[10] The figure for 'Campus companies using BI science services' includes companies that used any of the nine BI scientific facilities in at least one year over the period for which data were available (i.e. 2013/14-2018/19).

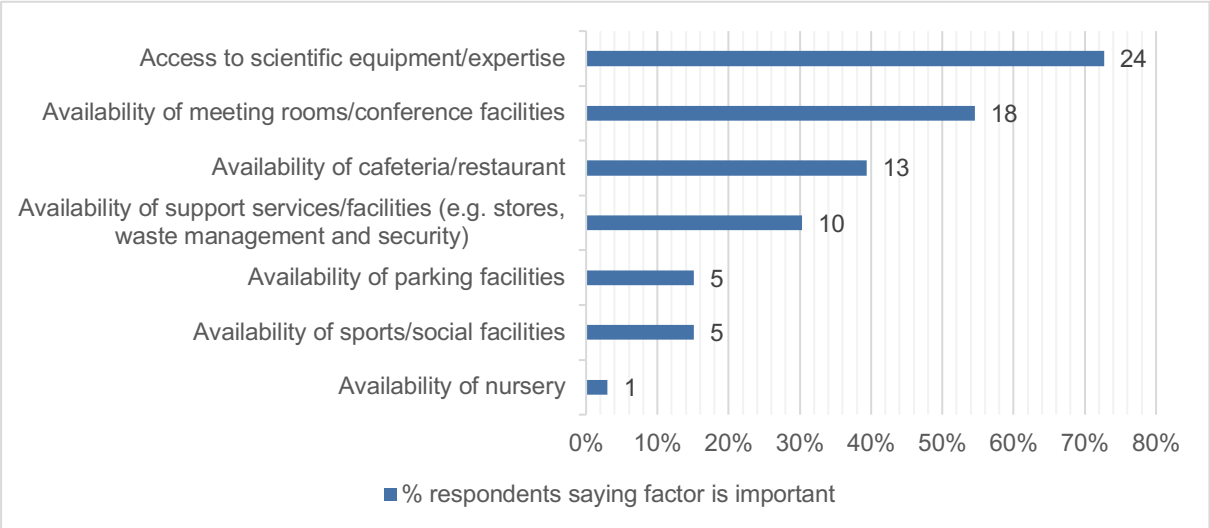
Figure 4.1 Reasons for setting up/moving to the Babraham Research Campus: property related



Number of responses: 33
Source: CBR.

4.13 The availability of premises suited to their needs is regarded by Campus companies as the most important property-related reason behind their decision to locate on the BRC (75.8%). The flexibility of lease terms also scores highly (48.5%), whereas the affordability of Campus premises does not tend to be regarded as a major reason attracting companies to the site (15.2%). These results suggest that Campus companies may be willing to pay a relatively high rent to have suitable laboratory and office space on flexible lease terms on the BRC. Figure 4.2 reports the facilities-related reasons for setting up on or moving to the BRC in descending order of importance as identified by Campus companies.

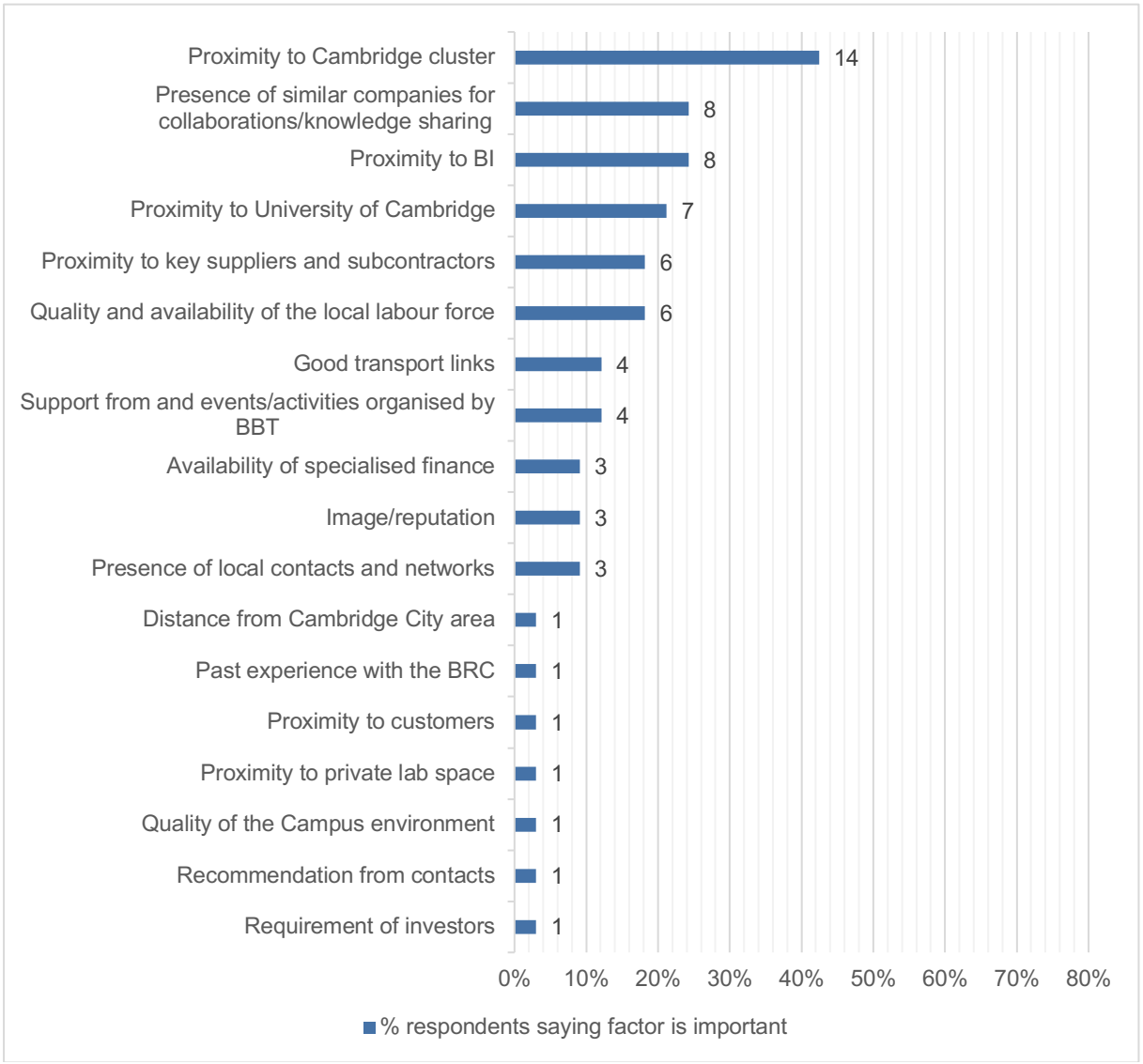
Figure 4.2. Reasons for setting up/moving to the Babraham Research Campus: facilities related



Number of responses: 33
Source: CBR.

4.14 Access to scientific equipment and expertise features as the most important facilities-related factor behind companies' decision to locate on the BRC (72.7%). Particularly important for respondents is the range of scientific facilities provided by BI (and coordinated by BIE), which do not tend to be used routinely enough by these companies to justify internal capital expenditure. Among the most important factors is also a number of other facilities that are made available by BBT, such as meeting rooms and conference facilities (54.5%), cafeteria and restaurant (39.4%) as well as other support services (30.3%) – e.g. stores, waste management and security. These responses can be taken as evidence that companies assess positively the range of facilities (both scientific and not) on offer on the BRC. Figure 4.3 presents a set of other factors that were put forward by respondents to explain their decision to locate on the BRC.

Figure 4.3 Reasons for setting up/moving to the Babraham Research Campus: other reasons



Number of responses: 33
Source: CBR.

4.15 The opportunity to be close to the Cambridge biotech cluster is perceived by Campus companies as a major reason behind the choice of the BRC as their location (42.4%). Some of the most important factors are also the presence of similar companies (both on and off the Campus) for collaborations or knowledge sharing and the opportunity to be co-located with BI (24.2%). Around 20% of the survey respondents view the proximity to the University of Cambridge, the presence of key suppliers and subcontractors in the sub-region and the availability of highly skilled labour as important factors explaining their decision to set up on or move to the BRC. Good transport links and support from BBT are rated as important by 12.1% of respondents.

4.16 Campus companies were also asked to state the benefits they have gained from being located on the BRC since their arrival. A list of benefits as identified by respondents is reported in descending order of importance in Figure 4.4.

Figure 4.4 Benefits of company's location on the Babraham Research Campus

Number of responses: 34
Source: CBR.

4.17 Respondents tend to regard access to scientific equipment and expertise (47.1%) and availability of suitable space (44.1%) as the most important benefits they have derived from their location on the Campus. Other factors that score highly are the availability of support services and the flexibility of lease terms (29.4%). Although the affordability of Campus premises is also mentioned, only 8.8% of respondents view this factor as an important benefit of their location on the BRC. These results seem to imply that the BRC is benefiting Campus

companies primarily through the suitable space on flexible lease terms it provides as well as through its supportive and collaborative environment.

4.18 To delve deeper into the benefits Campus companies obtain from their location, we asked participants to discuss how their interactions with a variety of organisations both on and off the BRC is contributing to their business. The main benefits Campus companies have received from, together with the value they have contributed to, these interactions are detailed in Table 4.2.

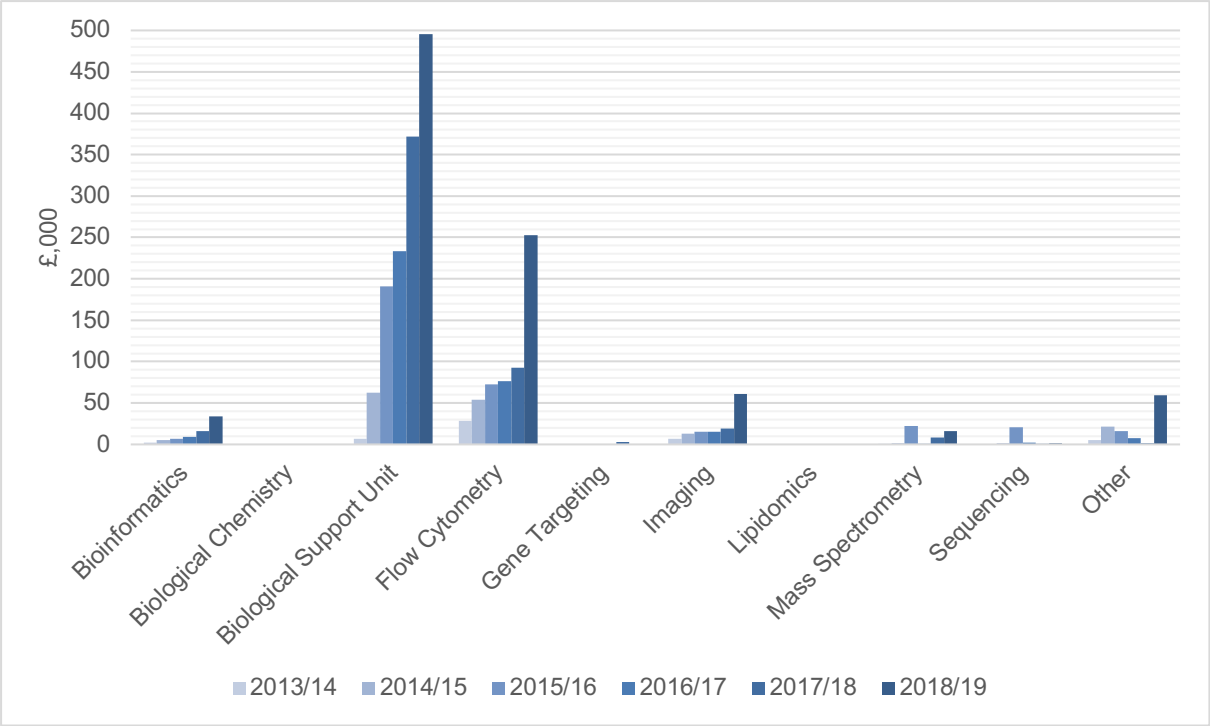
Table 4.2 Benefits Campus companies have received from and value they have contributed to other organisations

	Benefits received from other organisations	Value contributed to other organisations
Babraham Bioscience Technologies	- Support services/facilities (e.g. washing/sterilisation, stores and liquid nitrogen) - Communal lab space and hot desks - Shared facilities (e.g. meeting rooms) - Training (e.g. fire and H&S) - Events/activities on Campus (e.g. Accelerate@Babraham, Campus Coffee Mornings and Babraham Investor Conference) - Networks/contacts - Advocacy for local/national life sciences strategy	- Income (e.g. rent and consumables) - Events/activities on Campus (e.g. Accelerate@Babraham, Campus Coffee Mornings and Babraham Investor Conference)
The Babraham Institute and Babraham Institute Enterprises	- Access to scientific facilities (e.g. BSU and Flow Cytometry) - Training - Consultancy services - Models and assays - Contractual collaborations - Founding scientist(s)	- Income (e.g. access to scientific facilities and training) - Contractual collaborations - Translational research - PhD funding
Other companies on the Babraham Research Campus	- Informal networking/knowledge sharing - Contractual collaborations - Purchase or sale of product/service - Joint development of product/service/technology - Funding	- Informal networking/knowledge sharing - Contractual collaborations - Purchase or sale of product/service - Joint development of product/service/technology - Success of core scientific programme/platform - Support to scientists - Funding - International customer base
University of Cambridge	- Contractual collaborations - Licence agreements - Founding scientist(s) - Pool of talent - Rented lab space - Scientific consultancy/support - Funding	- Contractual collaborations - Skill development/training - Job opportunities - Funding for PhD students and postdoctoral researchers - Academic/guest lectures - Scientific consultancy/support - Events organised by Cambridge Enterprise
Other organisations and companies in the Cambridge area	- Contractual collaborations - Alliances with pharma companies - Informal networking/knowledge sharing - Purchase or sale of product/service - Joint development of product/service/technology - Services from suppliers and subcontractors - Training and information services/organisations (e.g. One Nucleus) - Occupational health services	- Contractual collaborations - Alliances with pharma companies - Success of core scientific programme/platform - Informal networking/knowledge sharing - Purchase or sale of product/service - Joint development of product/service/technology - Funding
Other organisations and companies outside the Cambridge area	- Contractual collaborations - Alliances with pharma companies - Licence agreements - Cash flows - Royalties - Funding - Services from suppliers and subcontractors	- Contractual collaborations - Alliances with pharma companies - Funding - Use of proprietary technology - Industrial placements

Source: CBR.

4.19 A central aspect that was revealed by the survey is the value Campus companies assign to the opportunity to access the range of science services provided by BI. This allows companies to make use of expensive equipment that is essential for their scientific programme on an ad hoc basis, thereby offering a cost-effective solution. Figure 4.5 illustrates the income generated by BIE from the sales of BI's science services to Campus companies over the period from 2013/14 to 2018/19.[11]

Figure 4.5. Usage of The Babraham Institute's science services by Campus companies, 2013/14-2018/19



Source: CBR's calculations based on data from Babraham Institute Enterprise Ltd (2019), *Sales by customer by year*.

4.20 The BSU (animal facility) and Flow Cytometry facilities are the most widely used by Campus companies among the facilities made available by BI. Companies located on the BRC have also accessed the Imaging, Bioinformatics and Mass Spectrometry facilities on a regular basis, while more limited has been the usage of the other facilities. It is also worth noting that usage has gone up over time for all of the science services accessed by Campus companies, suggesting that these companies have taken increasingly more advantage of the scientific facilities provided by scientists at BI.

4.21 The co-location of a vibrant community of start-up and scale-up companies with a best-in-class academic institute such as BI, as well as the opportunity for these companies to access a range of state-of-the-art scientific facilities made available by the Institute, are unique

[11] The 'other' category includes mainly income from consultancy services and training provided to Campus companies.

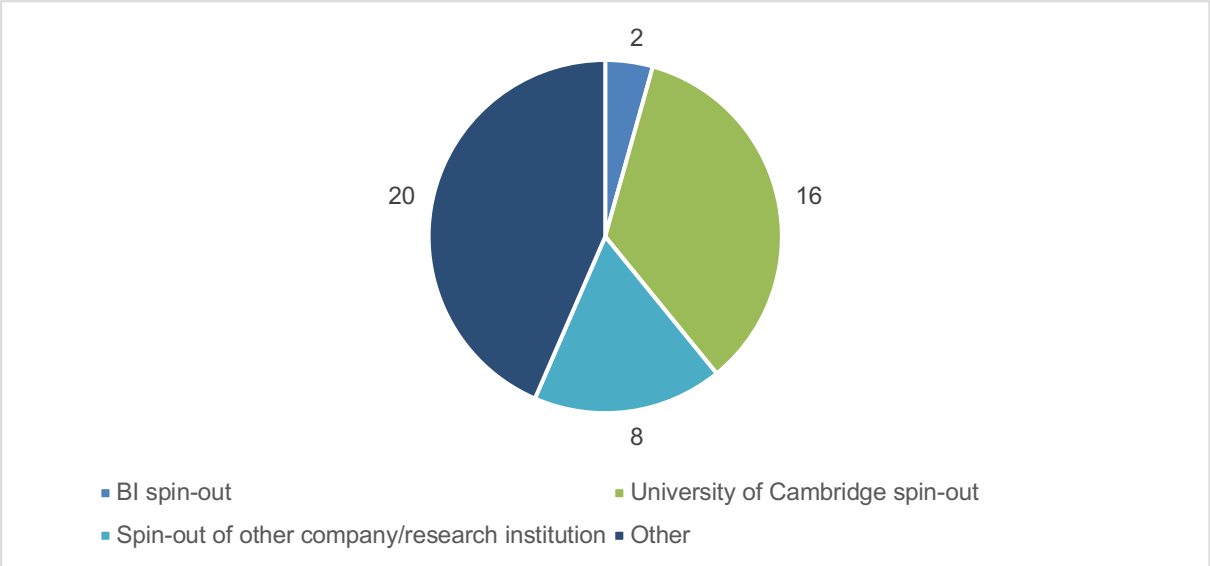
features of the BRC that differentiate it from other life sciences campuses in the UK.

Growth performance and ambitions

4.22 The survey responses on the benefits of being located on site point to the support structure provided by the BRC as a key factor enabling Campus companies to make scientific advancements. A number of these companies have grown rapidly over the past few years and are based on the best of global scientific discoveries, often originating from the University of Cambridge and other research institutions in the region.

4.23 Although important similarities exist among Campus companies, they differ between each other in a number of important ways and it is critical that these differences are adequately captured. To this end, this section profiles the 46 companies that were selected for the study based on their origin, age and whether they set up on or moved to the BRC. Figure 4.6 shows a breakdown of Campus companies according to the origin of the business.

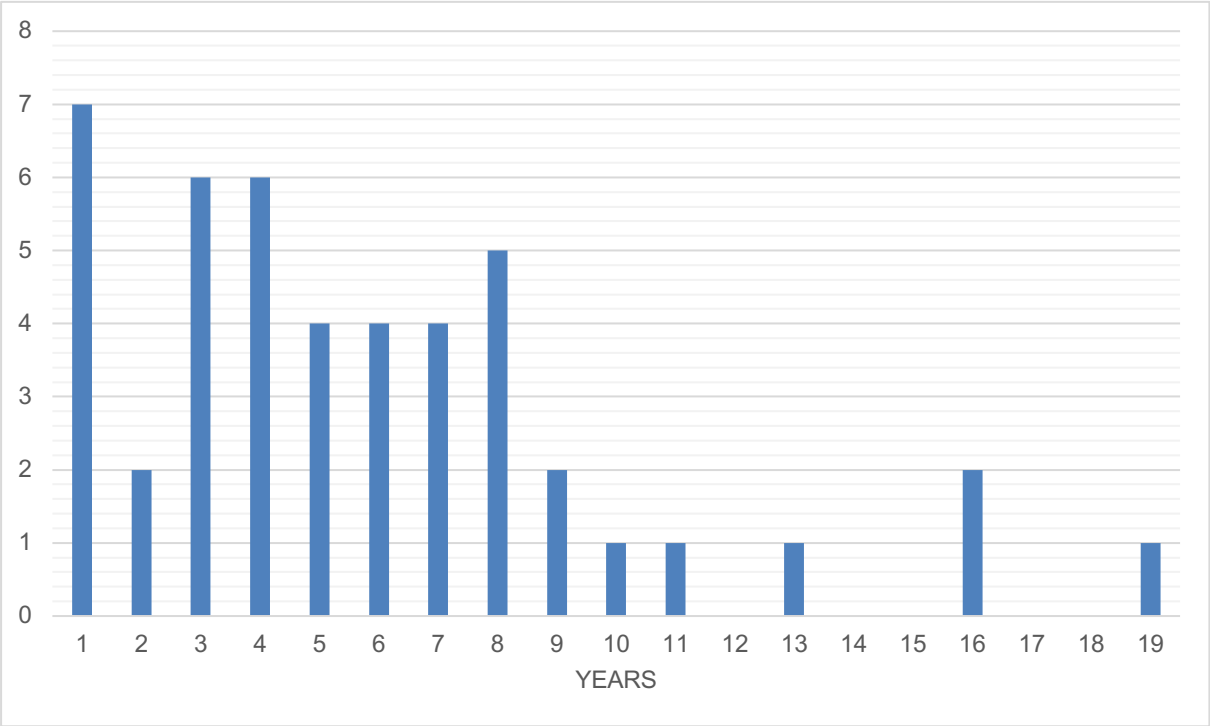
Figure 4.6 Origin of the business



Source: CBR.

4.24 Approximately 35% of companies located on the BRC are based on science or technology originating from the University of Cambridge, pointing to the close ties that exist between start-up and scale-up companies on site and scientific advancements made at the University. A further 17.4% of Campus companies are spin-outs of other companies or research institutions, including best-in-class organisations such as the MRC Laboratory of Molecular Biology, the Wellcome Trust Sanger Institute and the Norfolk and Norwich University Hospital. Two of the companies that are currently on site have spun out of research from BI, while the remainder had no direct link with science or technology generated in other companies or research institutions at the time they were first set up. Figure 4.7 analyses Campus companies by the age of the business, calculated as the number of years since incorporation.

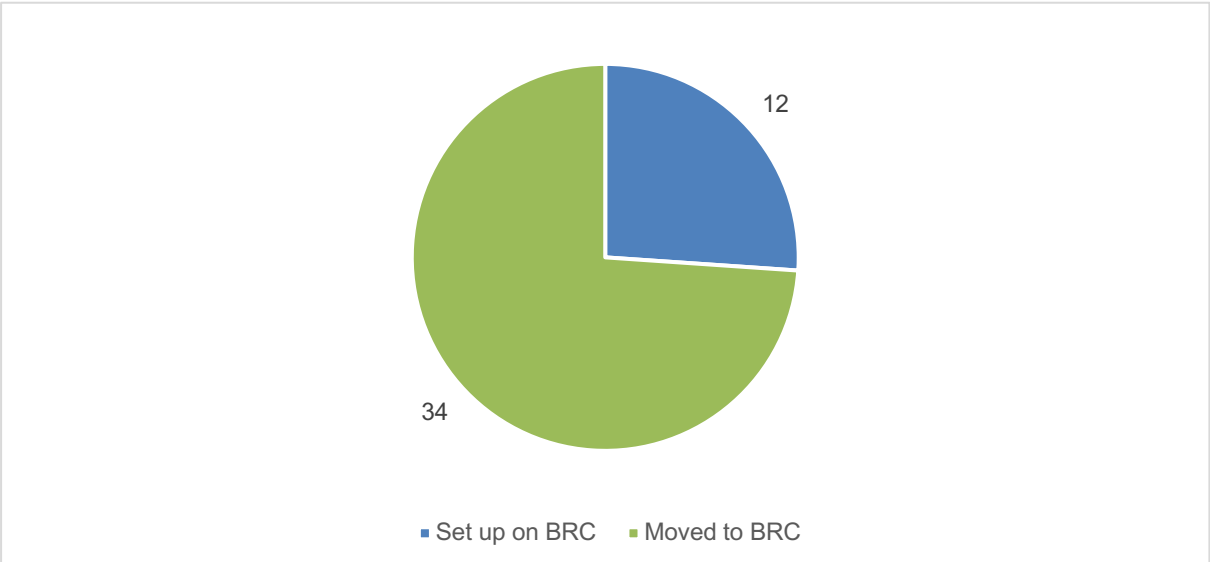
Figure 4.7 Age of the business (years)



Source: CBR.

4.25 More than half of the companies that are currently on site are within five years of incorporation, with a third of the companies on the BRC being set up during the past three years. Around 37% of Campus companies have been in operation between six and ten years, while another 8.7% have been trading for more than ten years. These figures indicate that the BRC hosts a dynamic community of younger businesses operating alongside more mature and established businesses. Figure 4.8 provides a split of Campus companies based on whether they set up directly on the BRC or whether they moved to the site sometime after incorporation.

Figure 4.8 Set up on/moved to the Babraham Research Campus



Source: CBR.

4.26 Around 74% of the companies that are located on the BRC moved to the Campus from elsewhere, often within a short period after they were first incorporated. Our survey responses suggest that these companies may have been attracted by the availability of suitable premises on flexible lease terms located on a supportive Campus environment. To capture the extent to which their location on the BRC is central to their operations, Campus companies were asked about the location of their employment during each of the last three years. We summarise their responses in Table 4.3.[12]

Table 4.3 Location of company's employment

	2018/19	2017/18	2016/17
On Babraham Research Campus	86.8%	73.1%	76.9%
Not on Babraham Research Campus but within 20 miles of centre of Cambridge	2.5%	2.1%	0.1%
Not within 20 miles of Cambridge but within the United Kingdom	5.2%	3.6%	3.6%
Outside the United Kingdom	5.5%	21.2%	19.4%

Number of responses: 45

Source: CBR.

4.27 Irrespective of which year is considered, employment on the BRC represents over two-thirds of total employment of Campus companies.[13] Significant is also the share of employment located overseas, in most cases in North America. Conversely, more limited is the number of employees that are either elsewhere in the Cambridge region or in other parts of the UK. It follows that the BRC tends to be the primary location for these companies, with other sites generally being smaller and located outside of the country.

4.28 Over the past few years, the 46 companies selected for the study have grown the number of people they employ worldwide at rates that are consistent with those of scale-up companies. In the three-year period to 2018/19, global employment at these companies has increased by 22.5% pa, with most of this growth taking place on the BRC.

4.29 If one looks at the subset of participants that occupy space in BBT leased buildings, Campus companies have witnessed a growth rate of 24.1% pa in their global employment and of 20.9% pa in their floor space on the BRC. These figures suggest that Campus companies have grown rapidly over the past few years, despite the prolonged period of uncertainty following the Brexit referendum in June 2016.

[12] The figures reported in 4.3 may differ from the employment figures used for the business and science parks comparison presented later in this chapter, since they are based on survey returns and not on audited data drawn from their accounts. One respondent has been excluded from the analysis because it only provided a split between employees on the BRC and those not on the BRC.

[13] The figure for 2018/19 is significantly higher than the equivalent figures for 2017/18 and 2016/17 due to data for one company with a large share of employment outside of the United Kingdom not being available for that year.

Campus companies and their science

4.30 Companies located on the BRC share a number of common features, including a strong focus on life sciences, an international scope of operation and a rapid rate of growth since they were first established. At the same time, these companies differ in some important ways, one of which relates to the nature of their science. In this section, we put forward a classification of Campus companies according to their science and provide a comparison of selected key characteristics across science categories. Further analysis comparing the totality of companies on the BRC with those located on other business and science parks in the Cambridge region is presented later in this section as well as in Section 5.

4.31 The set of companies analysed in this component of the work corresponds to the sample that was selected for our survey of Campus companies, that is, all of the tenants, virtuals and communal lab users that were on site as at April 2019 and operated in the life sciences sector.[14] Companies were initially assigned to a group by Prof Lisa Hall, Professor of Analytical Biotechnology and Head of Department of Chemical Engineering and Biotechnology at the University of Cambridge. This original classification was refined further following advice from BBT, resulting in the four science categories below:

- 'Drug discovery / development'.
- 'Biological therapeutic discovery platform'.
- 'Founded *in silico* design of therapeutics'.
- 'Others', including diagnostics, materials suppliers, personalised healthcare and service providers.

Comparison of company characteristics by science category

4.32 Taking these science categories as the point of departure, we conducted a comparison across groups of companies based on the following characteristics:

- Tenant type.
- Employment on the BRC.
- Funds raised to date.
- R&D spend to date.
- Company age.
- Origin of the business.

4.33 Tables 4.4 and 4.5 present a comparison of these characteristics, in terms of both totals and averages, across science categories.

[14] Cancer Research UK's Therapeutic Discovery Laboratories (CRUK-TDL) is not included in the analysis presented hereinafter as data on funds raised and R&D spend were available only for the past five years. Over this period, funds raised and R&D spend by CRUK-TDL have run at the level of approximately £40m and £50m respectively. Total Scientific Limited is also excluded as it was acquired by Campus tenant RxCelerate Limited in April 2018.

Table 4.4 Comparison of company characteristics by science category: totals

Science category	N	Tenant type	Tot empl on BRC	Funds raised to date £,000	R&D spend to date £,000	No. large (empl >= 10)	No. old (age > 5 years)	Origin
Drug discovery / development	15	Tenant = 15 Virtual = 0 Communal lab user = 0	541	495,102	229,470	9	8	BI spin-out = 1 UoC spin-out = 3 Spin-out of other org = 5 Other = 6
Biological therapeutic discovery platform	8	Tenant = 6 Virtual = 2 Communal lab user = 0	316	86,885	29,911	4	1	BI spin-out = 0 UoC spin-out = 4 Spin-out of other org = 0 Other = 4
Founded in in silico design of therapeutics	6	Tenant = 1 Virtual = 5 Communal lab user = 0	46	137,756	83,113	1	2	BI spin-out = 0 UoC spin-out = 3 Spin-out of other org = 0 Other = 3
Others inc diagnostics, materials suppliers, personalised healthcare, service providers	15	Tenant = 12 Virtual = 2 Communal lab user = 1	81	15,030	7,903	3	8	BI spin-out = 1 UoC spin-out = 6 Spin-out of other org = 3 Other = 5
		Tenant = 34	967	719,950	339,755	17	17	
		Virtual = 9	14	14,543	10,028	0	1	
		Communal lab user = 1	3	280	613	0	1	
All	44		984	734,773	350,396	17	19	

Source: CBR.

Table 4.5 Comparison of company characteristics by science category: averages

Science category	N	Tenant type	Average empl on BRC	Average funds raised to date £,000	Average R&D spend to date £,000	% large (empl >= 10)	% old (age > 5 years)	Average age (years)	Origin
Drug discovery / development	15	Tenant = 100.0% Virtual = 0.0% Communal lab user = 0.0%	36	33,007	16,391	60.0%	53.3%	6.1	BI spin-out = 6.7% UoC spin-out = 20.0% Spin-out of other org = 33.3% Other = 40.0%
Biological therapeutic discovery platform	8	Tenant = 75.0% Virtual = 25.0% Communal lab user = 0.0%	40	10,861	4,985	50.0%	12.5%	3.6	BI spin-out = 0.0% UoC spin-out = 50.0% Spin-out of other org = 0.0% Other = 50.0%
Founded in in silico design of therapeutics	6	Tenant = 16.7% Virtual = 83.3% Communal lab user = 0.0%	8	22,959	13,852	16.7%	33.3%	5.0	BI spin-out = 0.0% UoC spin-out = 50.0% Spin-out of other org = 0.0% Other = 50.0%
Others inc diagnostics, materials suppliers, personalised healthcare, service providers	15	Tenant = 80.0% Virtual = 13.3% Communal lab user = 6.7%	5	1,002	718	20.0%	53.3%	5.9	BI spin-out = 6.7% UoC spin-out = 40.0% Spin-out of other org = 20.0% Other = 33.3%
		Tenant = 77.3%	28	21,175	12,584	50.0%	50.0%	5.6	
		Virtual = 20.5%	2	1,616	1,114	0.0%	11.1%	3.4	
		Communal lab user = 2.3%	3	280	613	0.0%	100.0%	16.0	
All	44		22	16,699	9,470	38.6%	43.2%	5.4	

Source: CBR.

4.34 Drug discovery / development emerges as the largest group of companies on the BRC, employing over half of the total number of staff on the Campus. These companies also contribute the biggest share of funds raised and R&D spent by Campus companies to date. On average, each company in the drug discovery / development category has raised over £33m funds and spent more than £16m in R&D to date, two figures that are significantly higher than the average for all companies (£17m and £9m respectively). In addition to being larger, most of these companies have been in operation for more than five years and are the most mature among Campus companies. One of these companies spun out of BI, while a further three are based on science or technology originating from the University of Cambridge.

4.35 The second largest group in terms of employment on site is represented by biological therapeutic discovery platform companies, which have the largest figure for average employment among companies located on the BRC. However, these companies tend to be smaller compared with those engaging in drug discovery / development if size is measured as either funds raised or R&D spend to date. These companies are also found to be the youngest of the whole set, with an average age (3.6 years) that is significantly below the average age of all companies.

4.36 While the majority of companies belonging to the first two categories are renting premises on the Campus, most of the companies founded in *silico* design of therapeutics only have a virtual presence on the BRC. Not surprisingly, this group of companies accounts for the lowest share of employment on the Campus, despite contributing the second highest amount of funds raised and R&D spent to date.

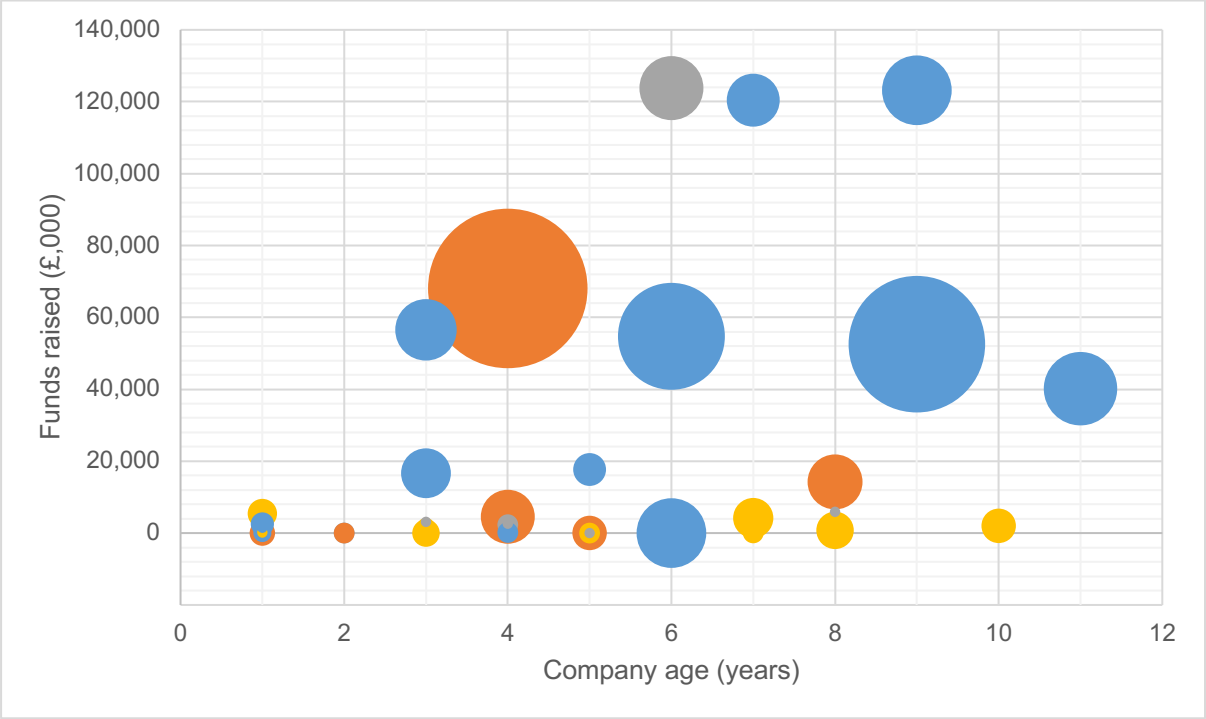
4.37 Companies in the residual category, which includes diagnostics, materials suppliers, personalised healthcare and service providers, tend to be characterised by a smaller size as well as a lower degree of fundraising and R&D activity. This group features the highest number of University of Cambridge spin-outs.

Funds raised and R&D spend by company age

4.38 In the remainder of our analysis, we delve deeper into the relationship between company age and two main variables, that is, funds raised and R&D spend to date. Our aim is to examine whether this relationship changes depending on the science group being considered.

4.39 Figure 4.9 shows the extent to which funds raised by Campus companies to date vary according to the age of the business. Each science category is identified by a different colour on the chart.

Figure 4.9 Funds raised by company age



= Drug discovery / development
= Biological therapeutic discovery platform
= Founded in in silico design of therapeutics
= Others inc diagnostics, materials suppliers, personalised healthcare, service providers

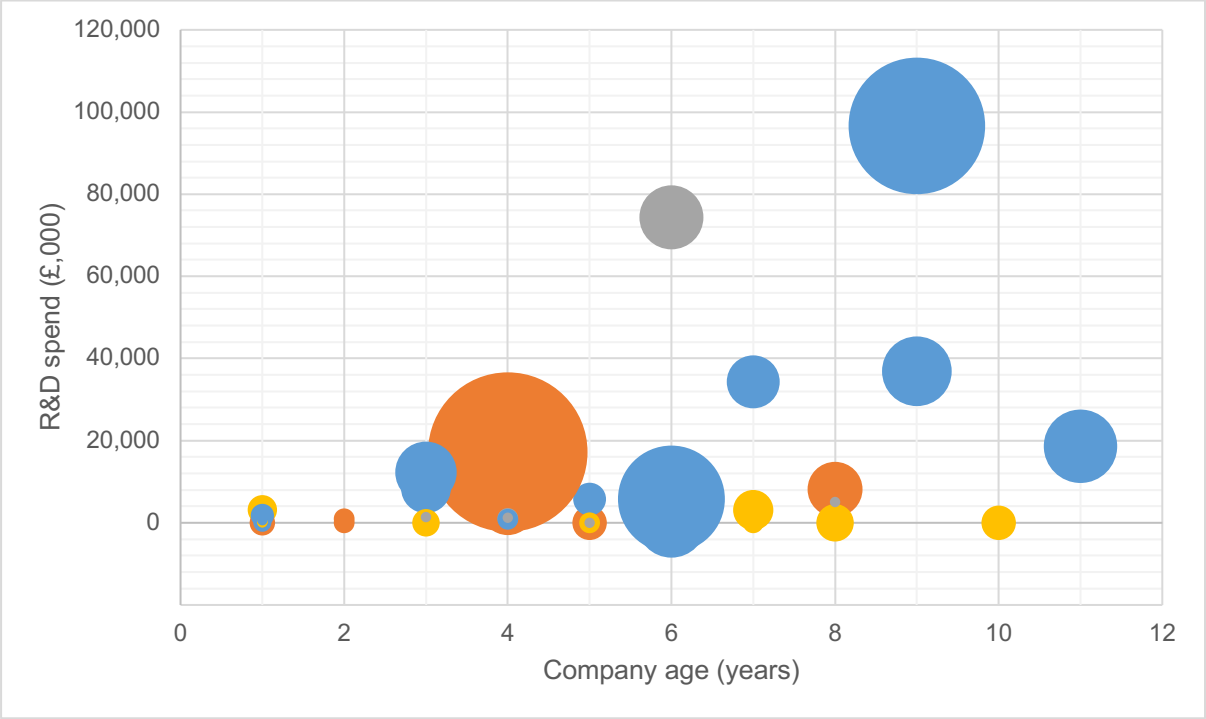
Notes: The chart shows the amount of funds raised by companies aged between 1 and 11 years. The size of the bubble represents employment on the BRC in 2018/19.
Two companies are excluded from the analysis as their age (16 and 19) is significantly above the average age of all companies.

Source: CBR.

4.40 We generally find evidence of a positive relationship between company age and funds raised, implying that Campus companies that have been in operation for longer tend to have raised more funds than younger ones. This relationship appears to be particularly strong for companies in the drug discovery / development group, which also includes some of the most mature companies among those located on the BRC. A notable exception to this pattern is the biological therapeutic discovery platform group, for which the amount of funds raised reaches its peak for companies that have been in operation for four years and does not appear to change significantly beyond that point.

4.41 Figure 4.10 depicts R&D spend to date by companies located on the BRC as a function of the age of the business.

Figure 4.10 R&D spend by company age



= Drug discovery / development
= Biological therapeutic discovery platform
= Founded in silico design of therapeutics
= Others inc diagnostics, materials suppliers, personalised healthcare, service providers

Notes: The chart shows the amount of R&D spend by companies aged between 1 and 11 years. The size of the bubble represents employment on the BRC in 2018/19.
Two companies are excluded from the analysis as their age (16 and 19) is significantly above the average age of all companies.

Source: CBR.

4.42 The relationship between company age and R&D spend exhibits a pattern similar to the one described above in relation to funds raised. Although – as one might expect – R&D spend tends to increase with the age of the business, a notable exception is represented by companies in the biological therapeutic discovery platform group. For this group, our results suggest that more mature companies have not carried out greater R&D activity compared with younger ones – with such a feature differentiating this set of companies from those in the drug discovery / development group. The chart also offers a visual confirmation of the results summarised in Tables 4.4 and 4.5, that is, companies in the 'others' category have a lower level of R&D (and fundraising) activity and are smaller than companies in any of the other groups.

4.43 A further central question we address is how companies located on the BRC compare with those on other business and science parks in and around Cambridge. As explained in the methodology section, this element of the work draws on unique data that are available to us as part of the CBR corporate database.

4.44 Table 4.6 below provides a comparison of companies on the BRC with those located on other business and science parks in the region in terms of their age, employment size and growth.[15] The parks that appear at the top of the list are those that may be regarded as more similar to the BRC in terms of the nature of the companies they host.

[15] In the tables below, figures for the BRC also include BI and BBT. The weights used in the last four columns of Table 4.6 correspond to the number of employees. Unweighted growth figures are calculated as the average of the growth rates for all of the companies on a given park, whereas weighted growth figures are calculated from the total number of employees on a given park (i.e. they weigh the growth rates for a given company by the number of people it employs).

Table 4.6 Comparison of companies on business and science parks: age, employment size and growth

BUSINESS & SCIENCE PARKS	End 2018 Number of companies	Average age yrs	Average number of employees	Total Employment Latest Year	Employment growth over the last year % pa		Employment growth over the last three years % pa	
					Weighted	Unweighted	Weighted	Unweighted
Babraham Research Campus	52	6.6	31.6	1,643	9%	25%	14%	22%
Cambridge Research Park	15	17.3	331.3	4,969	0%	9%	10%	8%
Cambridge Science Park	94	13.8	162.7	15,290	2%	21%	0%	11%
Chesterford Research Park	17	11.6	78.2	1,329	27%	20%	19%	14%
Granta Park	15	18.7	235.9	3,539	14%	13%	9%	3%
Iconix Park	3	18.0	55.3	166	24%	17%	28%	38%
O2h Scitech Park	4	4.0	1.8	7	17%	13%	15%	11%
Wellcome Genome Campus	6	9.0	200.2	1,201	3%	56%	5%	56%
C P C 1 Capital Park	75	11.8	31.8	2,382	7%	16%	3%	10%
Cambourne Business Park	12	18.6	250.8	3,010	-3%	-6%	11%	0%
Cambridge Business Park	39	15.3	243.6	9,500	-4%	0%	-4%	4%
Harston Mill	9	14.3	80.6	725	8%	12%	7%	2%
Melbourn Science Park	4	21.5	99.8	399	-13%	-1%	1%	15%
St John's Innovation Centre / Park	180	10.8	11.6	2,089	27%	9%	20%	8%
Cambridge Commercial Park	17	17.6	339.9	5,779	-1%	-1%	-1%	2%
Colmworth Business Park	101	9.0	4.5	451	-1%	2%	3%	4%
Lancaster Way Business Park	29	20.2	57.0	1,653	17%	2%	11%	6%
South Cambridge Business Park	93	10.4	5.0	461	5%	4%	12%	5%
Vision Park	31	7.5	2.7	83	8%	6%	9%	6%
Total	**796**	**11.7**	**68.7**	**54,676**				

Source: CBR.

4.45 The 52 companies on the BRC tend to be younger than those located on the other parks, with an average age (6.6 years) that is significantly lower compared with Granta Park (18.7), Cambridge Science Park (13.8) and Chesterford Research Park (11.6). The age profile of companies located on the BRC makes it more similar to the Wellcome Genome Campus (9.0), which is characterised by the co-existence of a number of start-ups with a more mature, larger company (Genome Research Limited).

4.46 The BRC differs from other parks in the region also in relation to the size of its companies. While a company operating on any of the parks employs on average 69 people worldwide, Campus companies have an average size of 32 employees. For example, differences in size are particularly large when compared with Cambridge Research Park (331) and Granta Park (236). At the same time, companies on the BRC tend to be larger than those on the St John's Innovation Centre (12), though the latter is home to a considerably higher number of companies many of which only have a virtual presence.

4.47 The employment growth figures show that Campus companies have performed well against their peers. Over the past three years, companies on the BRC have achieved a growth rate (weighted by number of employees) of 14%. Their unweighted growth rate over the last year (25%) is also among the highest of the whole group, pointing to the BRC as a dynamic and growing community.

4.48 Table 4.7 compares the R&D activity of Campus companies with those located on other business and science parks in the region. Whenever data on R&D spend by these companies was not available in their accounts, it was estimated using either next year's or last year's R&D, or the proportion of R&D staff identified in the accounts, or the R&D tax credits shown that year. For companies without significant turnover, we obtained estimates of their R&D activity based on changes in their share premium account, ordinary shares and shareholders' funds from the previous year.

Table 4.7 Comparison of companies on business and science parks: R&D activity

BUSINESS & SCIENCE PARKS	Latest Year		Total over last 3 years		Over last 3 years	
	Number of companies with R&D estimate	Total R&D exp £,000	Number of companies with R&D estimate	Total R&D exp £,000	Proportion doing R&D	Average annual exp of those doing R&D £,000
Babraham Research Campus	41	131,759	41	312,509	73%	3,512
Cambridge Research Park	8	30,064	8	82,342	63%	5,489
Cambridge Science Park	65	321,460	65	988,339	58%	8,747
Chesterford Research Park	12	353,570	12	1,014,073	67%	42,379
Granta Park	7	13,677	7	25,318	57%	2,110
Iconix Park	2	3,772	2	8,905	100%	1,484
O2h Scitech Park	3	6	3	116	33%	39
Wellcome Genome Campus	3	3,356	3	7,054	100%	1,014
C P C 1 Capital Park	62	108,345	62	337,602	11%	16,076
Cambourne Business Park	10	27,608	10	90,769	60%	5,043
Cambridge Business Park	36	538,104	36	1,430,251	22%	59,606
Harston Mill	5	10,045	5	28,293	60%	3,144
Melbourn Science Park	4	6,384	4	18,236	25%	6,079
St John's Innovation Centre / Park	138	41,572	138	78,466	16%	1,262
Cambridge Commercial Park	14	-	14	-	0%	-
Colmworth Business Park	92	-	92	-	0%	-
Lancaster Way Business Park	25	111	25	545	12%	61
South Cambridge Business Park	89	87	89	87	2%	44
Vision Park	29	6	29	6	3%	6
Total	**645**	**1,589,924**	**645**	**4,422,911**	**22%**	**10,220**

Source: CBR.

4.49 More than two-thirds of Campus companies for which an R&D estimate is available have carried out R&D activity in the last three years. This proportion is one of the highest among business and science parks in the region.

4.50 If one looks at the proportion of companies that have engaged in R&D during the last three years, the BRC appears to be more similar to Chesterford Research Park (67%), Cambridge Research Park (63%) and Cambridge Science Park (58%). Conversely, it differs somewhat importantly from the St John's Innovation Centre (16%), Cambridge Business Park (22%) and Melbourn Science Park (25%), which are characterised by a much lower proportion of their companies with available R&D estimates incurring R&D expenditure. These figures suggest that Campus companies tend to be very active in terms of R&D activity, particularly if compared with the average proportion of companies doing R&D for the whole group (22%).

4.51 The relatively small size of companies located on the BRC is reflected in a lower average annual spend on R&D by Campus companies over the last three years compared with an average company on any of the parks (£3,512,000 and £10,220,000 respectively).

4.52 Collectively, the R&D activity of companies operating on business and science parks accounts for the bulk of R&D activity in the Cambridge region, with the Life Science sector alone contributing 48% of total R&D expenditure for these parks.[16]

4.53 These differences in R&D activity across parks call for a closer look at the sectors within which companies located on these parks operate. Table 4.8 presents the sectoral distribution of companies on the BRC and their employment in the latest year against those located on other business and science parks in the area. Four main sectors are considered, namely Life Science, Information and Communications Technology (ICT), Other KI (i.e. high-tech manufacturing and knowledge intensive services) and Non-KI (e.g. property and finance).

[16] An earlier analysis conducted by the CBR revealed that largest companies in and around Cambridge had carried out £2.5bn of R&D in 2016/17, most of which had been concentrated in the Life Science and Information and Communications Technology sectors.

Table 4.8 Sectoral distribution of companies on business and science parks: number of companies and employment (latest year)

LATEST YEAR	Life Science		ICT		Other KI		Non-KI		Life Science		ICT		Other KI		Non-KI	
BUSINESS & SCIENCE PARKS	**No of cos**	**%**	**No of cos**	**%**	**No of cos**	**%**	**No of cos**	**%**	**Total empl**	**%**	**Total empl**	**%**	**Total empl**	**%**	**Total empl**	**%**
Babraham Research Campus	50	96%	0	0%	0	0%	2	4%	1,480	90%	-	0%	-	0%	163	10%
Cambridge Research Park	5	33%	2	13%	3	20%	5	33%	520	10%	69	1%	284	6%	4,096	82%
Cambridge Science Park	27	29%	27	29%	22	23%	18	19%	4,019	26%	1,723	11%	4,843	32%	4,705	31%
Chesterford Research Park	13	76%	1	6%	0	0%	3	18%	1,309	98%	1	0%	-	0%	19	1%
Granta Park	12	80%	2	13%	0	0%	1	7%	3,303	93%	220	6%	-	0%	16	0%
Iconix Park	1	33%	1	33%	1	33%	0	0%	71	43%	89	54%	6	4%	-	0%
O2h Scitech Park	3	75%	0	0%	0	0%	1	25%	4	57%	-	0%	-	0%	3	43%
Wellcome Genome Campus	6	100%	0	0%	0	0%	0	0%	1,201	100%	-	0%	-	0%	-	0%
C P C 1 Capital Park	7	9%	17	23%	8	11%	43	57%	44	2%	118	5%	1,979	83%	241	10%
Cambourne Business Park	1	8%	6	50%	1	8%	4	33%	49	2%	587	20%	6	0%	2,368	79%
Cambridge Business Park	3	8%	9	23%	2	5%	25	64%	4	0%	5,820	61%	2,399	25%	1,277	13%
Harston Mill	1	11%	5	56%	2	22%	1	11%	64	9%	255	35%	403	56%	3	0%
Melbourn Science Park	0	0%	0	0%	2	50%	2	50%	-	0%	-	0%	383	96%	16	4%
St John's Innovation Centre / Park	22	12%	56	31%	27	15%	75	42%	124	6%	1,292	62%	372	18%	301	14%
Cambridge Commercial Park	0	0%	2	12%	2	12%	13	76%	-	0%	28	0%	35	1%	5,716	99%
Colmworth Business Park	2	2%	13	13%	7	7%	79	78%	4	1%	60	13%	44	10%	343	76%
Lancaster Way Business Park	1	3%	2	7%	3	10%	23	79%	13	1%	50	3%	479	29%	1,111	67%
South Cambridge Business Park	0	0%	12	13%	6	6%	75	81%	-	0%	78	17%	43	9%	340	74%
Vision Park	0	0%	3	10%	3	10%	25	81%	-	0%	15	18%	4	5%	64	77%
Total	**154**	**19%**	**158**	**20%**	**89**	**11%**	**395**	**50%**	**12,209**	**22%**	**10,405**	**19%**	**11,280**	**21%**	**20,782**	**38%**

Source: CBR.

4.54 Campus companies operating in the Life Science sector represent 96% of the total number of companies on the Campus and 90% of their total employment, with the remainder operating in non-KI sectors. These figures point to a strong focus of the BRC on life sciences, which differentiates it from other parks in the region such as the Cambridge Science Park and the St John's Innovation Centre that specialise more in the ICT sector.

4.55 Parks that tend to be similar to the BRC in relation to the sectoral distribution of the companies located on them are Granta Park and Chesterford Research Park. Important similarities also exist between the BRC and the Wellcome Genome Campus, which are both characterised by the co-location of a world-leading research institution (The Babraham Institute and the Wellcome Trust Sanger Institute respectively) with life science companies as well as the provision of incubator space. Table 4.9 examines the sectoral distribution of Campus companies alongside those on other business and science parks based on their R&D spend over the last three years.

Table 4.9 Sectoral distribution of companies on business and science parks: R&D (over last three years)

TOTAL OVER LAST THREE YEARS	Life Science		ICT		Other KI		Non-KI	
BUSINESS & SCIENCE PARKS	**R&D exp £,000**	**%**	**R&D exp £,000**	**%**	**R&D exp £,000**	**%**	**R&D exp £,000**	**%**
Babraham Research Campus	312,509	100%	-	0%	-	0%	-	0%
Cambridge Research Park	36,551	44%	-	0%	25,407	31%	20,384	25%
Cambridge Science Park	702,818	71%	43,606	4%	241,915	24%	-	0%
Chesterford Research Park	1,014,073	100%	-	0%	-	0%	-	0%
Granta Park	25,318	100%	-	0%	-	0%	-	0%
Iconix Park	-	0%	5,601	63%	3,304	37%	-	0%
O2h Scitech Park	116	100%	-	0%	-	0%	-	0%
Wellcome Genome Campus	7,054	100%	-	0%	-	0%	-	0%
C P C 1 Capital Park	4,780	1%	2,458	1%	330,342	98%	21	0%
Cambourne Business Park	3,051	3%	87,718	97%	-	0%	-	0%
Cambridge Business Park	-	0%	339,421	24%	1,090,831	76%	-	0%
Harston Mill	4,161	15%	-	0%	24,132	85%	-	0%
Melbourn Science Park	-	0%	-	0%	18,236	100%	-	0%
St John's Innovation Centre / Park	7,191	9%	64,485	82%	6,791	9%	-	0%
Cambridge Commercial Park	-	-	-	-	-	-	-	-
Colmworth Business Park	-	-	-	-	-	-	-	-
Lancaster Way Business Park	-	0%	-	0%	379	70%	166	30%
South Cambridge Business Park	-	0%	87	100%	-	0%	-	0%
Vision Park	-	0%	6	100%	-	0%	-	0%
	2,117,622	**48%**	**543,382**	**12%**	**1,741,337**	**39%**	**20,571**	**0%**

Source: CBR.

4.56 An even more vivid illustration of the BRC's focus on life sciences is offered by the sectoral split of R&D expenditure over the last three years. As is the case for other parks such as Chesterford Research Park, Granta Park and the Wellcome Genome Campus, all of the R&D activity on the BRC is carried out by companies operating in the Life Science sector.

4.57 The BRC has had one of the highest total R&D spend in Life Science in the entire Cambridge region over the last three years, together with Chesterford Research Park and Cambridge Science Park. Overall, R&D spend by companies on the BRC represents 15% of total R&D spend by Life Science companies located on any of the parks.

4.58 Our qualitative and quantitative analyses presented above show that Campus companies have achieved remarkable growth over the past years and performed well against companies on other business and science parks in the Cambridge region. Therefore, it is instructive to explore the extent to which Campus companies feel this growth will continue in the foreseeable future.

4.59 We asked companies located on the BRC about their growth objectives in two and five years' time in terms of employment and floor space occupied. Their responses are presented in Table 4.10.

Table 4.10 Growth objectives of Campus companies

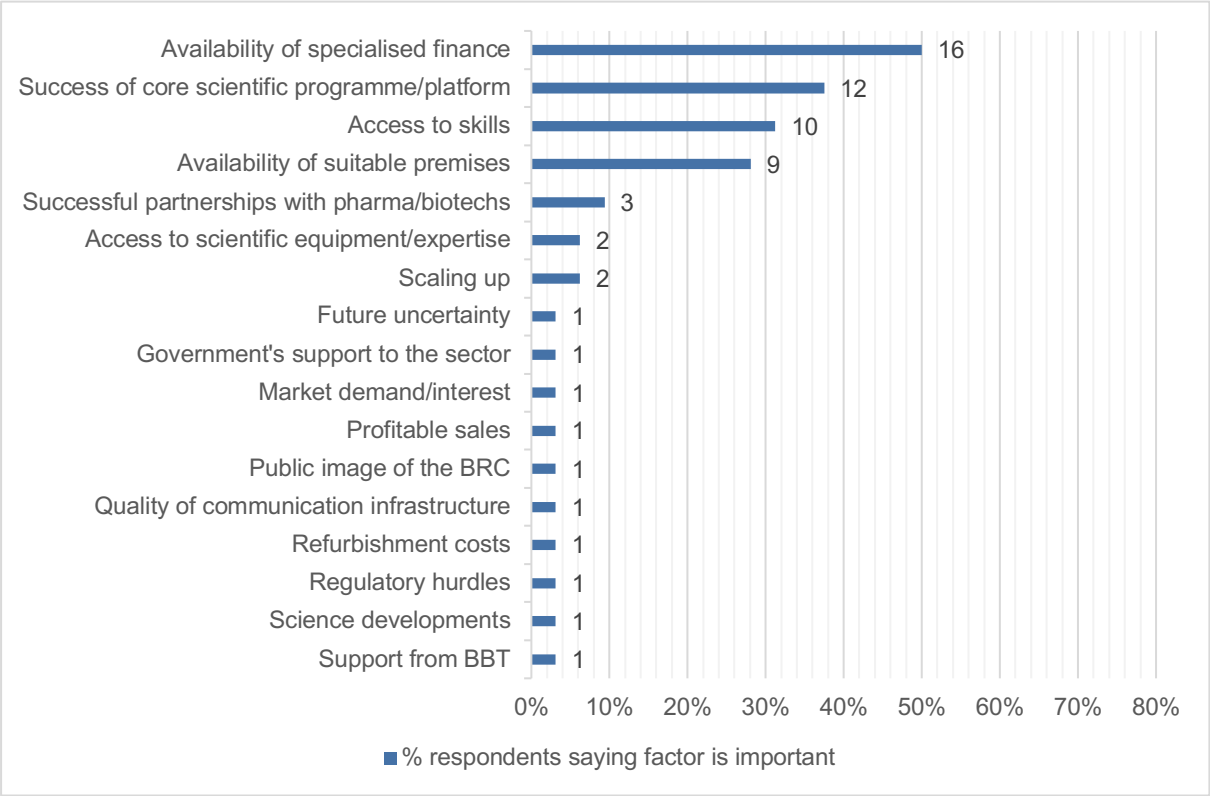
	2 years' time		5 years' time	
Growth	**%**	**% pa**	**%**	**% pa**
Number of employees	47.5%	21.5%	149.4%	20.1%
Floor space occupied (sq ft)	63.7%	28.0%	155.6%	20.6%

Number of responses: 33
Source: CBR.

4.60 The results of our analysis suggest that respondents remain quite bullish about their growth prospects. Overall, Campus companies aim to grow both their number of employees and floor space occupied by more than 20% pa, in line with their past growth rates and with those that tend to characterise scale-up companies. If these growth rates are indeed realised, these companies may have to seek larger premises either on the BRC or elsewhere to accommodate their expansion.

4.61 Campus companies were also asked about the important challenges they may be facing in attaining their growth objectives. A list of factors influencing companies' ability to achieve their growth objectives is presented in descending order of importance in Figure 4.11.

Figure 4.11 Factors influencing Campus companies' ability to attain their growth objectives



Number of responses: 32
Source: CBR.

4.62 It is not surprising that the availability of suitable premises is stated as an important challenge by almost a third of the respondents, with a further 6.3% indicating that scaling up represents a major challenge for their company. Campus companies also tend to regard access to finance (50.0%) and to skilled labour (31.3%) as two of the most important factors influencing their ability to achieve their growth objectives, along with the success of their core scientific programme or platform (37.5%).

Impacts of business growth

4.63 The supportive and collegiate environment offered by the BRC has enabled Campus companies to grow and make an impact at the local, national and international level. Besides their direct, indirect and induced economic impacts, companies located on the BRC are contributing to other organisations in the local area and beyond as well as to the development of the local skill base.

4.64 The main ways in which Campus companies are adding value to other organisations located on the BRC, in the wider Cambridge region or elsewhere in the country or overseas are summarised in Table 4.2 above.

4.65 Among the major pathways through which companies located on site contribute to other organisations both on and off the BRC are formal collaborations with fellow scientists and researchers.

4.66 For example, collaborations between scientists working at Campus companies and researchers at BI have helped turn innovative ideas into benefits for human health. A case in point is the collaboration between PhoreMost and members of the Signalling research programme at BI, which started from an informal conversation at the Campus premises and has the potential to deliver new drugs for diseases such as pancreatic cancer. This collaboration, which received support from the Babraham Research Campus Collaboration Fund (BRCCF), also led to a £600,000 grant from Innovate UK being awarded in 2017. This example shows how collaborations involving companies on the BRC may lead to further investment into the Campus while delivering key scientific advances.

4.67 Alongside the benefits they bring to other organisations in the local area, companies located on the BRC are making important impacts on the labour market of the Cambridge region by contributing to the development of the local skill base. A dedicated question was included in our follow-up survey of Campus companies asking them to reflect on the main ways through which they are impacting on skill development.

4.68 A first and major contribution Campus companies are making to the local skill base relates to the training they provide to their staff. A large part of this training takes the form of on-the-job training, whereby staff – some of whom may be at their first experience in the private sector – can develop a set of core skills that are central to a successful career in the life sciences. The analysis of survey responses points to three main set of skills that benefit from on-the-job training by Campus companies:

- Technical skills: for example, staff at companies located on the BRC may strengthen their technical knowledge by accessing the range of scientific facilities and services made available by BI.
- Interpersonal and communication skills: working at Campus companies requires staff to interact with fellow researchers and scientists in the Cambridge region and beyond, allowing them to strengthen important soft skills such as presentation and networking skills.
- Entrepreneurial skills: staff have the opportunity to learn the entrepreneurial skills that are needed to grow a start-up into a successful company and to raise funds to support that growth.

4.69 Besides on-the-job training, staff at Campus companies benefit from formal training offered either internally or through other organisations (e.g. One Nucleus). An example is the regular series of training courses provided by some of the science service groups at BI, which are generally open to researchers at Campus companies as well as other external organisations. These courses, some of which are also conducted on a one-to-one basis, equip researchers with technical and detailed knowledge in key areas such as flow cytometry, bioinformatics and imaging.

4.70 The on-the-job and formal training provided by Campus companies enables staff to become well-rounded scientists, consolidating their knowledge of the drug discovery and development process and related techniques. In turn, this knowledge is likely to enhance their

employability and provide them with the core skills they need should they decide to set up their own company.

4.71 The skill development of staff at Campus companies is also benefiting from the dynamic and supportive environment within which they are working. Being located on the BRC and at the heart of the Cambridge cluster means that staff can interact and share best practices with fellow researchers and scientists at other organisations both on and off Campus. Access to a wide network of scientists in related fields may stimulate a cross-fertilisation of ideas, which may in turn translate into contractual collaborations with other organisations in the Cambridge area and beyond. Campus companies also provide dedicated mentoring and coaching to their employees, supporting them in the different stages of their career.

4.72 The fact that a number of companies located on the BRC operate from multiple sites means that staff may be able to collaborate with colleagues based on other labs and benefit from a range of other cross-site initiatives. Since some of these sites are located outside of the UK, mainly in North America, staff may have the opportunity to travel to other countries for secondments or similar arrangements. Such international experience may expose them to a wide range of working styles, helping to equip them for their future career choices.

4.73 The contribution of companies located on the BRC to the development of the local skill base is not limited to their staff. Emphasis is also put by Campus companies on engaging with local education to attract younger people into bioscience.

4.74 A number of Campus companies host school students aged 16-18 on site to observe practical work taking place in both their laboratories and offices, with plenty of time to question the staff on their experiences of college, university studies and industry work. Apprenticeships are also offered to school leavers, which gives them the opportunity to work in a highly novel, disruptive field.

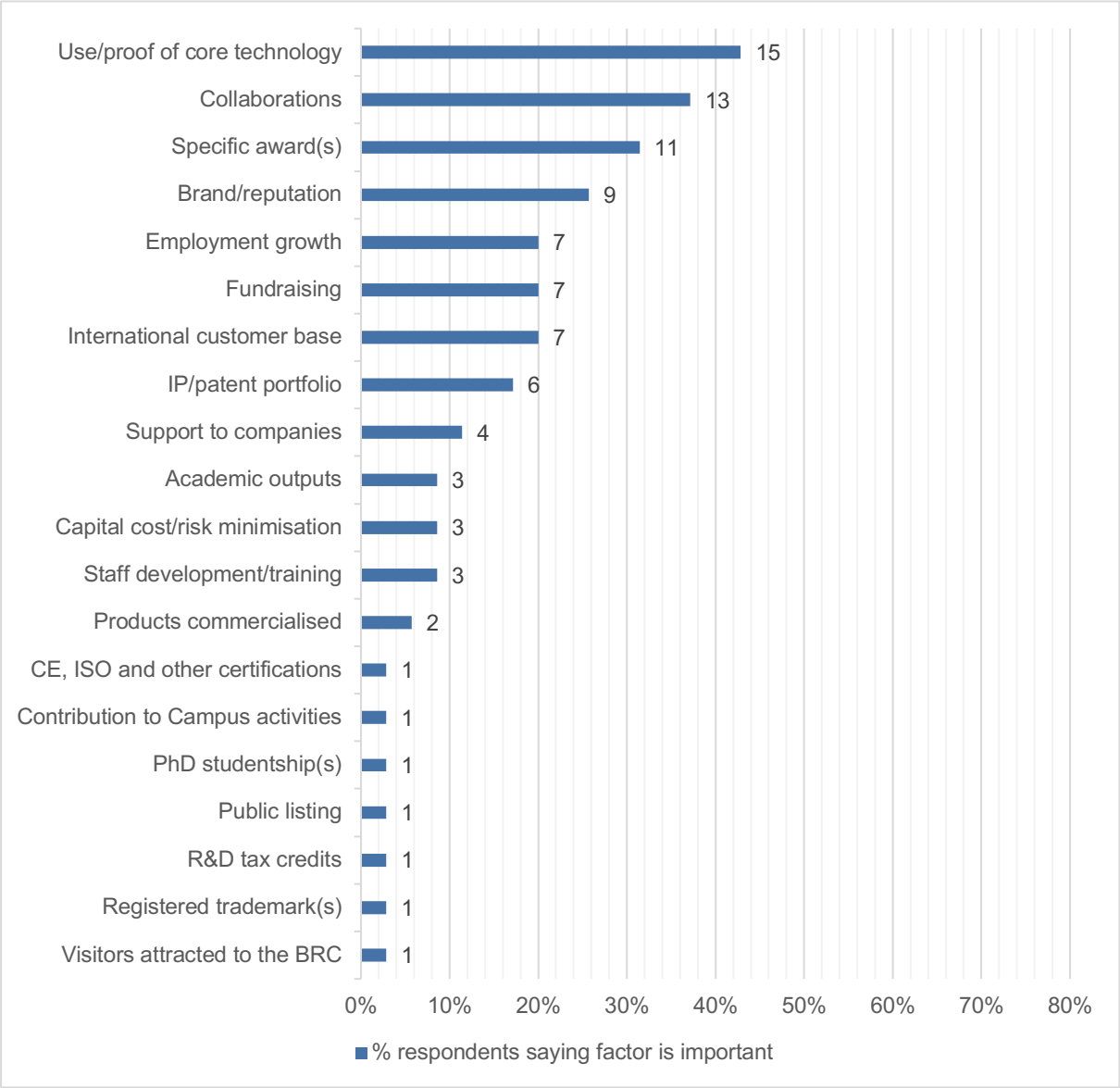
4.75 Companies on the BRC also engage proactively with universities and other research institutions to attract some of the best talent. Campus companies offer opportunities to both undergraduate and postgraduate students in the form of internships, industry placements and CASE studentships. These students benefit from advanced training courses and access to state-of-the art facilities, as well as from working alongside some of the best scientists and researchers in the field.

4.76 This engagement with local education supports schools, universities and other research institutions in the Cambridge region, while encouraging students and early career researchers to consider employment in the life sciences industry or other R&D-intensive areas. Campus companies may also provide direct employment contribution by recruiting some of these students. The start-up and scale-up biotech community may benefit as a result, together with the R&D activity in the Cambridge cluster and elsewhere.

4.77 To establish the impact that companies on site have made in local, national and

international ecosystems, we asked them to identify the key achievements of their business to the present time. The achievements stated by respondents are shown in descending order of importance in Figure 4.12.

Figure 4.12 Key achievements of Campus companies to the present time



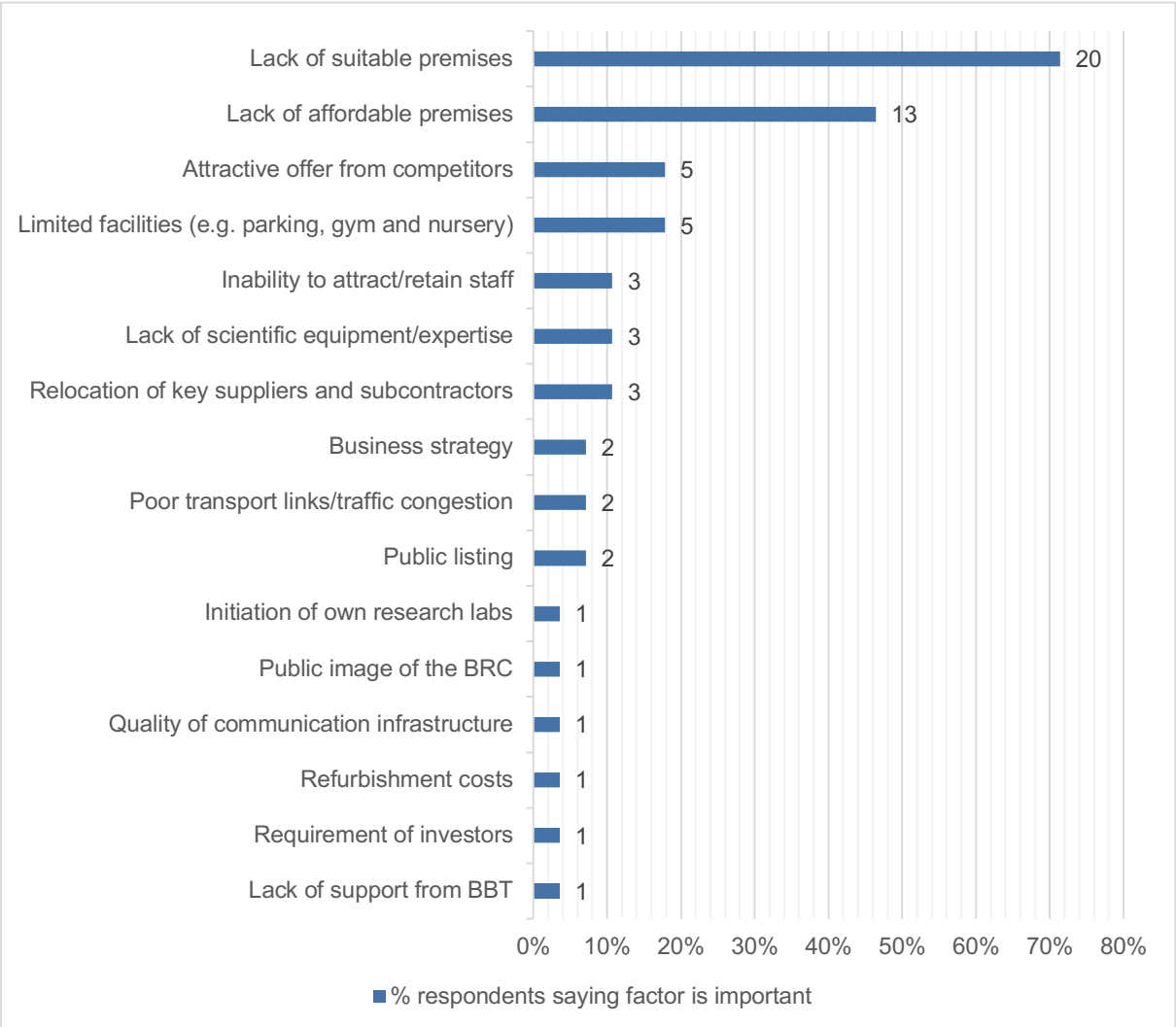
Number of responses: 35
Source: CBR.

4.78 The ability to prove their core technology is regarded by over 40% of respondents as one of their major achievements to date, followed by the establishment of successful collaborations with other companies and research institutions locally, nationally and globally (37.1%). Among the factors that score highly are the receipt of specific awards to either an individual or the whole company for exceptional achievements (31.4%) and the consolidation of their brand and reputation in the field (25.7%). The ability to grow their staff and raise funds (20.0%) tends to be viewed by Campus companies as another key achievement they have made to date.

Relocation of activity

4.79 To gain a better understanding of how being located at the heart of the Cambridge cluster makes a difference to Campus companies, we asked participants to identify the factors that might make them consider moving off the BRC and the areas where their activity might be relocated. Figure 4.13 lists a series of reasons that might cause Campus companies to relocate their activity out of the BRC.

Figure 4.13 Factors that might make Campus companies consider moving off the Babraham Research Campus



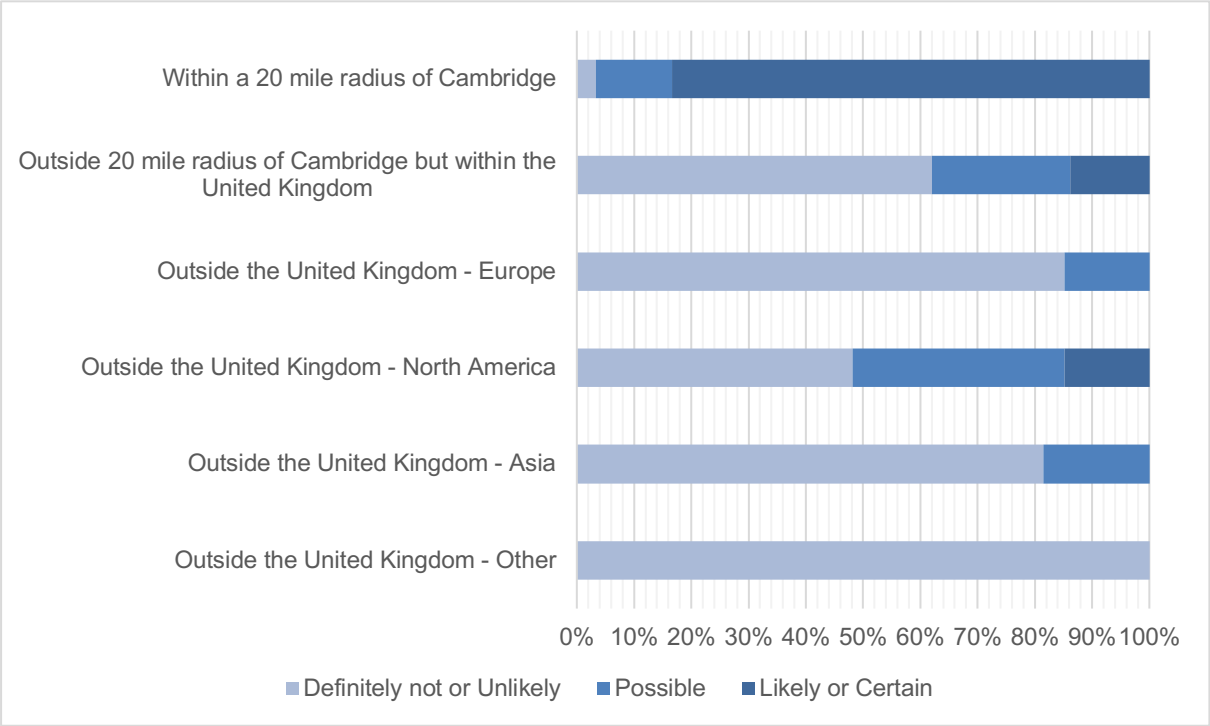
Number of responses: 28
Source: CBR.

4.80 Over 70% of respondents stated that the lack of suitable laboratory and office space to expand might make them consider moving off the BRC. Similarly, the lack of premises at a reasonable cost (46.4%) and an attractive offer from another campus (17.9%) are put forward by Campus companies as other important factors, along with the situation in which a shortage of support facilities available on site (e.g. parking, gym and nursery) were to materialise (17.9%). Other important factors that might make companies relocate out of the BRC are linked to some of the long-standing problems affecting the Cambridge region, including the

inability to attract or retain staff due to the high cost of living (10.7%) and a failing transport network (7.1%).

4.81 Therefore, the key question to be addressed is where would Campus companies relocate their activity if they decided to move off the BRC? To this purpose, participants were presented with six alternatives, namely elsewhere within a 20 mile radius of Cambridge, the United Kingdom, Europe, North America, Asia and other countries, and their responses are illustrated in Figure 4.14. Since each respondent could give only one answer in each row, the sum for each of the rows equals 100%.

Figure 4.14 Areas where Campus companies' activity might be relocated



Number of responses: 30
Source: CBR.

4.82 The results suggest that the most common destination of a departing business might be elsewhere within a 20 mile radius of Cambridge, with 13.3% indicating that this is possible and 83.3% indicating that this is likely or certain. Taken together, 96.7% of the survey respondents feel that it is possible, likely or certain they would relocate elsewhere in the Cambridge region should they decide to move off the Campus.

4.83 The second most attractive destination of a departing business is North America, followed by other locations outside of the Cambridge region but within the United Kingdom. If one focuses on the percentage of companies that would likely or certainly move to another area if they were to leave the BRC, 14.8% would consider relocating their activity to North America compared with 13.8% who would move elsewhere in the United Kingdom. This finding is not surprising, since a number of survey respondents have already established operations in North America and may find it easier to move all or part of their activity there.

4.84 These results suggest that Campus companies tend to see this issue as one of either ‘Cambridge or overseas’. These companies regard the region as a unique location within the United Kingdom and might have to relocate somewhere overseas to be able to find a similar ecosystem. It is apparent that this would result in a significant loss of jobs in the United Kingdom in favour of other countries.

5. Assessing the scale of investment in Campus companies and investor returns

The evidence suggests that the total market value of the campus companies has risen to over £4.07 bn. The values range from £2.6 bn down to less than £5m. The largest fourteen companies in terms of market value have 10 in the range £15m to £99m; 3 between £100m and £500m; and one valued at £2.6bn. These values represent significant potential returns to the investors. The total market value of the largest fourteen companies is £4.1bn and, by the valuation dates, the investors have put £636m in total. This gives a 7.2 times return on their investments on average. This ratio varies between 0.7 and 18.6 across the fourteen.

The question of the scale of the value-added provided to the companies by their location on the Babraham Campus is even more difficult to answer. However, our estimates suggest a contribution to the growth in value of these companies at £191m – a sizeable achievement.

The BRC has attracted a significant amount of commercial investment over the last decade. Overall, our survey of Campus companies shows that they have raised over £1.2bn to date, of which more than £300m funding was received in the last year. There is evidence that the attractiveness of Campus companies among life science and other investors has increased over time.

Our analysis suggests that, for the majority of the companies selected, ownership has become more dispersed during the last five years. These results can be taken as evidence that companies on the BRC have been able to raise funds from an increasing number of investors, who are attracted by the returns that these companies may generate. The results show that companies on the BRC have been able to attract funding from a wide range of world-leading life science and technology investors, including IP Group, Atlas Venture, Merck Ventures, SV Health Investors and Index Ventures. These investors have supported Campus companies at different stages of their growth, from seed financing to Series B and C rounds.

Fundraising by the largest Campus companies has been facilitated further by the extensive support provided by the University of Cambridge, primarily through Cambridge Enterprise, its commercialisation arm, and Cambridge Innovation Capital, a preferred investor for the University.

Introduction

5.1 This chapter assesses the scale of investment that has occurred on the BRC and the returns that have been obtained by investors. To this end, we address the following objectives:

- To examine funding successes and failures of Campus companies.
- To establish the role of the BRC in facilitating fundraising by Campus companies.
- To compare fundraising by companies located on the BRC with those on other business and science parks in the Cambridge region.
- To analyse the scale and type of investments received by Campus companies over time.
- To quantify the growth in value of Campus companies.
- To identify who the main investors in Campus companies are.
- To gather the views of investors in the BRC on the importance of the Campus as a location, the reasons for selecting their investments and their satisfaction with progress to date.

Methodology

5.2 The data used for this component of the work were drawn from both qualitative and quantitative sources. Our main survey of Campus companies allowed us to gather information on their funding successes and failures, the amount of funds they have raised to date as well as their main investors. This information was complemented with insights from our follow-up survey on additionality, which captures the contribution of their location on the BRC to the fundraising activity of Campus companies.

5.3 An online survey of investors in the Campus was also conducted to obtain their views on the importance of the BRC as a location, the reasons behind their investments and their satisfaction with progress to the present time. Alongside information from our surveys of Campus companies and investors, we accessed data from the CBR corporate database to quantify the scale of investment in these companies and their growth in value over time.

Investment in Campus companies

5.4 Our survey of Campus companies pointed to access to finance as one of the most important challenges facing these companies in fulfilling their growth plans and ambitions. Half of respondents indicated that future growth in terms of number of employees and floor space occupied will depend critically on the extent to which they will be able to raise funds.

5.5 At the same time, fundraising is regarded by companies on the BRC as one of their major achievements to date, with 20% of companies highlighting their funding successes to date in their responses.

5.6 A central role in facilitating the fundraising activity of Campus companies has been played by the BRC. Results from our follow-up survey on additionality show that four out of five respondents view their location on the BRC as either a slightly important, important, very important or critically important factor in facilitating their fundraising. These companies estimate that being located on the Campus has accelerated their fundraising by three months and increased the amount of funds they have been able to raise to date by 10.0%.

5.7 These findings suggest that the supportive experience provided by the BRC has had important benefits for the fundraising activity of Campus companies. Among the different ways through which the Campus provides support to companies in accessing finance is the Babraham Investor Conference (BIC), a one-day annual conference for investors taking place on the Campus.

5.8 The BIC, which has now reached its 10th edition and is organised by BBT, is aimed at investors with a focus on early-stage and scale-up life science and med-tech companies from across the UK and Europe. Selected start-up and scale-up companies have the opportunity to pitch to investors to seek funding typically in the range of £250k-£20m. The conference also allows Campus companies to network with other companies operating in the same or similar sectors. The last edition of the BIC took place on 15th May 2019 and brought to the Campus

about 170 delegates, who also heard presentations from the 2018 winners of the inaugural Accelerate@Babraham competition.

5.9 In light of the impact that their location on the BRC has had on Campus companies' fundraising, it is useful to examine how the Campus compares with other business and science parks in the Cambridge region with regard to the fundraising activity of the companies that are located on them. This comparison is presented in Table 5.1[17].

[17] Figures in the column 'Average annual amount raised £,000' are calculated as an average across companies located on a given park that did raise finance over the last three years.

Table 5.1 Comparison of companies on business and science parks: fundraising

BUSINESS & SCIENCE PARKS	Latest Year		Total over last 3 years		Over last 3 years	
	Number of companies raising finance	Total Funding raised £,000	Number of companies raising finance	Total Funding raised £,000	Proportion raising finance	Average annual amount raised £,000
Babraham Research Campus	27	169,718	34	429,313	65%	4,286
Cambridge Research Park	7	9,642	10	251,467	67%	5,588
Cambridge Science Park	35	70,495	57	246,078	61%	1,453
Chesterford Research Park	8	34,997	11	235,677	65%	7,142
Granta Park	3	21,094	8	69,134	53%	2,881
Iconix Park	0	-	1	5,003	33%	1,668
O2h Scitech Park	0	-	2	401	50%	67
Wellcome Genome Campus	5	13,726	5	35,248	83%	2,776
C P C 1 Capital Park	7	13,817	8	38,320	11%	1,597
Cambourne Business Park	4	3,819	7	9,501	58%	452
Cambridge Business Park	7	22,441	13	46,576	33%	1,263
Harston Mill	3	9,952	4	29,163	44%	2,430
Melbourn Science Park	2	333	2	340	50%	57
St John's Innovation Centre / Park	26	72,446	68	191,106	38%	965
Cambridge Commercial Park	3	24	8	5,327	47%	231
Colmworth Business Park	14	2,029	19	7,910	19%	139
Lancaster Way Business Park	6	354	16	7,514	55%	157
South Cambridge Business Park	7	662	23	5,157	25%	76
Vision Park	2	43	9	1,273	29%	47
Total	**166**	**445,592**	**305**	**1,614,508**	**38%**	**1,762**

Source: CBR.

5.10 Among business and science parks in the Cambridge region, the BRC has the highest amount of funding raised by companies over the past three years. This amount accounts for over a quarter of the total funding that has been raised by companies on business and science parks during that period.

5.11 Over the last three years, around two-thirds of Campus companies have raised funds, compared with an average across the whole group of 38%. Similar figures are found for Chesterford Research Park (65%), Cambridge Research Park (67%) and Cambridge Science Park (61%), while significantly lower is the proportion of companies raising funds that are located on the St John's Innovation Centre (38%). Together with Chesterford Research Park and Cambridge Research Park, the average annual amount raised by Campus companies in the past three years is one of the highest among all business and science parks. Table 5.2 looks more closely at differences in fundraising between the BRC and other parks in the region by examining the sectoral distribution of companies raising funds over the last three years.

Table 5.2 Sectoral distribution of companies on business and science parks: fundraising activity (over last three years)

TOTAL OVER LAST THREE YEARS BUSINESS & SCIENCE PARKS	Life Science Total finance raised £,000	%	ICT Total finance raised £,000	%	Other KI Total finance raised £,000	%	Non-KI Total finance raised £,000	%
Babraham Research Campus	429,313	100%	-	0%	-	0%	-	0%
Cambridge Research Park	93,065	37%	1	0%	126,399	50%	32,002	13%
Cambridge Science Park	21,058	9%	88,066	36%	110,134	45%	26,820	11%
Chesterford Research Park	233,713	99%	1	0%	-	0%	1,963	1%
Granta Park	39,906	58%	29,094	42%	-	0%	134	0%
Iconix Park	-	0%	-	0%	5,003	100%	-	0%
O2h Scitech Park	1	0%	-	0%	-	0%	400	100%
Wellcome Genome Campus	35,248	100%	-	0%	-	0%	-	0%
C P C 1 Capital Park	25,435	66%	1	0%	12,505	33%	379	1%
Cambourne Business Park	151	2%	4,305	45%	100	1%	4,945	52%
Cambridge Business Park	-	0%	44,731	96%	200	0%	1,645	4%
Harston Mill	18,599	64%	6,861	24%	3,703	13%	-	0%
Melbourn Science Park	-	0%	-	0%	203	60%	137	40%
St John's Innovation Centre / Park	18,959	10%	135,911	71%	34,961	18%	1,275	1%
Cambridge Commercial Park	-	0%	5	0%	2,516	47%	2,806	53%
Colmworth Business Park	7	0%	39	0%	226	3%	7,638	97%
Lancaster Way Business Park	-	0%	-	0%	1,314	17%	6,200	83%
South Cambridge Business Park	-	0%	3,451	67%	255	5%	1,451	28%
Vision Park	-	0%	-	0%	-	0%	1,273	100%
	915,455	**57%**	**312,466**	**19%**	**297,519**	**18%**	**89,068**	**6%**

Source: CBR.

5.12 The funds raised by Campus companies during the last three years are concentrated in the Life Science sector, with the BRC alone contributing approximately 47% of total funding raised by Life Science companies operating on business and science parks. Similar are the figures for the Wellcome Genome Campus (100%) and Chesterford Research Park (99%), though companies located on these parks have raised a considerably lower amount of funds compared with those on the BRC.

5.13 Two parks that appear to be substantially different from the BRC in relation to the sectoral composition of their companies are the Cambridge Science Park and St John's Innovation Centre. Funding raised on these parks tends to come primarily from companies operating in the ICT and Other KI sectors.

5.14 Collectively, our findings point to the key role that the BRC plays in attracting large commercial investment into the wider Cambridge life science cluster.

Return to Investors

5.15 In order to examine returns to investors and market values we decided to focus on the largest fourteen companies on the campus. They represent 95% of the funds raised by all the companies currently on the campus.

5.16 Market values cannot be precisely measured and can be subject to very large changes in response to a single event such as a successful drug trial, or a new discovery by a competitor. We have made what we believe to be reasonable estimates of market value utilising one, or more, of three approaches: the value established at the latest funding round; the value given by dealroom.com, or the value implied in the report and accounts of an investor in the company.

5.17 Although we believe in the reasonableness of our estimates, we present them here in aggregate, anonymised.

5.18 The total market value of the campus companies has risen to over £4.07 bn. The values range from £2.6 bn down to less than £5m. The largest fourteen companies in terms of market value have 10 in the range £15m to £99m; 3 between £100m and £500m; and one valued at £2.6bn.

5.19 These values represent significant potential returns to the investors. The total market value of the largest fourteen companies is £4.1bn and, by the valuation dates, the investors have put in £636m in total. This gives a 7.2 times return on their investments on average. This ratio varies between 0.7 and 18.6 across the fourteen.

5.20 Of course, these returns represent the progress to date and can be subject to sudden and very large swings on the basis of drug trial results, change in partnerships, or an undermining success of a competitor.

Additionality of the Babraham Campus

5.21 The question of the scale of the value-added provided to the companies by their location on the Babraham Campus is even more difficult to answer. However, we attempt to get an estimate of this figure by drawing upon the replies given to us about the benefits they derived from their location on the Campus. If we look at their responses to how much the Campus had accelerated their scientific discoveries and fundraising, the median was 3 months in each case.

5.22 Making use of the valuations of the companies in 2018 discussed above we can estimate for each company what this represents in terms of the addition of market value per year. The total across the fourteen companies that dominate the current set of companies at Babraham amounts to £765m per year. If the contribution of the Babraham Campus to this figure is taken at one-quarter, in line with the medians above, this puts the contribution to the growth in value of these companies at £191m – a sizeable achievement.

Investors in Campus companies

Ownership concentration of Campus companies

5.23 The BRC has attracted a significant amount of commercial investment over the last decade. Overall, our survey of Campus companies shows that they have raised over £1.2bn to date, of which more than £300m funding was received in the last year.[18]

5.24 There is evidence that the attractiveness of Campus companies among life science and other investors has increased over time. We examined the percentages of ownership held by the top 1, 5 and 10 shareholders of the 14 largest companies that are currently on the BRC, with the aim of assessing whether ownership of these companies has become more or less dispersed over the last five years (or since the company was founded if later). These 14 companies represent 95% of the funds raised to date by all the companies that are currently located on the BRC. The results are summarised in Table 5.3.

Table 5.3. Ownership concentration of the 14 largest Campus companies

[18] These figures refer to all of the tenants, virtuals and communal lab users that were on site as at April 2019 and operated in the life sciences sector.

Company	Top 1 shareholder %		Top 5 shareholders %		Top 10 shareholders %	
	Latest year	5 years earlier (or foundation if later)	Latest year	5 years earlier (or foundation if later)	Latest year	5 years earlier (or foundation if later)
Abzena Limited	100.0	26.6	100.0	90.4	100.0	93.5
Artios Pharma Limited	18.7	19.2	79.8	82.3	98.7	99.6
BenevolentAI Limited (Proximagen)	50.0	50.0	55.8	50.5	55.8	50.5
Bicycle Therapeutics PLC (including BicycleRD, BicycleTX and Bicycle Therapeutics Inc)	15.0	17.9	61.5	81.6	78.8	95.4
Biosceptre International Limited	16.3	50.0	42.2	100.0	57.9	100.0
Crescendo Biologics Limited	20.8	59.2	79.1	96.6	95.1	100.0
F-star Therapeutics Limited (including F-star Biotechnology and its asset-centric vehicles)	28.8	28.8	72.6	72.6	84.1	84.1
Kymab Limited	34.6	69.7	70.9	93.4	88.9	98.1
Mission Therapeutics Limited	21.5	27.2	78.7	76.3	85.7	82.4
Morphogen-IX Limited	48.1	44.7	90.6	89.4	99.6	100.0
PhoreMost Limited	20.7	46.4	62.4	100.0	89.6	100.0
PredictImmune Limited	44.2	44.2	86.2	86.2	100.0	100.0
Sphere Fluidics Limited	23.9	18.4	52.9	55.9	68.6	76.7
STORM Therapeutics Limited	17.8	100.0	86.3	100.0	100.0	100.0

Source: CBR's calculations based on data from Fame, Bureau van Dijk.

5.25 Our analysis suggests that, for the majority of the companies selected, ownership has become more dispersed during the last five years. The largest differences over time can be observed for the top 1 shareholder, as a number of Campus companies have seen the percentage of ownership held by the top shareholder falling from over 50% to less than 20%. These results can be taken as evidence that companies on the BRC have been able to raise funds from an increasing number of investors, who are attracted by the returns that these companies may generate.

5.26 While ownership concentration has remained somewhat stable for several of the other largest companies, a special mention is needed for two of the Campus companies selected – Abzena Limited and F-star Therapeutics Limited. Abzena was acquired by Welsh, Carson, Anderson & Stowe (Astro Bidco), one of the world's leading private equity investors, in August

2018. In turn, F-star has recently completed a group restructuring as it transitions to a wholly-owned portfolio strategy. As a result of this restructuring, the shareholders in the Austrian parent F-star Biotechnologische Forschungs- und Entwicklungsges.m.b.H. and the other F-star entities have exchanged their shares in these companies for shares in the new holding company, F-star Therapeutics. Since the ultimate shareholders remain broadly the same, as confirmed directly by F-star, the figures in Table 5.3 are kept constant over time.

Main investors across Campus companies

5.27 We also explored the full set of shareholders of the 14 largest companies to identify who the main investors across these companies are. The results of our analysis show that companies on the BRC have been able to attract funding from a wide range of world-leading life science and technology investors, including IP Group, Atlas Venture, Merck Ventures, SV Health Investors and Index Ventures. These investors have supported Campus companies at different stages of their growth, from seed financing to Series B and C rounds.

5.28 A particularly active investor in Campus companies is IP Group, who holds or has held shares in 8 of the 14 largest companies being examined. Significant is also the percentage of ownership it holds in these companies, with an average share of 24.0% in the latest year. In most cases, investments have been made through the Group's subsidiaries Touchstone Innovations and Parkwalk.

5.29 Fundraising by the largest Campus companies has been facilitated further by the extensive support provided by the University of Cambridge, primarily through Cambridge Enterprise, its commercialisation arm, and Cambridge Innovation Capital, a preferred investor for the University. Collectively, we estimate that the University of Cambridge holds shares in 7 of the 14 companies selected, with an average ownership share in the latest year of 6.9%. These figures point to the important role played by the University in supporting the Cambridge biotech cluster.

5.30 Another significant investor in Campus companies is Pfizer, one of the leading research-based pharmaceutical companies worldwide, which has invested in 3 of the largest 14 companies on the BRC. In the latest year, the average share of ownership it held in these companies was 7.6%.

5.31 Other significant investors include Amadeus, Sofinnova, SR One, the Wellcome Trust and Woodford, illustrating the prominence and diversity of the pool of investors in Campus companies.

Funding from deals with pharmaceutical companies

5.32 An additional source of investment in Campus companies is represented by deals with pharmaceutical companies. Whilst not equity investment, these deals tend to generate major injections of cash for companies on site – e.g. in the form of upfront and milestone payments, R&D funding and royalties – and fulfil much of the same purpose as equity investment. Therefore, they provide a springboard for further growth and a valuable route to a global market, while bringing credibility to a company's scientific programme.

5.33 Campus companies have signed a significant number of successful and high-value deals with pharmaceutical companies over time and it is impossible to review all of them hereinafter. Below we will provide some examples of deals that were achieved by companies on the BRC during the past few years, which point to collaborations with pharmaceutical companies as one of the marks of success and value creation of Campus companies.

5.34 A first example of how companies on site work closely with pharmaceutical companies is provided by the collaboration between Campus tenant Mission Therapeutics and AbbVie, a research-based global biopharmaceutical company founded in 2013 as a spin-off of Abbott Laboratories. The two companies are working together on the research and preclinical development of specified deubiquitylating enzyme (DUB) inhibitors for the treatment of Alzheimer's and Parkinson's diseases. The collaboration, which was signed in November 2018, brings together Mission's unique science, chemistry and proprietary enzyme platform with AbbVie's strong neurodegenerative disease research, development and commercialisation capabilities. Under the terms of the agreement, AbbVie will have the option to gain exclusive rights to develop and commercialise DUB inhibitors against up to four selected targets. Mission will receive an upfront licence fee and is eligible to obtain success-based milestone payments as well as royalty payments for each commercialised product. In September 2019, this collaboration was nominated for the 2019 Scrip Best Partnership Alliance Award, which honours innovative partnerships in which companies share the risks and rewards associated with the development of new drugs from the earliest stages.

5.35 Another area where Campus companies are making scientific advances through partnerships with pharmaceutical companies is oncology. A case in point is the global, strategic, multi-target and licence agreement that was signed in October 2016 by BI spin-out Crescendo Biologics with Takeda, Japan's largest pharmaceutical company and a global industry leader. The collaboration aims to use Crescendo's proprietary transgenic platform and engineering expertise to develop and commercialise Humabody®-based therapeutics for the treatment of cancer. The targets, which are selected by Takeda, include both Immuno-Oncology (IO) modulators and Humabody® Drug Conjugates (HDC). Under the agreement, Crescendo is eligible to receive clinical development, regulatory and sales-based milestone payments of up to $754m, in addition to royalties on Humabody®-based product sales by

Takeda. The partnership has been highly productive so far, with five technical milestones reached and three novel oncology targeted Humabody® lead molecules successfully delivered. Takeda has already taken exclusive licences to both of the first two programmes, validating Crescendo's ability to deliver Humabody®-based therapeutic leads.

5.36 A similar approach to leveraging the strengths of a company's core scientific programme has been taken by F-star, which has partnered with leading biopharmaceutical companies within IO and beyond to deliver innovative treatments of cancer. Alongside agreements with AbbVie and Denali Therapeutics, F-star has a collaboration in place with Merck KGaA, a global pharmaceutical and chemical company headquartered in Germany. The research, licence and commercialisation agreement was signed in September 2011 for the discovery of new antibody-derived therapeutics against inflammatory disease targets using F-star's Modular Antibody Technology. The initial agreement gave Merck exclusive worldwide development and commercialisation rights, in exchange for a technology access fee and research-based funding as well as the potential for additional licence fees, tiered royalties on product sales and milestone payments that could reach an aggregate sum of €492m. An asset centric vehicle, F-star Delta, was also created in December 2016 with the specific purpose of licensing intellectual property to facilitate future funding. In June 2017, this collaboration was expanded to include the development and commercialisation of five bispecific IO antibodies (mAb$^{2\ TM}$), with the option for Merck to acquire F-star's lead asset FS118. F-star recently announced reconfiguration of its collaboration with Merck as it transitions to a wholly-owned portfolio and builds scale and value as a world-class biopharmaceutical company. As a result of this reconfiguration, F-star retains exclusive rights to develop and commercialise FS118 while Merck retains the right to option a second discovery programme.

5.37 Partnerships with pharmaceutical companies to deliver breakthrough medicines for cancer patients are also the focus of Cancer Research UK's Therapeutic Discovery Laboratories (CRUK-TDL). As the in-house CRUK drug discovery unit, CRUK-TDL operates through biologically-themed multi-project alliances with academia and commercial partners. The themed approach is regarded by CRUK-TDL as driving strong partner engagement, teamwork across the academic and industry communities, high-quality target selection and efficiency in the prosecution of drug discovery projects. This model, which was pioneered, developed and refined in recent years by CRUK-TDL, has allowed the organisation to establish successful alliances with a number of leading pharmaceutical companies. These include AstraZeneca, Teva Pharmaceuticals, Merck KGaA and Ono Pharmaceutical. Under the terms of these agreements, CRUK-TDL generally obtains research funding and is eligible to receive milestone payments and royalties on projects advancing through its partner's drug

pipeline.

Campus investors

5.38 There are a number of companies and individuals investing in companies on the Campus and during the course of the study they were surveyed to establish their views on the impact of the Campus and what it had achieved. For each area of enquiry they were asked to score their assessments on a scale of one to five where five was most important and five was of low importance. Table 5.4 shows the views of the investors on the importance of the Campus in building the capacity of the Cambridge Life Science sector in the provision of property and also securing funds for the sector. The first thing to note is the relatively high average score given across all of the relevant aspects. The most favourable score was in relation to the provision of new start-up, accelerator space and scale-up space. The investors thus reinforced a core finding of the study that the Campus has made a substantial contribution to augmenting the provision of space to accommodate and facilitate the growth of the Life Science sector in Cambridge.

5.39 It was noticeable that the investors emphasised the role of the Campus in attracting funds to the sector, particularly from Research Councils, Charitable Foundations and investment from the rest of the United Kingdom and other countries.

5.40 Table 5.5 shows the views of investors on the importance of the Campus in building the capacity of the Cambridge Life Science sector through the provision of knowledge, commercialisation and enhancing the skill base. There is a relatively high average score given across all of the relevant aspects. The most favourable score was enabling the commercialisation of Life Science research. Relatively high scores were also given to the contribution that the Campus was making to strengthening the knowledge based and enabling collaboration, the building of networks and encouraging educational programmes and research that promote the development of skills and the recycling of technologies and talent.

Table 5.4. How important do you consider the BRC has been in building the capacity of the Cambridge Life Science innovation system with respect to the following finance and property factors? (Average scores in descending order for all responses)

Respondent group	Investors
Providing new start-up and accelerator space	4.89
Overcoming property market constraints that inhibit Life Science based dev	4.44
The provision of facilities and services to assist Life Science Companies	4.67
Providing Scale-Up space	4.9
Attracting funds from Research Councils	4.71
Attracting funds from Venture Capitalists/Business Angels	4
Providing soft-landing programmes that help encourage and shape business dev	3.89
Attracting business investment from the rest of the United Kingdom	4.22
Attracting Corporates for R&D collaborations	4
Attracting funds to assist with Proof of Concept in the Life Sciences	3.88
Providing shared meeting space	4
Attracting business investment from other countries	4
Attracting funds from Charitable Foundations	4.29

NB: Average score based on range where 1 was 'Not at all important' to 5 being of 'Major Importance'.

Source CEA Ltd.

Table 5.5. How important do you consider the BRC has been in building the capacity of the Cambridge Life Science innovation system with respect to the following knowledge, commercialisation and skill factors? (Average scores in descending order for all responses)

Respondent group	Investors
Enabling the commercialisation of Life Science Research	4.5
Contribution to the Life Science knowledge base	4.33
Enabling entrepreneur driven businesses to form	4.11
Enabling collaboration to occur	4.25
Enabling new academic spin-outs to occur	4.11
Attracting Management and Commercial Talent	4
Enabling business spin-outs to occur	4.2
Facilitating Recycle of Technologies & Talent	4.38
Bldg res netwks, partic with university, other res institutes & med facs	4.11
Building business networks	4.33
Attracting Leading Researchers	3.5
Helping researchers become aware of commercial opps from their res	3.8
Encouraging educational progs & research that promote dev of skills	4.1
Providing businesses with the skills to Scale-Up	3.9
Encouraging Life Science related public engagement	4
Building international networks	4
Enabling researchers to have bus skills req to commercialise their res	3.7

NB: Average score based on range where 1 was 'Not at all important' to 5 being of 'Major Importance'.

Source CEA Ltd

5.41 Table 5.6 shows the views of investors on the importance of the Campus in contributing to the UK economy building on the core aspects of interest that featured in the recent UK Life Science Industrial Strategy. Very high scores were awarded to all elements reflective of the very high regard the investors had of the contribution that the Campus was making.

Table 5.6.How important do you consider the benefits of the BRC are to the UK economy? (Average scores in descending order for all responses)

Respondent group	Investors
Increasing the growth of employment in the UK Life Science sector	4.7

Increasing the infrastructure base of the UK Life Science sector	4.5
Increasing the skill base of the UK Life Science Sector	4.2
Increasing the global impact and value from UK Science	4.22
Attracting international Corporates for R&D collaborations	4.2
Increasing the presence of UK Life Science businesses in key markets	4.2
Enhancing the growth of sales of UK Life Science businesses	4
Increasing the growth of UK Life Science exports	4.25
Providing wider societal benefits	4.11
Improving health outcomes in the UK	4

NB: Average score based on range where 1 was 'Not at all important' to 5 being of 'Major Importance'.

Source CEA Ltd

5.42 It was particularly important to obtain the views of the investors on how they considered that the Campus compared with other Life science campuses with which they were familiar. The scores are very impressive indeed, virtually across the board.

Table 5.7. We would like to obtain your view as to how the BRC compares to other campuses in the UK with which you are familiar (Average scores in descending order for All responses).

Respondent group	Investors
Providing services and facilities to support Life Science businesses	4.89
Attracting Research Council funding	4.5
Accommodating new start-ups	4.8
Attracting leading researchers	4.71
Attracting Management and Commercial Talent	4.78
Allowing businesses to scale-up	4.7
Attracting Corporates for R&D collaborations	4.67
Providing networking events	4.11
Building business networks	4.2
Attracting Venture Capital	4.7
Attracting business investment from outside the UK	4.57
Facilitating Proof of Concept	4.56
Building research networks, partic between research institutions & medical facs	4.63
Attracting business investment from within the UK	4.63
Facilitating business to business collaboration	4.13
Commercialising R&D	4.44
Providing skills to enable researchers to commercialise their research	4.25
Attracting funding from charitable foundations	4.17

NB: Average score based on range where 1 was ''Much worse' to 6 being 'BRC unique location.

Source CEA Ltd

5.43 Table 5.8 shows the responses of the investors on the contribution of the Campus to the economy of the Cambridgeshire sub-region. Particularly strong responses were given to the building of the capacity of the Life Science cluster in the region and its ability to commercialise opportunities in the Life Science sector.

Table 5.8. We would like to obtain your views on the overall contribution that you consider the BRC has made to the economy of the Cambridgeshire sub-region (Average scores in descending order for All responses)

Respondent group	Investors
Built the capacity of the overall Life Science cluster	4.6
Expanded the Life Science knowledge base	4.2
Commercialisation of Life Science R&D	4.1
Increased economic growth	3.89
Increased jobs	3.8
Increased presence of International Corporates	3.8

NB: Average score based on range where 1 was 'None' to 5 'Major effect'

Source CEA Ltd

Views on what would have happened in the absence of the Campus

5.44 The investors were asked for their views on whether they considered businesses on the Campus would have developed if BRC had not established its infrastructure. Table 5.9 shows there was very little difference in view between the three scenarios though there was a slight preference for the view that only 0-25% of current business activity would have been developed without the BRC infrastructure with an average score of 2.44.

Table 5.9. If the BRC had not developed its infrastructure in recent years how much do you consider the businesses on the campus would have developed (Average scores)

Respondent group	Investors
0-25% of current business activity	2.44
26-50% of current business activity	2.22
51-75% of current business activity	2.22

NB: Average score based on range where 1 was 'Not likely' to 5 'Highly likely'

Source CEA Ltd

5.45 Figure 5.10 below looks at responses on where the BRC Campus businesses might have developed without the recent BRC infrastructure development. The highest average score of 3.6 was given for the likelihood that businesses would have developed more slowly. In terms of other areas for development elsewhere in the Cambridgeshire sub-region emerged as the most likely outcome with an average score of 2.8.

Table 5.10. If the BRC had not developed its infrastructure in recent years would the businesses currently on the campus have (Average scores)

Respondent group	Investors
Developed elsewhere in the Cambridgeshire sub-region	2.8
Developed elsewhere in England	2.6
Developed elsewhere in the United Kingdom	2.3
Developed elsewhere in Europe (not UK)	2.3
Developed elsewhere in the world (not Europe)	2.3
Developed more slowly elsewhere	3.6

NB: Average score based on range where 1 was ''Not likely' to 5 being 'Highly likely'

Source CEA Ltd

6. Assessment of contribution to science and knowledge

According to its mission, the Babraham Institute "undertakes world-leading research into understanding the biology of how our bodies work, including what changes as we age and during disease." This is in line with the BBSRC Strategic Priority 'Bioscience for Health'. It is a bioscience research institute engaged in fundamental research with a clear 'academic' culture of discovery. A critical expertise is focused on three Institute Strategic Programmes (ISPs) in Immunology, Signalling, and Epigenetics. This is driven by scientific advisory boards and a pragmatic top-down control of the direction of research, with the ability to recruit a critical number of world leading and emerging group leaders with the desired scientific focus, moderated by the freedom in their research to be innovative. The Institute's research is serviced by world class facilities and core expertise that is an essential component in the make-up and success of BI. The body of new knowledge and innovation, as evidenced by publication, IP agreement and translation (including through Campus Company set up) combines to create an output and contribution to the understanding of ageing that is greater than the sum of the parts.

Academic contribution

6.1 According to its mission, the Babraham Institute "undertakes world-leading research into understanding the biology of how our bodies work, including what changes as we age and during disease." This is in line with the BBSRC strategic challenge: Bioscience for an Integrated Understanding of Health. It is a bioscience research institute engaged in fundamental research with a clear 'academic' culture of discovery. This approach resonates strongly with the philosophy put forward by Max Plank that "knowledge must precede application", building strongly on the individual creativity of its scientists. The funding model also has some analogies with the Max Plank (MP) Institutes in providing a longer timescale than many short project based research grants. This has allowed outstanding creative individuals to be appointed with "the brightest minds" who build a research effort around them with a critical mass, and which is not bound by rigorous pre-determined deliverables associated with typical 3 year project funding. However, the BI model is different in its approach to its direction of research, which allows more strategic planning and effort to be focused on an area of emerging knowledge and rapid growth. The vision is to build on research on healthy ageing and be a centre for ageing research including social science. The portfolio focuses on ageing and, with BBSRC, the MRC, the Wellcome Trust, mainly crosses the scope of research supported by these bio- and medical research councils. Indeed, BI's mission includes a directive to address strategic imperatives within the BBSRC Strategic Plan.

6.2 From within this vision, a critical expertise has grown in a limited number of programme areas where significant fundamental mechanistic questions can be addressed. There are scientific advisory boards for each of three programmes that assess progress, performance

and direction with a top-down control on direction of travel. Currently there are three areas of ongoing focus (Immunology, Epigenetics, and Signalling), whereas the programme concerned with calcium release and signalling has been closed down since it was seen to have become iterative, no longer leading edge or contributing to addressing fundamental questions providing new directions for knowledge. The culture is profoundly "academic", with the associated freedom in research, but a strong and pragmatic philosophy gives the scientific advisory boards the mandate to recommend modification of the direction or closure of the programme.

6.3 In contrast, the MPs do not follow a research programme determined by the organisation or by market drive. The Group Leader alone decides on their research objectives and methods and since open recruitment seeks the best in a very broad subject area, the capability and character of the institute is strongly influenced by the research direction choices of the individuals. Nevertheless, the MPI programme is also subject to the scrutiny of a scientific advisory board who can similarly reduce and increase funding (but also modulate salaries) according to performance.

6.4 The environment for BI is also unique with an outward facing campus of Bioscience Industry, including but not limited to BI spin offs (see section four). One Group Leader at BI, for example, who had developed a collaboration with one of the campus companies, following a chance meeting during a coffee break comments: "If the collaboration ultimately leads to new drugs for diseases like pancreatic cancer, it will mark an extraordinary advance. But it's the huge potential that this way of working represents that's the real game changer….On average it takes 17 years to translate basic innovation into a new drug or company. That's too long and too random. The Babraham Research Campus shows that we can work much more cleverly. Here, we can facilitate and accelerate – funding basic bioscience and bringing people together who might otherwise never have talked."

6.5 The BRC has some analogy with the Boston ring around Harvard and MIT, the US West Coast technology parks or indeed the University of Cambridge itself and surrounding science parks. Other models in Asia are also emerging; e.g. CREATE (Campus for Research and Excellence and Technological Enterprise) in Singapore that sits on a campus with industry and involves a research institute that is a collaboration of NUS, NTU and several world leading Universities (Cambridge, MIT, ETH, Technical University of Munich, Hebrew University of Jerusalem, Berkeley, Shanghai Jiao Tong University, Illinois at Urbana-Champaign). In the latter case, there is a clear and focused vision that "researchers from diverse disciplines and backgrounds work closely together to perform cutting-edge research in strategic areas of interest, for translation into practical applications that can lead to positive economic and societal outcomes for Singapore." Despite these analogies, there remains a strong distinction

in the foundation of BI and its independence as a research institute, such that its researchers (including the Group Leaders) do not currently hold appointment with a department of a University in association with their appointment at BI.

Institute Strategic Programmes

6.6 The BI **academic vision** and direction has not been static but has grown organically year by year as portrayed in annual reviews. The trend in the past decade had been to support four interconnected and collaborative programmes (Institute Strategic Programmes: ISPs: Immunology, Signalling, Epigenetics and Nuclear Dynamics) that would lead to breakthrough in the mechanisms underlying developmental, immunological and ageing processes. The strategy provided alignment and input to the BBSRC's strategic challenge: Bioscience for an Integrated Understanding of Health. BI has also recognised that the field of their research requires big data techniques and they have recruited group leader expertise and have invested heavily in expanding computational and systems biology approaches. All research groups now have their own, or access to, extensive bioinformatics support through the excellent BI facilities. In the past 7-8 years there have also been efforts to address the Global Challenge of ageing and from the most recent (2016) review of the progress and interconnectivity, continuation of three ISPs in **Immunology, Signalling, Epigenetics**, was confirmed. Some of the advances and interconnectivity achieved through this strategic focussing are summarised in sections 6.7 – 6.14.

Immunology

6.7 In **Immunology** the programme integrates research directed to the role of lymphocytes in the immune system. There is a multifaceted approach with effort being invested in understanding the mechanism of RNA binding proteins (RBPs), immune GTPases, PI3K enzymes, lymphocyte lineage etc. and, from these different starting points beginning to build a concerted model that will influence the treatment and management of age related conditions. For example, work has shed light on RBPs that control the stability of messenger RNA and in the last few years several RBP mechanisms have been identified, essential for the survival of a subset of B lymphocytes (B-cells), suppression of mRNA encoding the tumour suppressor p53 and critical for the selection of B cells in the germinal centre and regulation of alternative splicing of genes needed for rapid B cell proliferation.

6.8 The link between the GTPase enzymes and homeostasis of mature T and B lymphocytes has also been studied, to understand where pharmacological intervention could moderate immune-mediated diseases and the question of cellular changes in the functioning of the immune system with age are being investigated. The BI team have identified that

dendritic cells and CD4+ helper T cells (one of the T-cell lineages) have impaired activation with age and have shown reduced function of the germinal centre. Their work has suggested that next generation of adjuvants will provide a viable strategy to improving vaccine formulation. Information specific for the 'flu vaccination has already identified where the cellular defect lies that causes the T-cell impairment; a similar strategy is being used to address the Global Challenge of effectiveness of malaria vaccination. In understanding of the factors that affect lymphocyte lineage the BI researchers have investigated specification of Treg cells and together with collaborators, discovered a human disease which results from changes to the BACH2 gene required for the differentiation of Treg cells. They have also gained new insights into how dysfunction of T cells and myeloid cells contribute to immunosuppression. The reduction in the production of B-lymphocytes in bone marrow with age has also been correlated with genes dysregulated in ageing and the effects on epigenetic mechanisms: impairment of signalling pathways might be targeted for restoration of the immune system. This has also revealed mechanisms that indicate how the immune system is suppressed in cancer emphasising the wide importance of these pathways. The potential extent of effect of the lymphocyte mechanisms has provided the impetus for further recruitment of emerging and established leaders in this area.

Signalling

6.9 The extent of the molecular cascades that are being revealed gives hints on the reach of regulation and signalling pathways. The **Signalling programme** has extended the knowledge of some key signalling pathways, for example by phosphoinositide 3-kinases (PI3Ks), kinase phosphorylation, autophagy, lipids etc. The PI3K pathway is implicated in phospholipid signals, regulating metabolism, immunity, ageing and growth and heavily mutated in human cancer. For example, some of the basic binding preferences between the regulatory and catalytic subunits of PI3Ks have been revealed and key properties that allow growth factors to selectively activate PI3Kα and β in fibroblast cells, and how inflammatory stimuli activate PI3Kγ in neutrophil immune cells has been identified. Furthermore, the BI team have developed a mouse model that reproduces many aspects, in activated PI3K-delta syndrome (APDS) reduced production of B and T cells in order to study the cellular and biochemical mechanisms. The level of extracellular signal-regulated kinases (ESKs) has been found to be critical to cell division with a threshold concentration required for cell growth, but too high a level resulting in senescence. This pathway is relevant to aging and cancer. Cannibalism by cancer cells and the role of dendritic cells (see section 6.8) in the non-canonical autophagy pathway that regulates the immune system have been some of the current challenges that are being addressed by both cultured cells and mice models. Together with collaborators, the BI researchers have revealed the rearrangements of cell membranes

that happen during mitophagy and generated computer models of autophagy. Their work is beginning to shed light for example, on the mechanism by which synuclein fibres, the key amyloidogenic proteins in Parkinson's disease, activate autophagy in brain microgial cells, through lysosomal malfunction. Progress has also been made on the impact of RAC-GEFs (guanine nucleotide exchange factor) in the immune system and, for example, following migrating white blood cells, approaching sites of infection or in the maintenance of healthy blood glucose levels.

6.10 One area where BI has a long-standing reputation is in the field of lipids, but nevertheless, the attention to lipidomics is experiencing a rebirth as the understanding of the impact of their structure and function is emerging as a result of advances in bioinformatic techniques. BI have been instrumental in the development of many of the techniques that are now being used to investigate lipid connection with signalling pathways. This is now leading to several discoveries, for example, showing how dietary restriction (as often found in ageing animals) influences the lipid content and structure in cells, reducing shorter chain fatty acids or how a particular lipid can support the replication of hepatitis C virus in liver cells. The research has also allowed the determination of potentially novel therapeutic targets to treat rhinovirus infection of human bronchial epithelial cells.

6.11 The BI researchers have recognised the complex multiparameter system with which they work and the overarching need to be able to consider the whole system and its links between cell signalling, metabolism and epigenetics. They are developing with collaborators, a whole system knowledge through a model of the metabolism of the nematode worm *Caenorhabditis elegans*, which will be applicable to ageing studies.

Epigenetics

6.12 The role of **Epigenetics** in cell diversification has required BI (with collaborators) to develop methods to read the methylome and transcriptome. This innovation has been instrumental in establishing the first systematic molecular map of cell fate decisions in early mouse development and discovering that slight variations in gene expression and methylation increases before cells become committed to different cell types. Epigenetic DNA methylation has been correlated with chronological age and the role of environment (e.g. diet) noted on the acceleration of ageing. The nematode model *Caenorhabditis elegans* is also being employed here to identify key gene expression switches, while a yeast model is being used to consider the impact of nutrition on cells and the dichotomy in fitness of different cells according to age. The breakthrough in this work now allows functional profiling of multiple epigenetic marks during the chromatin upheavals that are thought to accompany ageing in all eukaryotes and the BI programme is now using mutation techniques to home in on extrachromosomal

DNA formation mechanisms that can address drug resistance.

6.13 The interest in epigenetics follows from the embryo and the BI researchers now have the ability to map chromatin states in very small numbers of cells, which has indicated a link between genetic information in DNA, its methylation and the H3K4me3 (widely accumulated in oocytes) modification on the chromosome. Epigenetic maps of early stage mouse embryos can now separate maternal and paternal chromosomes information, allowing genes that depend on DNA methylation to be distinguished from those that depend on repressive chromatin. Progress is also accelerating on an epigenetics map that addresses the interplay with transcriptional events, and genes have been identified that are activated at either the early or late stages of naïve cell formation.

6.14 Functional information looking at the transcriptional and epigenetic regulation of trophoblast stem cells during the process of placental development are also able to add further information to the system from a different dimension. The BI teams have established that placenta abnormalities are present in a high number of embryo deaths and that decidualisation supporting embryo implantation and early placenta formation reduces with age. This is proposed to be correlated with a lack of progesterone receptor protein and reduced levels of the signalling molecule pSTAT3. Further mapping of promoter–regulator interactions in mouse embryonic stem cells and trophoblast stem cells has demonstrated that 3D genome organisation changes early in cell lineage differentiation and also changes in ageing in mouse B lymphocytes.

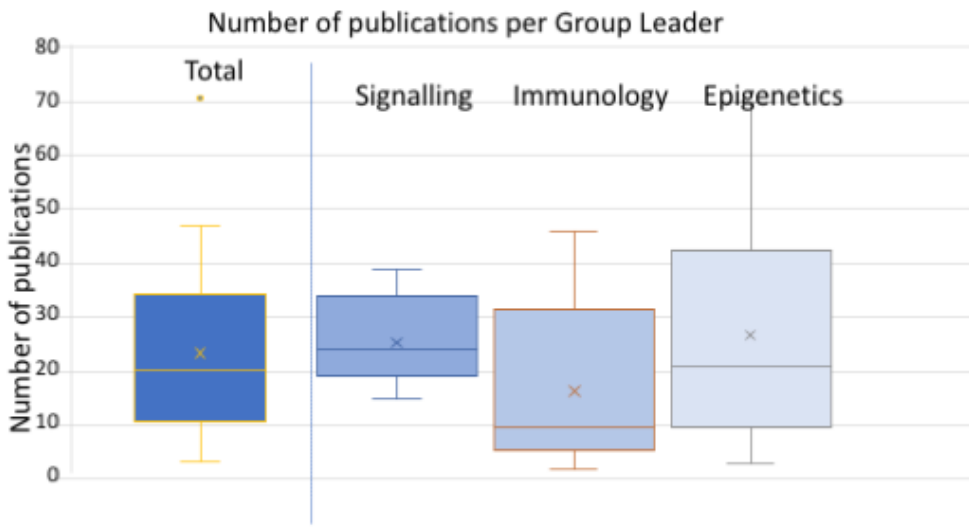
Publication metrics

6.15 An overarching conclusion from the advances made in the world leading research undertaken by BI is the 'fit' of the output by individual groups to the mission to understand the biology of ageing. This singular approach to a research challenge combined with the academic freedom of individual research groups to undertake innovative research in their area of leadership combines to create a unique research environment. Nevertheless, the metrics to indicate the particular character or success of BI are difficult to quantify. It is clear that individual publication and citations of the BI researchers are on par with those of individuals in the top ranking University departments. However, breakdown analysis of their output does not reveal any exceptional or unusual indicator of excellence. Nevertheless, the overall performance for circa 20 research groups is outstanding in the separate contribution to a central theme, whereby the body of new knowledge combines to create an advance that is greater than the sum of the parts.

6.16 The **publication data** for each Group Leader in peer reviewed highly cited journals

lies in the range of 1-11p.a. for the period from 2014-19 with the Nature, Science and Cell journals featuring. In 2016 a Leiden Ranking exercise ranked the Institutes publication record from 2010-13 higher than most biomedical science departments in Universities around the world. However, many highly ranked University based research groups working in comparable areas are also delivering in or above the top quartile of the BI range and the BI distribution is strongly skewed; Figure 6.1 shows that for each programme the median is lower than the mean and for the immunology and epigenetics programmes, there is a strong separation of the Group Leaders with higher publication rates. These higher publication rates is also (coincidentally) consistent with the extent of collaboration outside BI. However, the correlation of these metrics is untested.

Figure 6.1: Number of publications from BI from 2014-19 given as total across all programmes and within the individual programmes (Signalling, Immunology, Epigenetics)[19].



6.17 The publications from the Group Leaders involving BI in the period 2014-19 have yielded an average citation rate of 29/paper and a median of 16.9. However, this figure embraces some extremes. Figure 6.2 shows the citation data and suggests that in the field of immunology there is quite a narrow variation, so that having a high or low publication rate has little correlation with citations. This is more clearly identified in Figure 6.3, where the Citation: Publication ratio is shown. In contrast, in the signalling theme there are some Group Leaders producing a higher output in number of publications (>5 p.a) but this does not correlate with high citation impact. Indeed, those with an annual publication rate <4 have achieved the highest citation impact; this creates the wide variance on the citation: publication ratio for

[19] Data from *Web of Science- These reflect number of citations since 2014 on publications published ≥ 2014, while PI was based at BI*

signalling seen in figure 6.3 and negates attempts to establish any robust conclusion of excellence based on publication or citation metrics.

Figure 6.2: Citations from BI publications from 2014-19 given as total across all programmes and within the individual programmes (Signalling, Immunology, Epigenetics) [13].

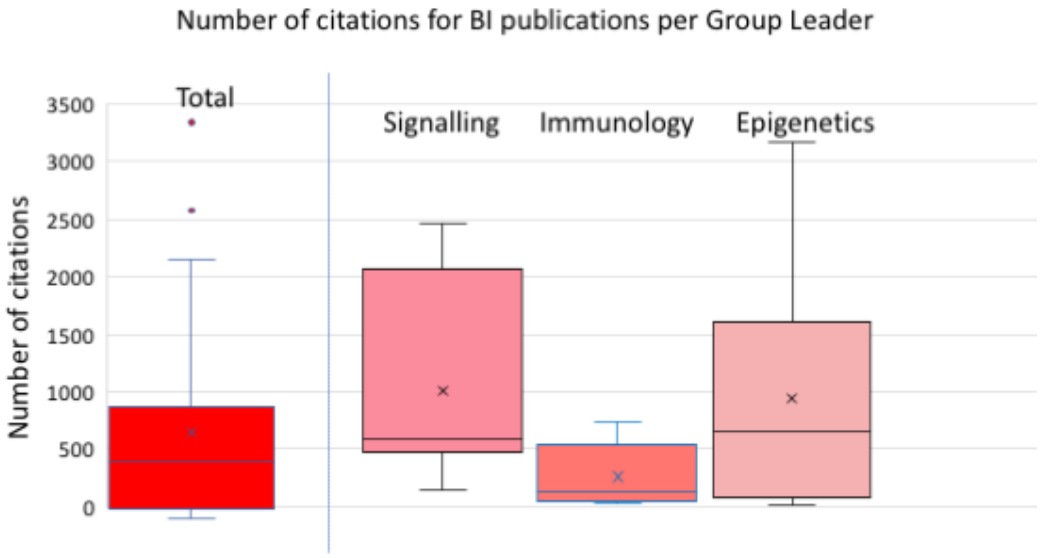
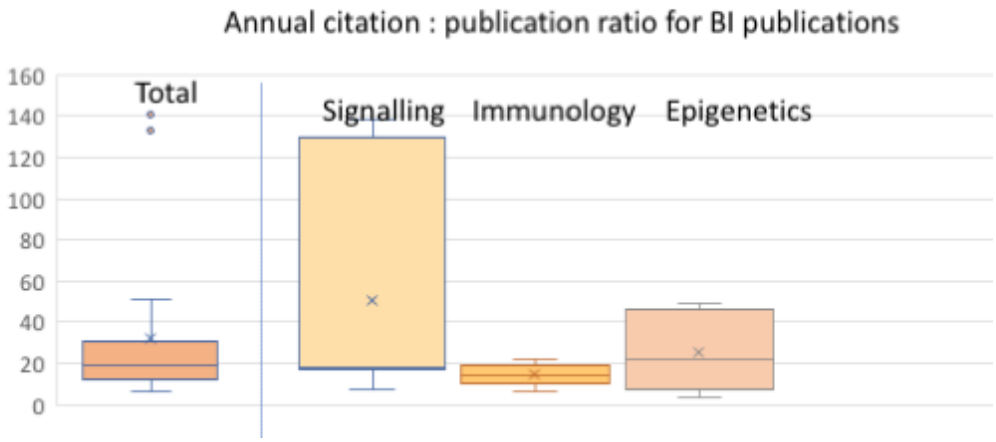
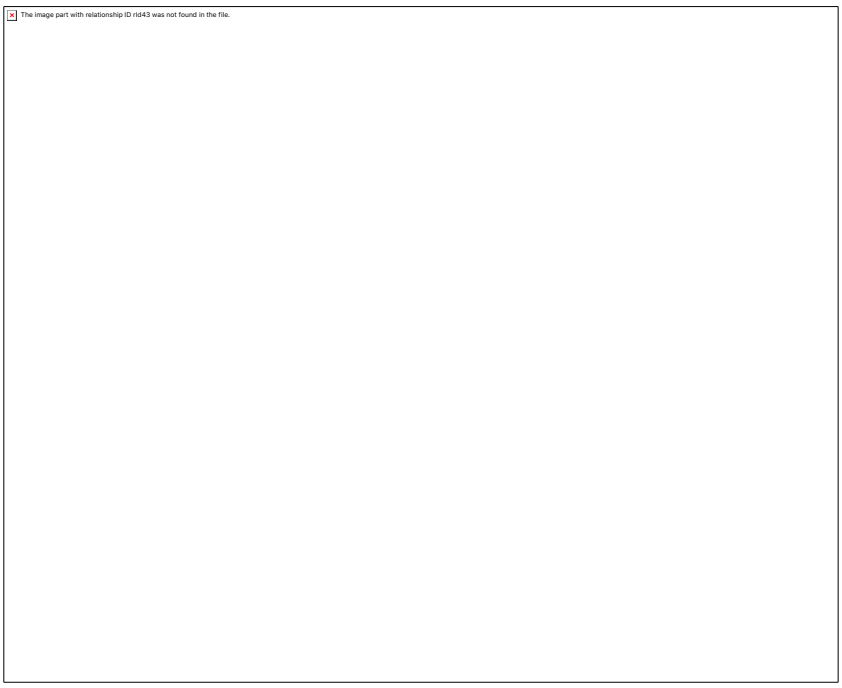


Figure 6.3: Citation: Publication ratio from BI publications from 2014-19 given as total across all programmes and for group leaders within the individual programmes (Signalling, Immunology, and Epigenetics) [13].



6.18 One of the dilemmas in considering these data is that the experimentation yielding new data is emerging at different rates depending on the maturity of the programme or the discovery of a new window to mechanistic knowledge. This creates opposing outcomes where publication can be ahead of the body of research, requiring time for others to take the findings on board, or the scope of international collaborators who are working in tandem to achieve many of the pivotal outcomes emerging from BI, create an exponential multiplier on the likelihood of citation. As can be seen in Figure 6.4, there are some very highly cited works associated with the signalling and epigenetic themes, but mainly the publications are receiving <20 citations/year and demonstrating a consistent level of interest and recognition of some innovative work at the forefront of research on the mechanism of ageing.

Figure 6.4 Citation as ranges from B1 publications from 2014-19 given as total across all programmes and for group leaders within the individual programmes (Signalling, Immunology, Epigenetics) [13].



Research environment

6.19 As shown above, the strategic approach to academic contribution has been driven by a pragmatic top-down control of the direction of research, moderated by the freedom of group leaders to be innovative. There are three scientific advisory boards, one for each research programme and BI is able to recruit a critical number with a desired scientific focus or close down areas of research to adjust to the environment. Appointments are mainly made on tenure track (6-7 years), with a success rate of about 50% towards tenure. Together with the appointment of postdoctoral researchers and the involvement of students and visiting

researchers there is a high turnover at BI that maintains an academic freshness and enthusiasm for research. It also has to be recognised that behind the world leading research groups are world class facilities that provide outstanding know-how and input to the development of individual projects. The level of expertise that is available is an essential component in the make-up and success of BI. This level of serviced facility is rarely as concentrated in a University department and less targeted to the strategic research direction as found at BI. The facilities are an important part of BI and the Campus as a whole (see section 4 and 6.45) and include:

- **Bioinformatics:** providing support in the analysis of biological data with guidance and training in data analysis, statistics and data management.
- **Biological Chemistry:** support the synthetic chemistry to make compounds which are not commercially available through to developing new analytical methods to analyse lipids in cell extracts. Routine lipid analysis.
- **The Biological Support Unit** provides state-of-the-art housing and care for pathogen-free rodents
- The **Flow cytometry facility** allows cells to be identified, counted, analysed and sorted on the basis of specific physical or chemical features, including using fluorescently labelled antibodies.
- The new **Gene Targeting service** is trialling new gene editing technologies to produce genetically altered mouse models. The service goal is to be able to aid in the design, generation, screening and evaluation of genetic modifications.
- The re-established **lipidomics facility** provides chromatography and ion mobility to identify and semi-quantify a range of neutral, phospho-and sphingolipids.
- **Mass spectrometry facility** provides and develops new methods for the analysis of biological molecules, particularly proteins and nucleic acids
- **Next generation sequencing** which provides researchers with rapid high throughput information on DNA sequencing

Commercial contribution

6.20 Over the last 25 years, the fundamental research carried out by BI has led to major advances in our understanding of the biological mechanisms underpinning lifelong wellbeing and healthy ageing. These advances have made substantial contributions to the academic community (see Section 6.1), while paving the way for the translation and commercial development of the Institute's research.

6.21 To fulfil its mission of creating significant social and economic impacts, BI is committed to the dissemination and exploitation of knowledge generated by and held within the Institute. This commitment is explained well in the following statement from BI's annual report (The Babraham Institute, 2018, *Annual Report and Financial Statements Year Ended 31 March 2018*, p. 10):

"Implicit in this is the recognition that this knowledge is the product of public investment and

we have a duty to maximise outcomes from this investment for societal and economic benefit".

6.22 The translation and commercialisation of the Institute's research are facilitated by two main support structures: the Knowledge Exchange and Commercialisation (KEC) programme and Babraham Institute Enterprise (BIE) Limited.

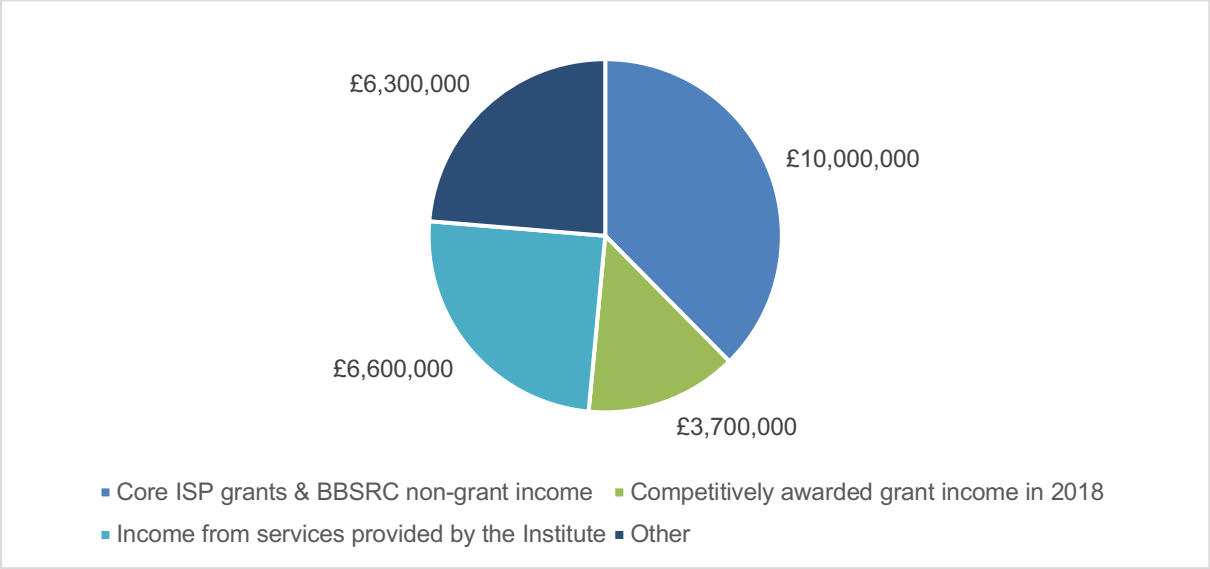
6.23 The KEC programme seeks to maximise the dissemination, impact and, where appropriate, exploitation of knowledge originated from within the Institute. Through a KEC grant provided by the BBSRC, BI employs a team of skilled KEC specialists whose remit is to facilitate the impact of the Institute's research by promoting national and international collaborations with other research institutions, networking bodies and commercial organisations.

6.24 BIE, a wholly-owned subsidiary of BI, supports the delivery of the commercialisation of the Institute's science and is tasked with the following key responsibilities:

- To manage, develop and commercialise the Institute's IP portfolio.
- To facilitate collaborations between the Institute and industry.
- To arrange commercial access to the Institute's expertise and scientific facilities and services.

6.25 BIE also holds shares in two BI spin-out companies, Crescendo Biologics Limited and Discerna Limited, as well as in Aitua Limited. Figure 6.5 provides a breakdown of the total income generated by the Institute in 2017/18.

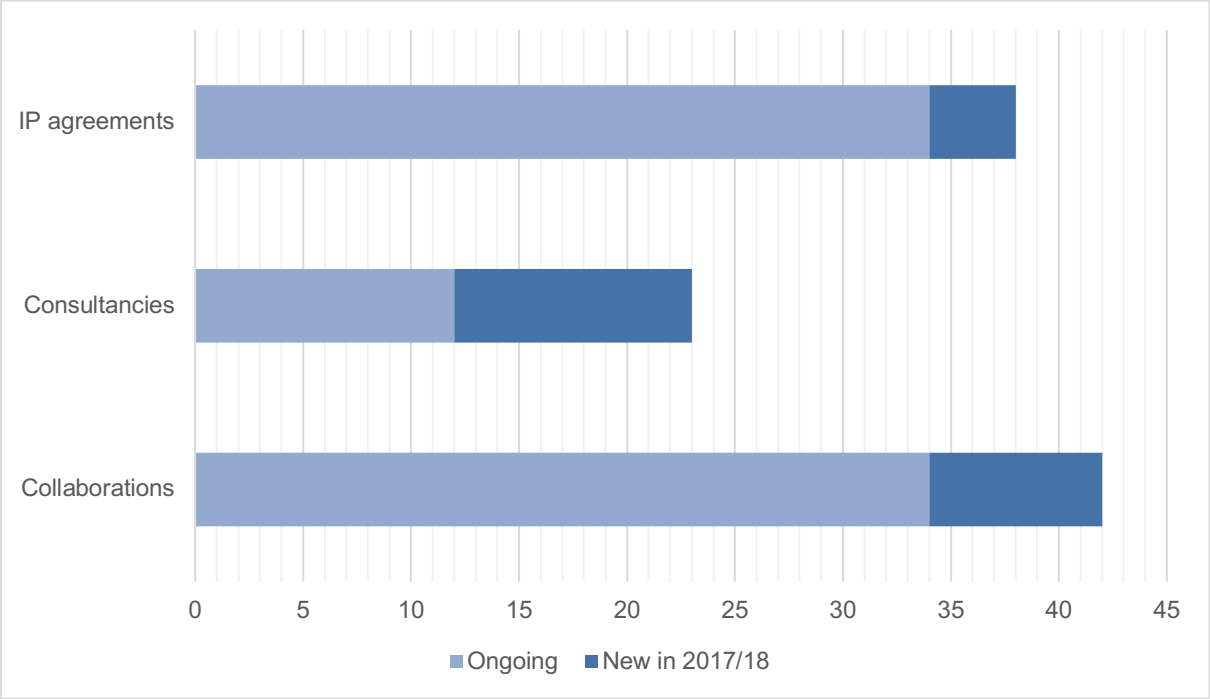
Figure 6.5 Total income of The Babraham Institute, 2017/18



Source: The Babraham Institute (2019), *Annual Research Report 2018*.

6.26 Over a third of the Institute's income comes from BBSRC core ISP grants and other non-grant income, while income from competitively awarded grants represents about 14% of total income. Income from services provided by the Institute, which constitutes the focus of the analysis presented in this section, is large and accounts for almost 25% of the total amount of income generated by the Institute. Figure 6.6 reports the number of projects, either ongoing or new in 2018, between BI and commercial partners.

Figure 6.6 Commercial projects of The Babraham Institute, 2017/18



Source: The Babraham Institute (2019), *Annual Research Report 2018*.

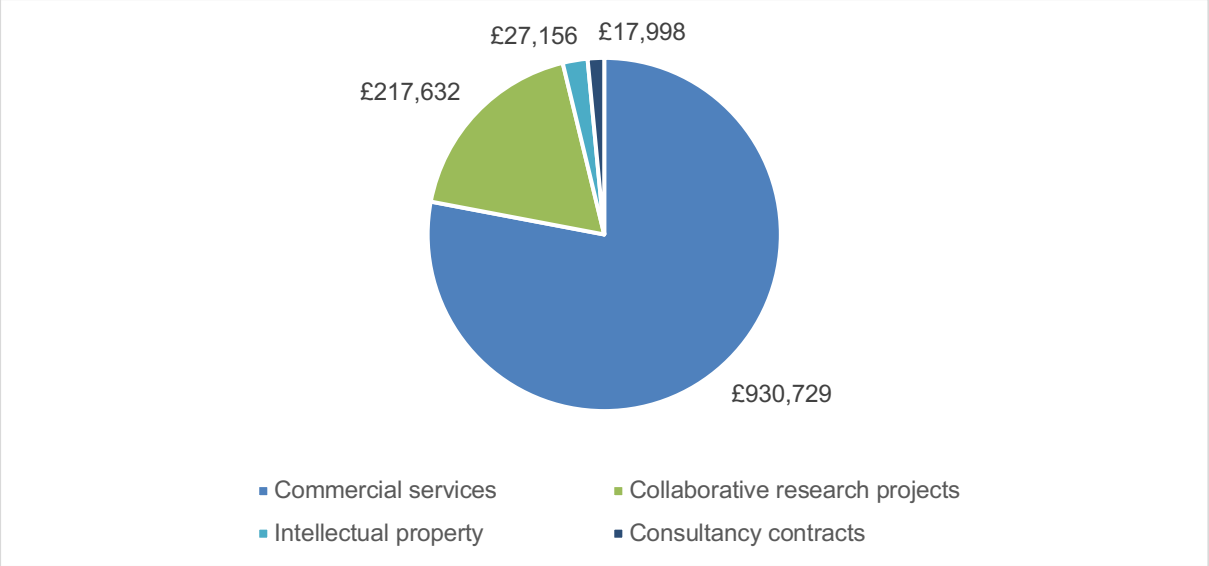
6.27 Researchers at BI participated in a total of 42 collaborations with commercial partners in 2017/18, with 8 of these being newly established during the year.[20] Significant is the number of consultancy activities that were initiated in 2017/18, whereby BI scientists provided their advice to industry on a variety of scientific subjects. A total of 38 IP agreements, in the form of either IP assignments, licences or revenue sharing agreements, were also in existence during the year.

6.28 Figure 6.7 presents a split of the commercial income generated by BI in 2017/18, while Table 6.1 lists a number of core indicators capturing the Institute's work with commercial partners. Commercial services income is represented primarily by income from the commercial use of BI scientific facilities.[21]

[20] Collaborations include industry research collaboration agreements and CASE studentships.

[21] The figure for the number of people trained in BI's scientific facilities for 2014/15 refers to 2016.

Figure 6.7 Commercial income of The Babraham Institute, 2017/18



Source: The Babraham Institute (2019), *KEC core indicators*.

Table 6.1 Commercial contribution of The Babraham Institute: selected indicators

Cumulative increase	2017/18	2014/15	% change
Patent portfolio	19	16	18.8%
Number of IP agreements	38	36	5.6%
Number of licences generating income	10	12	-16.7%
Number of spin-offs	4	3	33.3%
Number of collaborations	42	45	-6.7%
Number of research collaborations worth >£50k	4	5	-20.0%
Number of research collaborations with Campus companies	10	7	42.9%
Number of CASE studentships	19	15	26.7%
Number of consultancies	23	34	-32.4%
Number of companies using BI science services	93	42	121.4%
Income from commercial use of BI scientific facilities (£)	930,729	386,000	141.1%
Number of people trained in BI scientific facilities	1,195	634	88.5%

Sources: The Babraham Institute (2019), *KEC core indicators*; The Babraham Institute (2019), *The Babraham Institute performance indicators*.

6.29 Taken together, Figure 6.7 and Table 6.1 suggest that BI generates commercial income in the following important ways:

- IP commercialisation.
- Research collaborations with industry partners.
- Scientific consultancy to industry.
- Commercial use of BI scientific facilities and services.

6.30 A first source of commercial income for the Institute is represented by the commercialisation of its IP rights. This activity, which is responsibility of BIE, involves primarily licencing new discoveries and technologies to biotech and pharmaceutical companies. Although the number of IP agreements has increased over the last three years, income from commercialisation of BI's IP portfolio accounts for only 2.3% of total commercial income generated by the Institute and is lower compared with the levels reached in earlier years. Among the reasons behind this downward trend is the relatively low level of antibody out-licencing over recent years, though work in this area is starting between the KEC Team and one of the Group Leaders at BI and is likely to result in higher income levels in future years.

6.31 Commercialisation of the Institute's IP rights is also achieved through spinning out new companies. Two examples of how scientific advances made by researchers at BI may lead to the formation of start-ups are Crescendo Biologics Limited and Cambridge Protein Arrays Limited, both of which are still based on the BRC and continue to collaborate with the Institute's scientists.

6.32 Crescendo Biologics (formerly Translocus) was spun out of BI in 2008. It is focused on developing potent, multi-functional oncology therapeutics based on best-in-class antibody fragment technology invented by scientists at the Institute, including Dr Marianne Brüggemann, a pioneer in the development of human antibody transgenics, and Dr Mike Taussig, an expert in protein display and array systems. Since its foundation, the company has raised over £80m in equity and grant funding and established collaboration and licence agreements with a number of leading pharmaceutical companies.

6.33 Founded by Dr Mike Taussig, formerly head of the Protein Technology Group at BI, in 2010, Cambridge Protein Arrays has its roots in technology for production of protein microarrays for research use developed at the Institute. The company is the European distributor and service provider for HuProt™ human proteome microarrays, the most extensive arrays of full length human proteins currently available on the market.

6.34 A larger share of commercial income (18.2%) arises from collaborative projects between scientists at BI and industrial organisations with the aim of advancing scientific research. A number of these collaborative projects also involve mutually beneficial research collaborations between academic and partner organisations as part of the CASE studentship scheme.

6.35 It is estimated that over 80% of the Institute's research groups participate in collaborative projects with industry, ranging from those examining a specific topic for a few months to strategic relationships lasting several years. BI is a founding member of the Milner Therapeutics Consortium, working alongside the University of Cambridge, the Wellcome Trust Sanger Institute and seven world-leading pharmaceutical companies.

6.36 With support from the Babraham Research Campus Collaboration Fund (BRCCF), researchers at BI have also established important and novel collaborative work with scientists at Campus companies. A total of 10 research collaborations with companies on the BRC were in place in 2017/18, 3 of which started during that year.

6.37 An example of how collaborative effort between BI and Campus companies can bring about societal and economic impacts is the collaboration between members of the Institute's Signalling research programme and PhoreMost, which originated from an informal conversation on the BRC and has the potential to deliver new drugs for diseases such as pancreatic cancer. This collaboration also led to a £600,000 grant from Innovate UK being awarded in 2017.

6.38 Research collaborations are not the only way through which BI interacts with scientists and researchers at Campus companies. There are at least three other ways in which the

Institute and companies on the BRC are working together, partly reflecting a growing orientation of BI researchers towards businesses.[22]

6.39 A first and important opportunity for BI and Campus companies to interact is provided by cross-Campus events organised by the Institute. These events include:

- Campus Coffee Morning: this is an informal event organised jointly with BBT to promote an Institute's scientific facility or a Campus company to all on the BRC. This event, which has been running since 2017, takes place every month with about 100 delegates regularly attending.
- Science Morning: held for the first time in 2018, this annual event aims at encouraging communication and networking between BI and companies on the Campus. The 2019 edition hosted a set of flash talks and poster presentations by researchers from Campus companies, the Institute's research groups as well as the Institute's science services. A total of 180 people attended on the day and 64 posters were presented, with more than 60% of Campus companies being represented.
- Schools Day: this event provides a chance to secondary and sixth-form students to meet scientists on the BRC, take part in projects in Campus laboratories and learn more about a career in the life sciences. The 25th Babraham Institute Schools Day, which was held in March 2019, saw over 20 lab-based projects for both students and teachers being run by the Institute's research groups and science services as well as by Campus companies.

6.40 Staff at Campus companies are also a valued part of a number of long-standing Institute's committees. These include the Knowledge Exchange and Commercialisation (KEC) Committee and Translational Advisory Group (TAG) panel, which have run since 2012 and 2011 respectively. These panels of senior group leaders and scientists have long appreciated the commercial perspective brought by scientists at Campus companies on BI's translational projects. Moreover, representatives from companies on the BRC also participate in the Institute's Animal Welfare and Ethical Review Body (AWERB), which is tasked with providing the Campus with independent ethical advice on the balance of harms to benefits in research using animals.

6.41 A third additional way through which BI is interacting with Campus companies relates to the flow of staff. A survey of BI Group Leaders conducted in September 2019 reveals that over the past nine years at least nine PhD and postdoc researchers moved from the Institute to work at Campus companies. At the same time, two researchers moved from companies on

[22] We would like to thank Emily Boyce at BI for providing us with information on the main ways through which the Institute interacts with Campus companies.

the BRC to the Institute during the same period.

6.42 Alongside research collaboration agreements with industry, BI engages with commercial partners through CASE studentships. There were 19 such collaborations in 2017/18 (7 of which were with Campus companies), up from 15 three years earlier.

6.43 A third source of commercial income for BI is associated with specialist expertise provided by the Institute's scientists in the form of consultancy. External organisations can access the specialist expertise of scientists at BI across areas including ageing, epigenetics, signalling and immunology. Despite contributing the smallest share of income, consultancy contracts have remained a somewhat stable source of income over time and have helped industry partners foster new ideas.

6.44 The major stream of the Institute's commercial income is linked to the commercialisation of BI scientific facilities and services, which alone accounted for 78.0% of total commercial income generated by BI in 2017/18. Organisations both on and off Campus can benefit from access to state-of-the-art scientific facilities and services offered by the Institute on a fee-for-service basis. This is in line with one of the key strategic objectives set out by BI, that is (The Babraham Institute, 2018, *Annual Report and Financial Statements Year Ended 31 March 2018*, p. 4):

"Leveraging the capital investment in Institute infrastructure and equipment, in particular the animal, mass spectrometry, next generation sequencing and flow cytometry facilities, to attract investment and interaction from both the public and private sectors".

6.45 Over the period since 2013 the Institute has provided services to Campus Companies, Non-Campus Companies and other external users, and to its own researchers (Table 6.2). The total amount of revenue associated with these services has amounted to £10.6 million. Of this, some £2.3 million of services (21.7% of the total) was provided to companies on the Campus itself and a further 0.82 million (7.7 % of total) to BI researchers located on the Campus. The majority of the services, amounting to some 7.5 million (70.1% of total), went to non-Campus companies and other external users. Table shows a breakdown of the services provided by BI Enterprises over the period by science services (Figure 4.5 in Section 4 showed the usage of the services by Campus companies since 2013/14 by service).

Table 6.2. Use of BI facilities by Campus, Non Campus and Babraham Institute researchers (2013-2019 (£)).

	Bioinform Camb Ep	Chemisty	Gene Targetting	Antibody Sales	Bioinform atics	BSU	Consult-ancy	Corporate	Flow Cytometry	Flow Traing Course	Health & Safety
2013-14				4999	35860	52632	47609	137012	39856		
2014-15	6763	22500	650	8984	18106	144105	56382	142201	72907	27800	
2015-16	2200	5300	14975	1308	35866	231182	47464	162887	99485	34600	
2016-17		5800	22000	7073	20713	235964	44480	139051	89008	36775	
2017-18			20307	8647	61648	373290	17998	78273	103137	52125	
2018-19		8600	-2250	6780	91278	522083	31558	134007	293592	75220	8778
Total all 6 yrs	**8963**	**42200**	**55682**	**37792**	**263471**	**1559256**	**245491**	**793430**	**697985**	**226520**	**8778**

	Imaging	IP Assign. & Lic	IP Assign. & Lic.	Lab Services	Lipidom-ics	Mass Spec	Research Agreemts	Sequenc-ing	Vet Service	Grand Total
2013-14	13105	3687964	111504		36140	420	496600	30327	58035	4752061
2014-15	33760		92316		4940	6760	159565.6	-10168	39624	827195
2015-16	27871	9582	92726		48266	27930	323000	78589	64046	1307277
2016-17	49324		24072		11180	3870	137475	55937	93826	976548
2017-18	40928		30072		49540	17460	152049	30262	94573	1130311
2018-19	71743		25740	3677	1408	19940	209564	35963	109500	1647180
Total all 6 yrs	**236731**	**3697546**	**376429**	**3677**	**151474**	**76380**	**1478253**	**220910**	**459604**	**10640572**

Source: The Babraham Institute 2019.

Table 6.3 below shows that on top of the external use by Campus and non-Campus companies and some funds to BI researchers, since 2012 the Institute has generated a total of £26m from providing science services to its own internal different research programmes/ISPGs. The largest focus relating to Lymhocyte Signalling (38.9%), followed by Signalling at 26.4% and Epigenetics at 22.4%.

Table 6.3. Service Take-Up by Biological Research Specialism 2012-2019 % per annum (£ million *totals per annum in Italics*)

	2012/13 %	2013/14 %	2014/15 %	2015/16 %	2016/17 %	2017/18 %	2018/19 %	2012-2019 %	Total £ all years
BI Self-Funded Science	0.2	0.6	0.5	0.0	0.0	0.0	0.1	0.2	*£45,919*
Epigenetics	23.0	28.8	22.2	21.0	20.6	20.9	22.3	22.4	*£5,820*
Nuclear Dynamics, Self-Funded	11.1	12.6	19.3	16.4	12.1	10.5	4.7	12.2	*£3,165*
Lymphocytes	37.9	34.2	33.5	37.7	40.9	43.5	41.7	38.9	*£10,126*
Signalling	27.7	23.8	24.5	24.9	26.4	25.1	31.2	26.4	*£6,862*
Total £m per year	*£2,462*	*£2,946*	*£3,755*	*£3,706*	*£4,191*	*£4,400*	*£4,559*	*£26,019*	*£26,019*

Source: Babraham Institute

6.46 Table 6.4, below, shows that take-up by scientific service was greatest for Biological Services at 57.3%, followed by Sequencing at 15.4%.

Table 6.4. Service Take-Up by Scientific Services 2012-2019 % per annum (*£ totals per annum in Italics*)

	2012/13 %	2013/14 %	2014/15 %	2015/16 %	2016/17 %	2017/18 %	2018/19 %	2012-2019 %	Total £ all years
Bioinformatics	5.5	4.3	3.7	4.7	5.2	2.3	2.5	3.9	*£1,004,791.0*
BSU	62.1	55.9	50.6	48.9	50.9	65.8	65.3	57.3	*£14,897,254.0*
Chemistry#	0.0	0.0	3.5	3.3	4.8	4.3	3.7	3.1	*£813,807.8*

Flow Cytometry	10.3	8.7	8.6	9.7	9.2	7.7	6.8	8.5	*£2,223,868.7*
Imaging	7.8	7.0	6.3	7.8	4.9	3.5	3.7	5.6	*£1,450,143.6*
Lipidomics	0.0	0.3	1.7	2.0	2.1	0.0	0.7	1.0	*£267,613.2*
Mass Spec	4.6	9.5	3.8	2.5	4.2	2.4	5.8	4.5	*£1,173,809.6*
Sequencing	8.3	13.7	20.8	21.1	17.8	13.1	11.5	15.4	*£4,014,707.0*
Gene Targetting	1.5	0.6	1.0	0.0	0.9	1.0	0.0	0.7	*£173,065.3*
Grand Total £m pa	*£2,462*	*£2,947*	*£3,755*	*£3,706*	*£4,191*	*£4,400*	*£4,559*	*£26,019*	*£26,019*

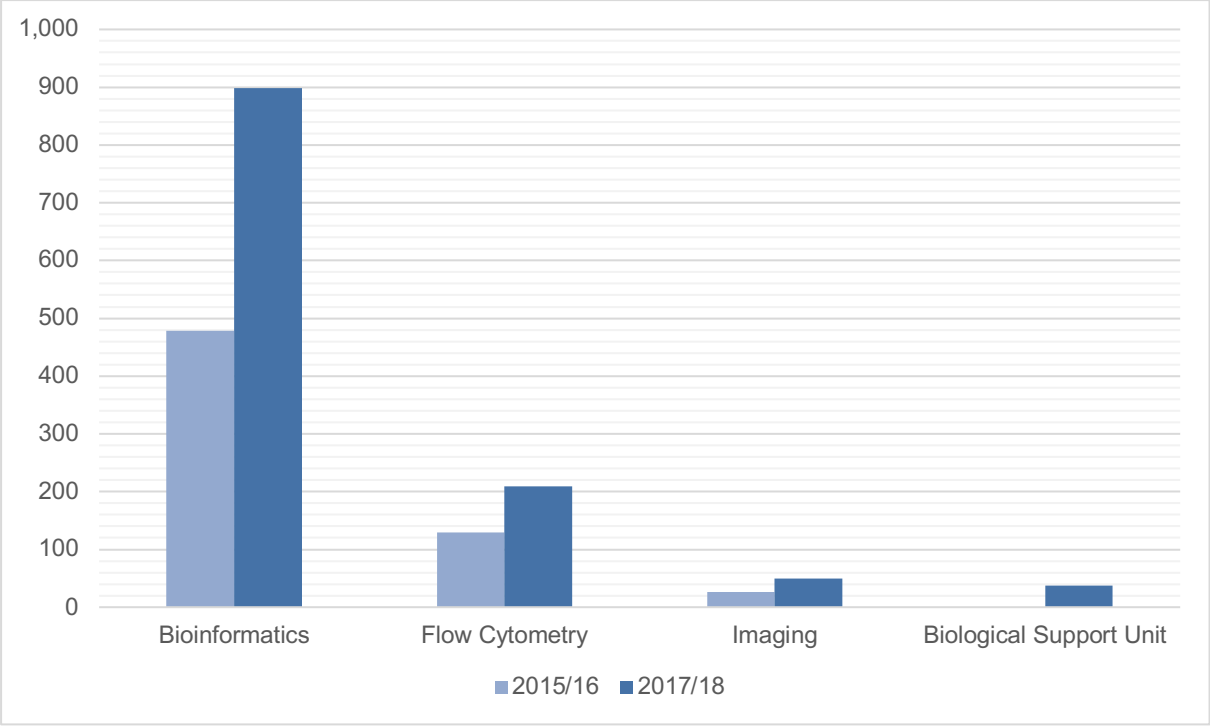
NB 2017/18 label is combined figure for Chemistry and Lipidomics

Source: Babraham Institute

6.47 Several of the science service groups at BI also provide formal and well-established training programmes to share best practice with both internal and external users. For example, the Bioinformatics facility runs courses for internal and external scientists both at the Institute and at outside venues, including the Institute of Cancer Research in London as well as universities in Spain and Jordan. Similarly, the Flow Cytometry facility offers a series of flow cytometry training courses that attract delegates from across the world.

6.48 In 2017/18, 1,195 people were trained in the Institute's scientific facilities, primarily in the Bioinformatics and Flow Cytometry facilities. This is almost twice as much as two years earlier. A summary of the number of people trained in BI's scientific facilities during 2017/18 compared with 2015/16 is presented in Figure 6.8 below.

Figure 6.8 Number of people trained in The Babraham Institute's scientific facilities



Source: The Babraham Institute (2019), *The Babraham Institute performance indicators*.

6.49 Alongside the training courses mentioned above, the Institute runs an Animal Technician Apprenticeship scheme. The apprenticeship, which is provided by the Biological Support Unit (BSU) at BI, is an 18-month mentoring and training programme aimed at

equipping apprentices with animal husbandry skills as well as knowledge of the relevant ethics and legal processes underpinning research using animals.

6.50 Apprentices are employed by Agenda Life Sciences, a major recruitment agency for the life sciences industry, and train for an Institute of Animal Technology (IAT) Level 2 Diploma qualification. On completion of the apprenticeship, they will either be offered a placement with BI or join Agenda's team of agency staff. There have been three apprentice animal technicians training in the BSU facility during 2019, with the potential for a further three to be employed in 2020 once a new scheme will be implemented by the Department for Education.

6.51 Qualified animal technicians are a vital part of research using animals, yet in the UK there is currently a shortage of available skilled technicians to support its world-leading life sciences industry. Through this apprenticeship scheme, the Institute is filling an important skills gap while ensuring that new discoveries are based on high-quality evidence.

7. Assessing the impact on the Cambridge Innovation System

The contribution of the Babraham Campus to the overall Cambridge innovation system was assessed by consulting widely across the Bioscience research community, University and other relevant Knowledge Based Institutes, Venture capitalists, public and charitable funding organisations, Campus tenants and selected other businesses, representatives from local and central government and relevant support industries.

- The contribution of the Campus in the provision of new start-up and accelerator space was widely acknowledged and it was considered that it was overcoming constraints in the provision of space and facilities;
- In relation to finance, its ability to enhance the flow of funds going into life science companies was considered to be very extensive, particularly in attracting funds from Research Councils;
- The Campus was regarded as providing a strong contribution to the commercialisation of Life Science research, but also the Life Science knowledge base were the most highly rated factors. Enabling entrepreneur driven businesses to form, enabling collaboration and new academic spin-outs were highlighted;
- The Campus was considered to be making a strong contribution to UK Life Sciences, particularly in generating jobs, enhancing the sector skill base and increasing the global impact and value from UK science;
- When compared with other UK campuses Babraham compared very favourably, particularly in relation to its support Life Science businesses which was most highly rated;
- In terms of its contribution to the overall Cambridgeshire sub-region, building the capacity of the overall Life Science cluster was considered the most important effect overall with expanding the Life Science knowledge base also highly rated by all respondents.

Introduction

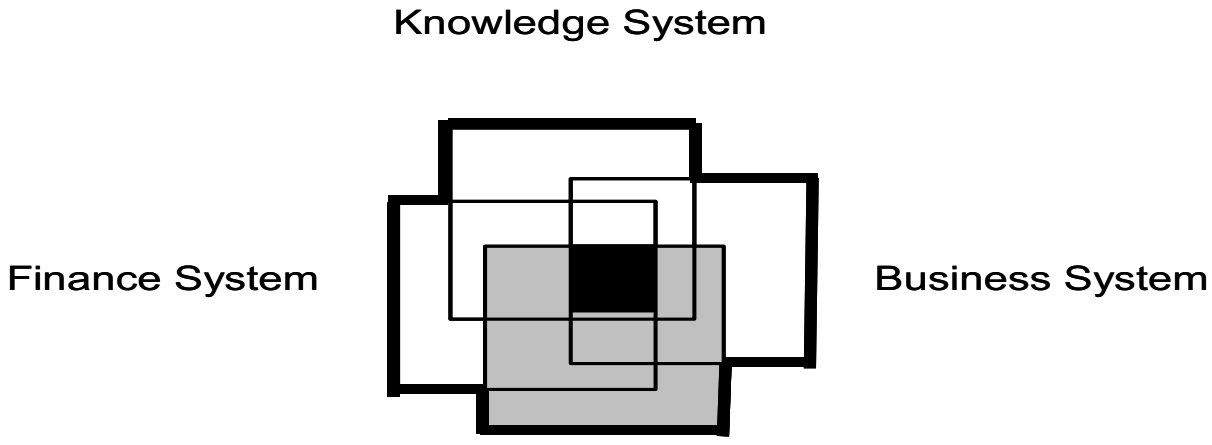
7.1 Local companies based on the Campus both compete and collaborate in bioscience, drug development and related life science fields, perhaps involving strategic alliances with similar firms elsewhere (including overseas). The Campus and its tenant companies interact with the knowledge system through participation with the institutions, networks, and agents that create the knowledge and ideas that form the basis for new inventions and sustained development. The Campus encourages accelerator and soft-landing programmes that shape business development and it also assists businesses to obtain funding from a wide variety of sources. Venture finance from outside the Cambridge sub-region has become of increasing importance in recent years. . The synergies between these different components become mutually reinforcing, acting to stimulate further innovation, enterprise and growth. There is also

extensive interaction with the wider business community that includes the agents, institutions, and formal and informal networks that facilitate enterprise and the development of globally competitive businesses, including business decision-makers, skilled labour, as well as the accountants, lawyers and consultants that provide the required business services.

7.2 Successful[23] innovation requires interaction and collaboration between the business and institutions. The formal mechanisms by which this occurs are often quite weak. A role for research campuses is often to help to fill this gap to enhance interaction and enhance the pathways by providing 'neutral space' for interaction to occur and also by encouraging educational programmes and research that will develop the conceptual understanding and personal and interpersonal skills required.

7.3 Research shows that[24] success requires attention across all the systems including building the capacity of the knowledge base, the quality of the physical place and infrastructure including the provision of premises, the financing of enterprise and also entrepreneurship and the fostering of business and industry networks. Attention to branding, marketing and promotion is important. All the factors that facilitate change including planning, financial incentives and institutional development are important. A further important impact of the Campus is that it strengthens the local skilled labour pool that in turn builds the capacity of the universities, institutes and the local bioscience, medical science and pharmaceutical companies. Figure 7.1 illustrates the key interfaces of the Babraham Research Campus with the local innovation eco-system.

Figure 7.1. Understanding the role of the Babraham Campus in the Cambridge Innovation System.



[23] https://www.landecon.cam.ac.uk/pdf-files/cv/pete-tyler/copy_of_PRI_ENTERPRISING_REPORT1.pdf

[24] https://www.landecon.cam.ac.uk/pdf-files/cv/pete-tyler/copy_of_PRI_ENTERPRISING_REPORT1.pdf

Qualitative assessment of success

7.4 The success of the Campus in enabling companies to start-up, grow, and secure benefits from the innovation system will determine the scale of its economic and wider societal impacts. To assess the degree of success it was necessary to undertake an extensive amount of more qualitative analysis that involved surveys and interviews with a wide range of stakeholders in the local and regional economy but also elsewhere in the United Kingdom. This involved consulting with the Bioscience research community, University and other relevant Knowledge Based Institutes, Venture capitalists and public and charitable funding organisations, Campus tenants and selected other businesses, representatives from local and central government and relevant support industries. A structured questionnaire based approach was undertaken involving face-to-face and telephone interviews combined with online surveying through Survey Monkey.

7.5 The online survey took place between May and August 2019. Invitations to take part were sent out to relevant groups including investors, pharmaceutical companies, the science community together with Policy and Service Providers and other key players in the field. By the close of the survey a total of 47 usable responses had been collected and were then analysed. The results of the survey are recorded in the Figures and Tables below. Overall a good spread was obtained across each of the respondent groups see Table 7.1 below which shows the breakdown of responses.

Table 7.1 Numbers of respondent to the Babraham Impact Study Final Questionnaire by respondent grouping

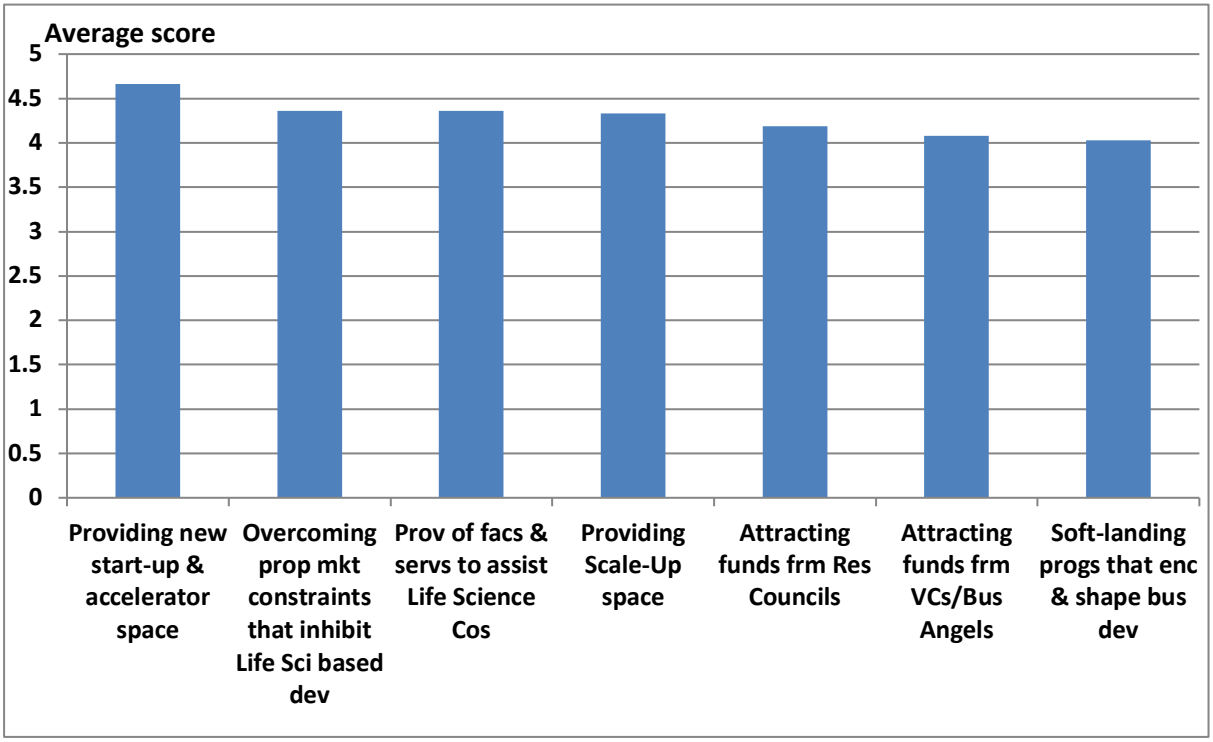
Respondent group	**No.**	**%**
Investors	10	21.3
Pharmaceutical companies	8	17
Science Community	12	25.5
Policy, Service Providers & others	17	36.2
Total Respondents	**47**	**100**

Source CEA Ltd

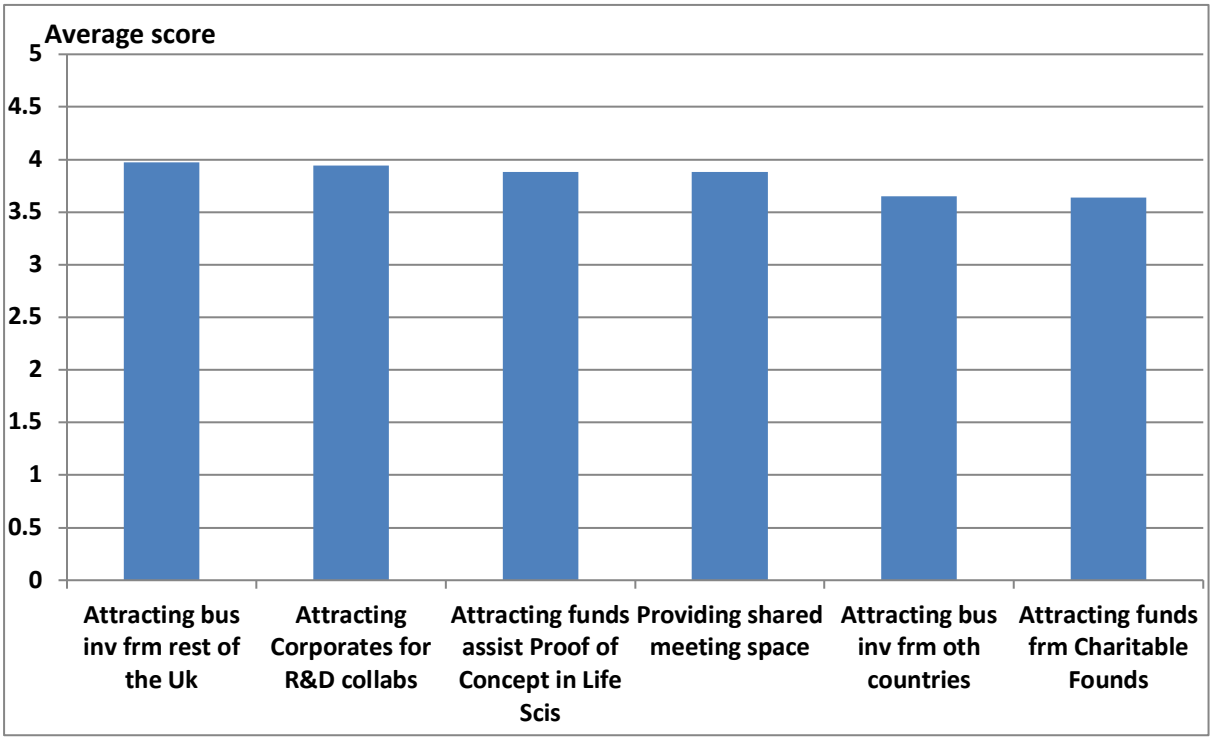
7.6 Those participating in the survey were asked to identify how important they considered that BRC had been in building the capacity of the Cambridge Life science innovation system according to a number of important aspects. They were asked to score the degree of importance of each aspect on a scale of one to five where five was of ‘major importance’ and one was ‘not at all important’. Figures 7.2a and b below show the overall average scores for all respondents with respect to finance and property factors. The first thing to note is the relatively high average score across all of the relevant aspects. In aggregate they ranged from 3.64 to 4.66. The most favourable score was in relation to the provision of new start-up and accelerator space at 4.66. Overcoming property market constraints and provision of

facilities and services to help Life Science companies were also highly rated both at 4.36 overall.

Figure 7.2a How important do you consider the BRC has been in building the capacity of the Cambridge Life Science innovation system with respect to the following finance and property factors?



b)



NB: Average score based on range where 1 was 'Not at all important' to 5 being of 'Major Importance'.

Source CEA Ltd

7.7 Table 7.2 below breaks the responses down by key respondent category. Interestingly, the high average rankings are generally reflected across all of the responding groups though the attraction of funds from Charitable Foundations was noticeably higher for the Investor group at 4.29 compared with a low score of 2.78 from the science community group. Providing a soft-landing programme to help encourage business development was also highly rated by the pharmaceutical company group (4.57).

Table 7.2 How important do you consider the BRC has been in building the capacity of the Cambridge Life Science innovation system with respect to the following finance and property factors? (Average scores in descending order for All responses)

Respondent group	Investors	Pharma Cos	Science Comm	Policy & Others	All
Providing new start-up and accelerator space	4.89	4.88	4.64	4.44	4.66
Overcoming property market constraints that inhibit Life Science based dev	4.44	4.57	4.17	4.29	4.36
The provision of facilities and services to assist Life Science Companies	4.67	4.88	4.33	3.94	4.36
Providing Scale-Up space	4.9	4.5	3.7	4.31	4.33
Attracting funds from Research Councils	4.71	4.33	3.64	4.33	4.19
Attracting funds from Venture Capitalists/Business Angels	4	4.43	4.1	3.92	4.08
Providing soft-landing programmes that help encourage and shape business dev	3.89	4.57	3.6	4	4.03
Attracting business investment from the rest of the United Kingdom	4.22	4	3.89	3.87	3.97
Attracting Corporates for R&D collaborations	4	4	3.43	4.2	3.94
Attracting funds to assist with Proof of Concept in the Life Sciences	3.88	4.17	3.57	3.92	3.88
Providing shared meeting space	4	4.38	3.44	3.77	3.88
Attracting business investment from other countries	4	3	3.25	3.92	3.65
Attracting funds from Charitable Foundations	4.29	3.6	2.78	3.92	3.64

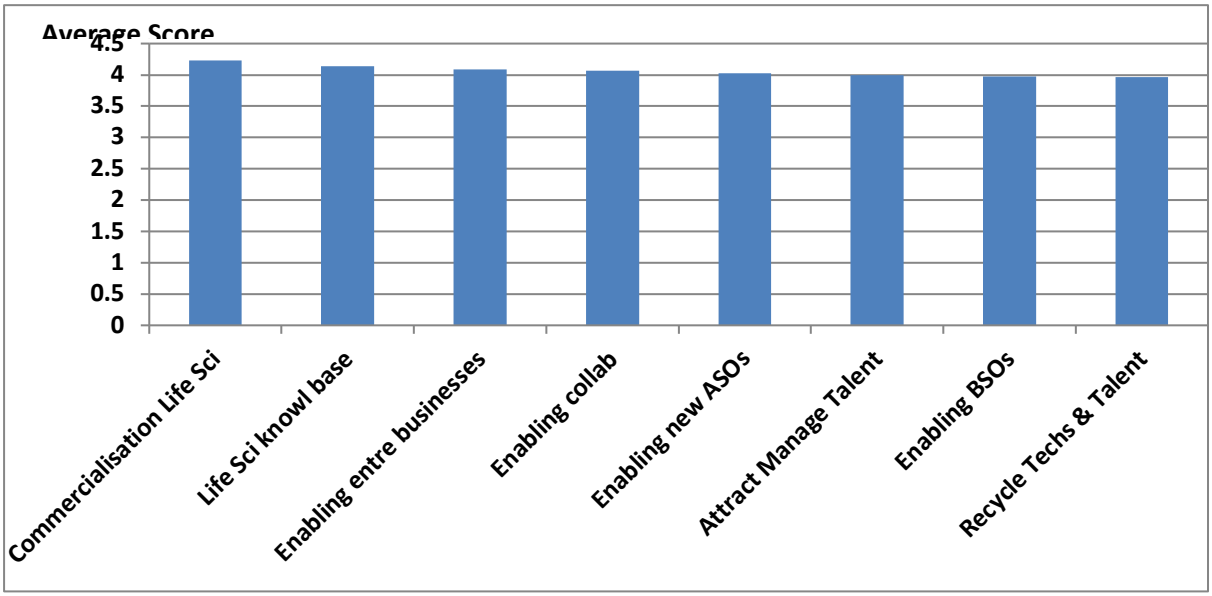
NB: Average score based on range where 1 was 'Not at all important' to 5 being of 'Major Importance'.

Source CEA Ltd.

7.8 Figures 7.3a and b below show the aggregate average score for the importance of BRC in building the capacity of the innovation system in relation to knowledge, commercialisation and skills factors. Overall enabling the commercialisation of Life Science research and the contribution to the Life Science knowledge base were the most highly rated factors. It is notable that scoring overall was high for all aspects, with the lowest rating for the importance of researcher's business skills was 3.49. The contribution to the Life Science knowledge base, facilitation for entrepreneur driven businesses to form, enabling collaboration and new academic spin-outs to occur all scored over 4 on average.

7.9 There were some differences between the respondent groups most notably the pharmaceutical companies who rated 'enabling collaboration and spin-outs to occur' the most important aspects (both scoring 4.5). The investors also considered the facilitating of Technologies & Talent an important aspect of building capacity with an average score of 4.38 (see Table 7.3).

Figure 7.3a How important do you consider the BRC has been in building the capacity of the Cambridge Life Science innovation system with respect to the following knowledge, commercialisation and skill factors? (Average scores in descending order for All responses).



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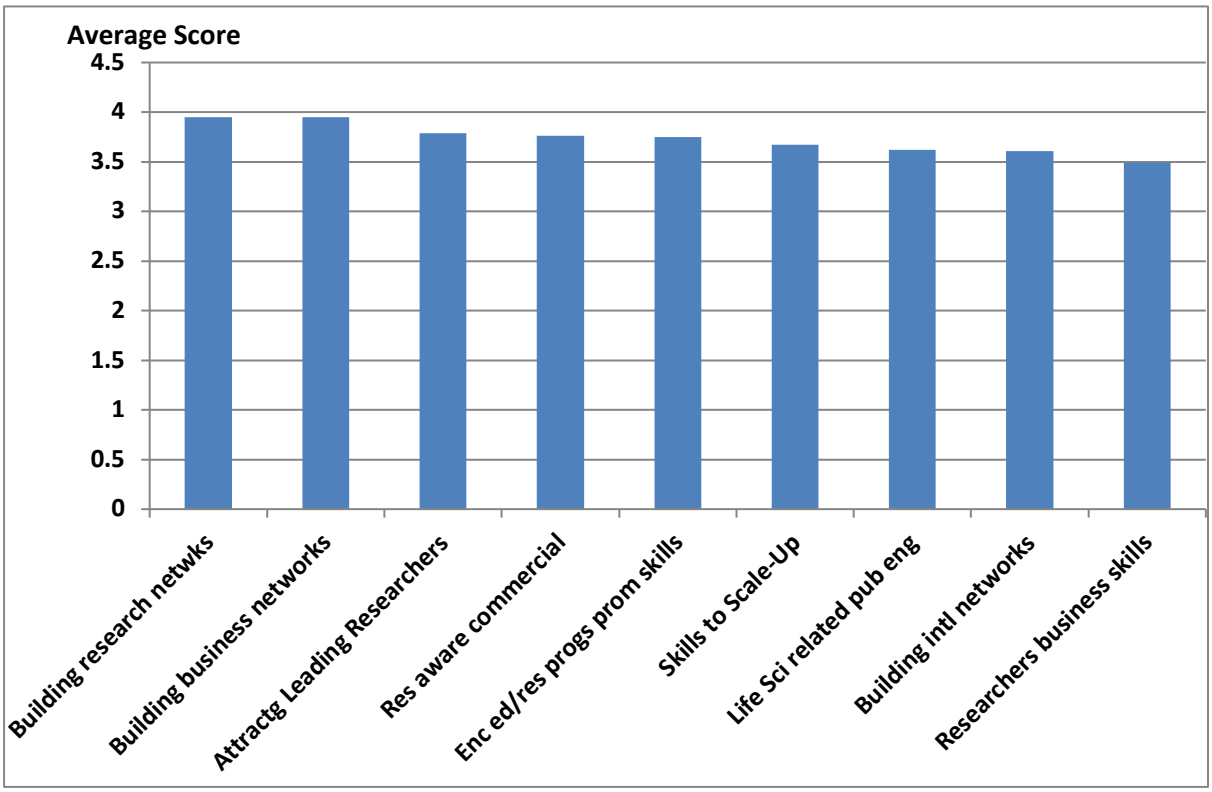


NB: Average score based on range where 1 was 'Not at all important' to 5 being of 'Major Importance'.

Source CEA Ltd

Table 7.3. How important do you consider the BRC has been in building the capacity of the Cambridge Life Science innovation system with respect to the following knowledge, commercialisation and skill factors? (Average scores in descending order for All responses)

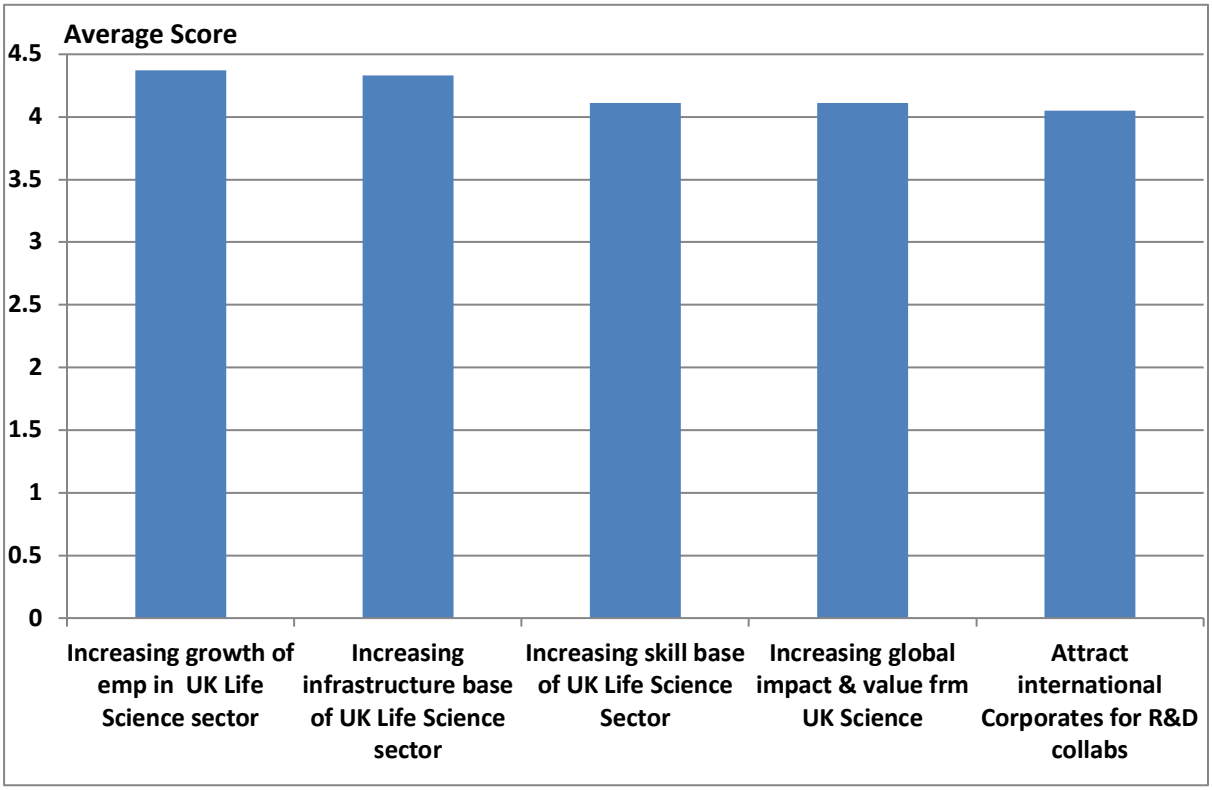
Respondent group	Investors	Pharma Cos	Science Comm	Policy & Others	All
Enabling the commercialisation of Life Science Research	4.5	3.88	4.36	4.13	4.23
Contribution to the Life Science knowledge base	4.33	3.75	4.36	4.07	4.14
Enabling entrepreneur driven businesses to form	4.11	4.38	4	3.91	4.09
Enabling collaboration to occur	4.25	4.5	3.91	3.86	4.07
Enabling new academic spin-outs to occur	4.11	4.5	3.9	3.75	4.03
Attracting Management and Commercial Talent	4	3.71	4.17	4.1	4
Enabling business spin-outs to occur	4.2	3.83	3.75	3.9	3.97
Facilitating Recycle of Technologies & Talent	4.38	3.83	3.6	3.88	3.96
Bldg research netwks, partic with university, other res institutes & medical facs	4.11	4.33	3.64	3.92	3.95
Building business networks	4.33	4.14	3.63	3.79	3.95
Attracting Leading Researchers	3.5	3.86	3.82	4	3.79
Helping researchers become aware of commercial opps from their research	3.8	3.88	3.5	3.9	3.76
Encouraging educational programmes & research that promote the dev of skills	4.1	4.2	3.13	3.67	3.75
Providing businesses with the skills to Scale-Up	3.9	3.67	3.43	3.6	3.67
Encouraging Life Science related public engagement	4	3.71	3.44	3.38	3.62
Building international networks	4	3.4	3.22	3.73	3.61
Enabling researchers to have business skills req to commercialise their research	3.7	4	3.13	3.2	3.49

NB: Average score based on range where 1 was 'Not at all important' to 5 being of 'Major Importance'.

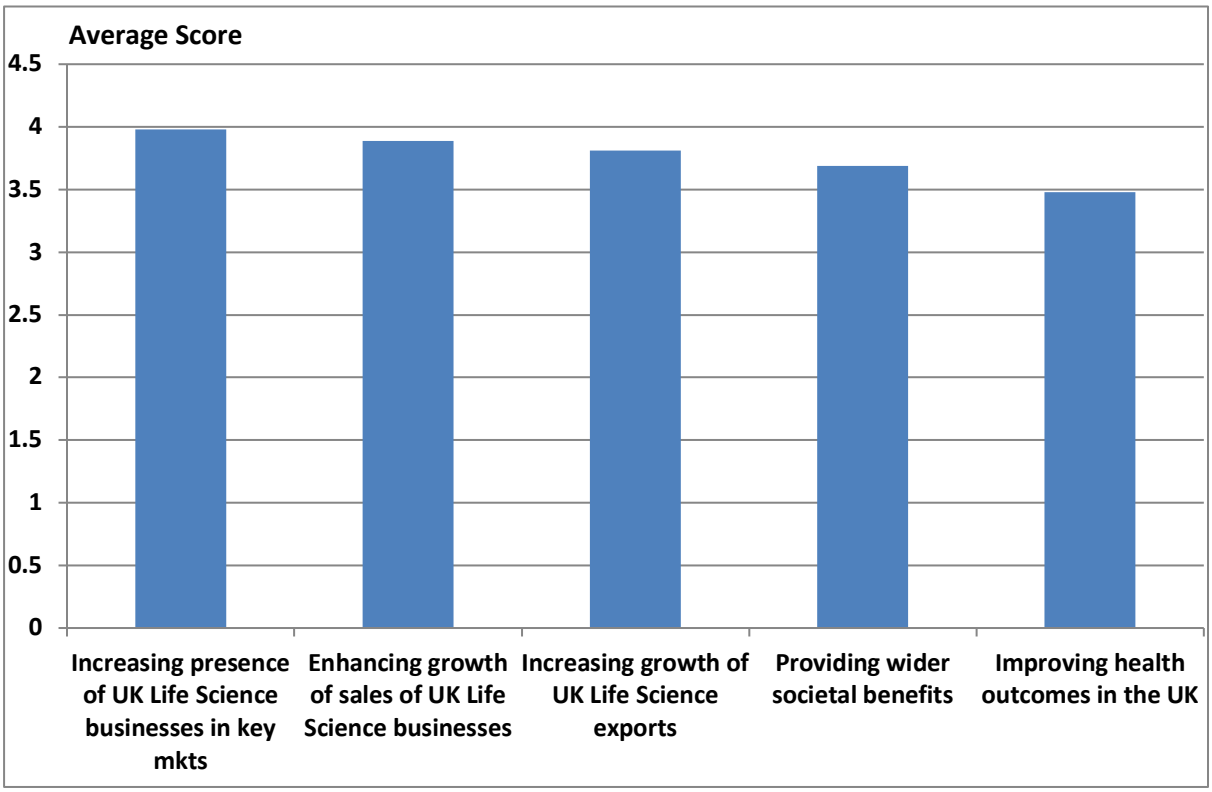
Source CEA Ltd

7.10 The survey then moved on to explore the benefits of the BRC to the UK economy. Figures 7.4a and b below show the overall average scores where increasing employment growth in the UK Life Science sector and increasing the infrastructure base of the UK Life Science sector were considered to be the greatest benefits scoring 4.37 and 4.33 respectively. Enhancing the sector skill base and increasing the global impact and value from UK science also scored highly on average at 4.11. Overall less importance was given to the wider societal benefits and health outcomes in the UK.

Figure 7.4a How important do you consider the benefits of the BRC are to the UK economy? (Average scores in descending order for All responses)



b)



NB: Average score based on range where 1 was 'Not at all important' to 5 being of 'Major Importance'.

Source CEA Ltd

7.11 With regard to differences between the respondent groups increasing the infrastructure and skill bases in the Life Science sector were rated highly among the pharmaceutical companies (both 4.63). Policy & others also rated the attraction of international corporates for R&D collaborations very highly at 4.25 (see Table 7.4 below).

Table 7.4 How important do you consider the benefits of the BRC are to the UK economy? (Average scores in descending order for All responses)

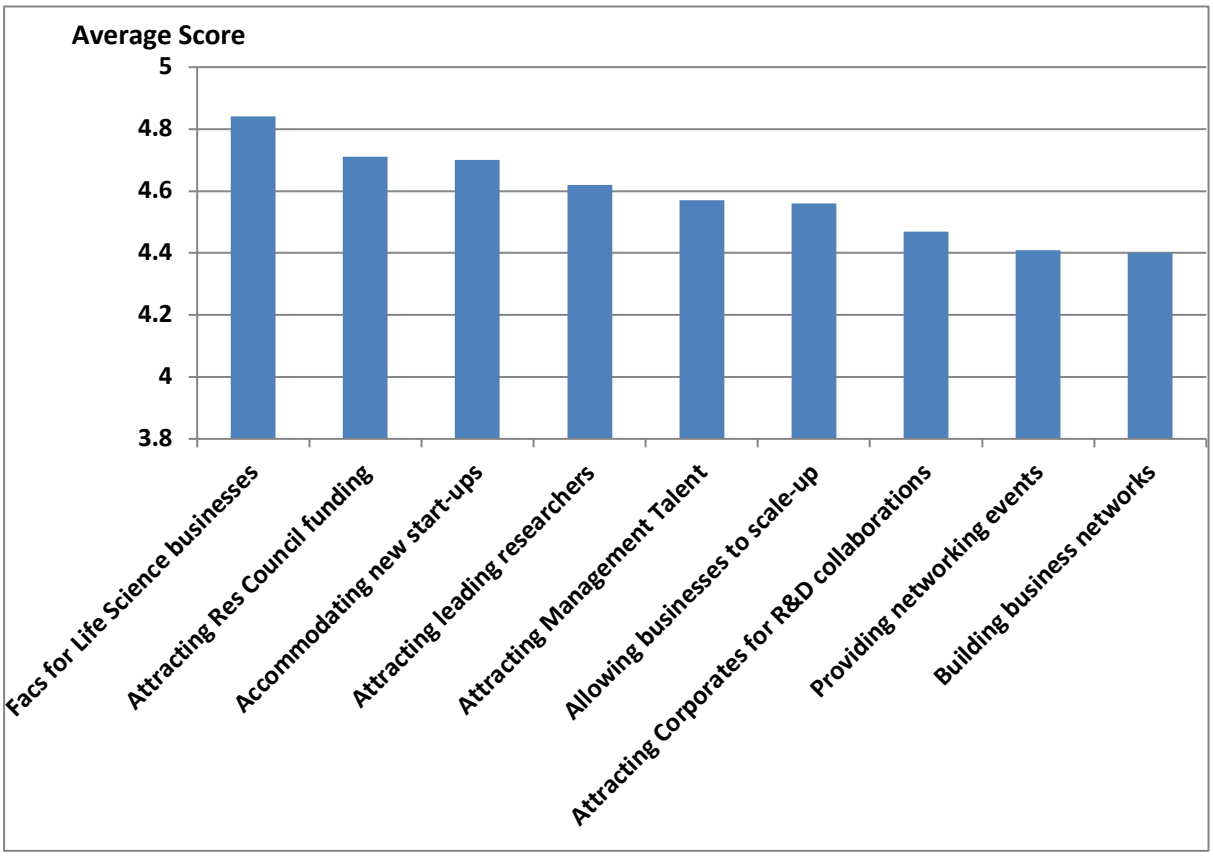
Respondent group	Investors	Pharma Cos	Science Comm	Policy & Others	All
Increasing the growth of employment in the UK Life Science sector	4.7	4.5	4.18	4.21	4.37
Increasing the infrastructure base of the UK Life Science sector	4.5	4.63	4	4.29	4.33
Increasing the skill base of the UK Life Science Sector	4.2	4.63	4.09	3.81	4.11
Increasing the global impact and value from UK Science	4.22	4.5	4	3.83	4.11
Attracting international Corporates for R&D collaborations	4.2	3.86	3.75	4.25	4.05
Increasing the presence of UK Life Science businesses in key markets	4.2	4.14	3.78	3.86	3.98
Enhancing the growth of sales of UK Life Science businesses	4	3.83	3.56	4.08	3.89
Increasing the growth of UK Life Science exports	4.25	3.17	3.67	3.92	3.81
Providing wider societal benefits	4.11	3.33	3.71	3.5	3.69
Improving health outcomes in the UK	4	3.33	3.5	3.18	3.48

NB: Average score based on range where 1 was 'Not at all important' to 5 being of 'Major Importance'.

Source CEA Ltd

7.12 Figures 7.5a and b below show the aggregate average scores when comparing the BRC to other UK campuses known to the respondents. Overall the scores show the BRC compares very favourably to other campuses. The facilities that support Life Science businesses were most highly rated at 4.84.

Figure 7.5a We would like to obtain your view as to how the BRC compares to other Campuses in the UK with which you are familiar. (Average scores in descending order all).



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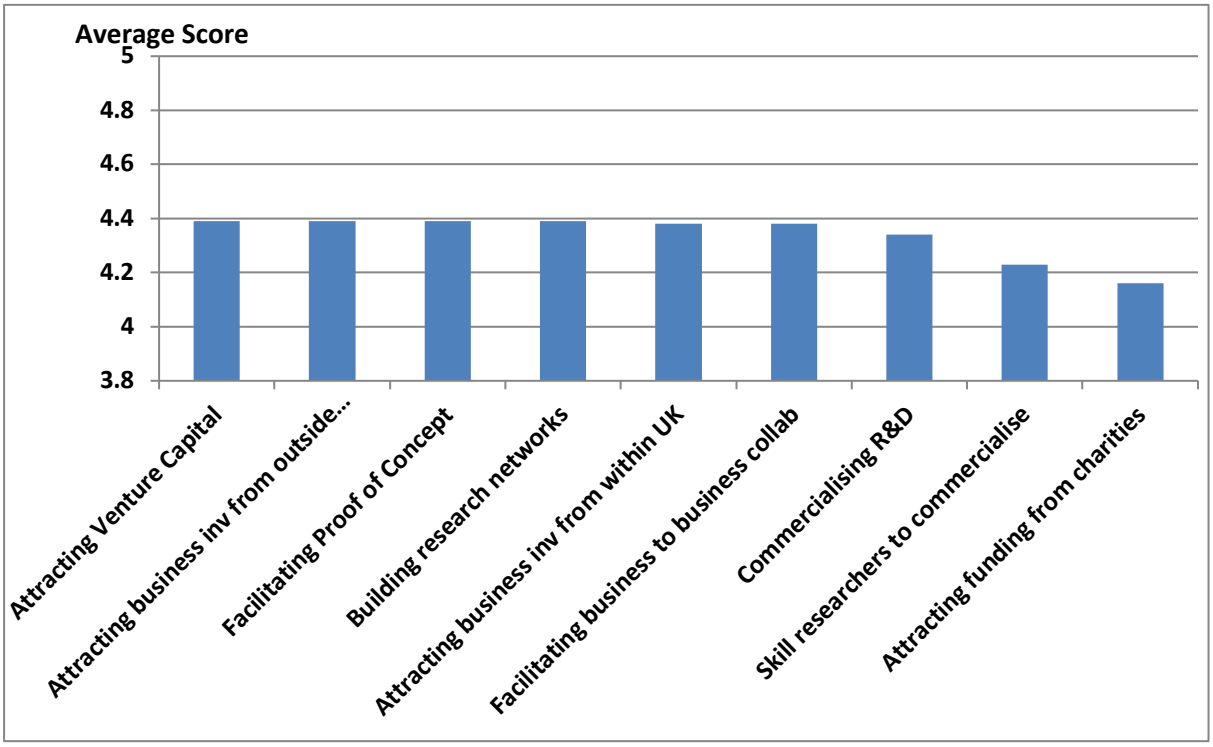


NB: Average score based on range where 1 was ''Much worse' to 6 being 'BRC unique location'.

Source CEA Ltd

7.13 In some cases respondents considered the BRC provided a unique location for some of the factors considered as shown in Table 7.5 where respondent group scores are over 5 as with services/facilities to Life Science businesses and accommodating new start-ups. It is also noticeable that the pharmaceutical companies scored most factors lower than the aggregate and considered facilitating business to business collaboration the most favourable comparison between the BRC and other campuses.

Table 7.5 We would like to obtain your view as to how the BRC compares to other campuses in the UK with which you are familiar (Average scores in descending order for All responses)

Respondent group	Investors	Pharma Cos	Science Comm	Policy/& Others	All
Providing services and facilities to support Life Science businesses	4.89	4	5.25	5.08	4.84
Attracting Research Council funding	4.5	4	5	5	4.71
Accommodating new start-ups	4.8	4.38	5.25	4.5	4.7
Attracting leading researchers	4.71	4.29	4.57	4.77	4.62
Attracting Management and Commercial Talent	4.78	4.43	4.5	4.5	4.57
Allowing businesses to scale-up	4.7	4.29	4.4	4.64	4.56
Attracting Corporates for R&D collaborations	4.67	3.75	4.6	4.8	4.47
Providing networking events	4.11	4.25	5	4.43	4.41
Building business networks	4.2	4.29	4.8	4.46	4.4
Attracting Venture Capital	4.7	3.71	4.29	4.58	4.39
Attracting business investment from outside the UK	4.57	3.25	4.6	4.58	4.39
Facilitating Proof of Concept	4.56	4.13	4.4	4.45	4.39
Building research netks, partic betw res institutions & med facs	4.63	4.4	4	4.5	4.39
Attracting business investment from within the UK	4.63	3.5	4.4	4.62	4.38
Facilitating business to business collaboration	4.13	4.43	4.67	4.38	4.38
Commercialising R&D	4.44	3.86	5	4.33	4.34
Providing skills to enable researchers to commercialise their res	4.25	4	4.17	4.36	4.23
Attracting funding from charitable foundations	4.17	3.5	4.2	4.4	4.16

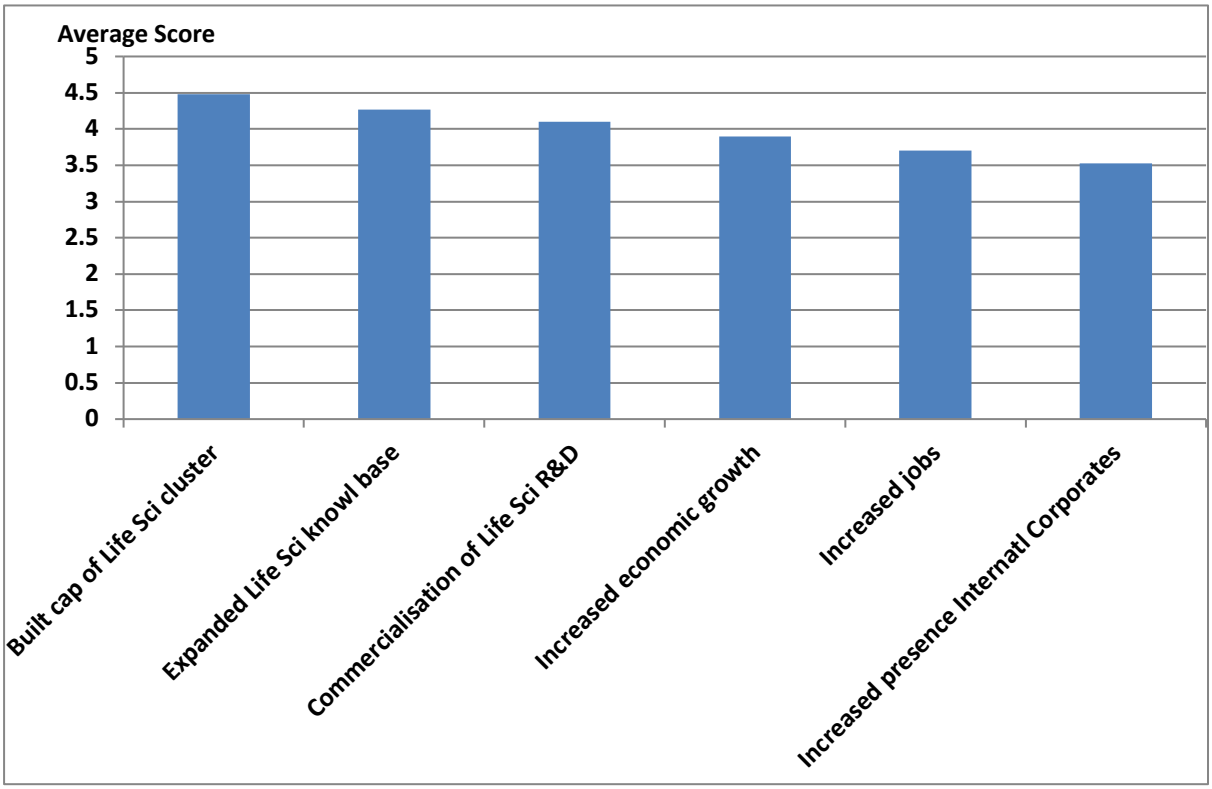
NB: Average score based on range where 1 was ‘'Much worse' to 6 being ‘BRC unique location.

Source CEA Ltd

7.14 Finally the survey considered the overall contribution of BRC to the economy of the Cambridgeshire sub-region. Figure 7.6 below shows the results. Building the capacity of the overall Life Science cluster was considered the most important effect overall with expanding the Life Science knowledge base was also highly rated by all respondents.

Figure 7.6 We would like to obtain your views on the overall contribution that you consider the BRC has made to the economy of the Cambridgeshire sub-region (Average

scores in descending order for All responses)



NB: Average score based on range where 1 was 'None' to 5 'Major effect'

Source CEA Ltd

7.15 A breakdown by respondent type illustrated in Table 7.6 below shows that the degree of importance of each factor is mirrored throughout all the groups.

Table 7.6 We would like to obtain your views on the overall contribution that you consider the BRC has made to the economy of the Cambridgeshire sub-region (Average scores in descending order for All responses)

Respondent group	Investors	Pharma Cos	Science Comm	Policy & Others	All
Built the capacity of the overall Life Science cluster	4.6	4.63	4.6	4.25	4.48
Expanded the Life Science knowledge base	4.2	4.5	4.4	4.13	4.27
Commercialisation of Life Science R&D	4.1	4	4.3	4	4.1
Increased economic growth	3.89	3.83	4.3	3.71	3.9
Increased jobs	3.8	3.71	4.1	3.38	3.7
Increased presence of International Corporates	3.8	2.83	3.63	3.58	3.53

NB: Average score based on range where 1 was 'None' to 5 'Major effect'

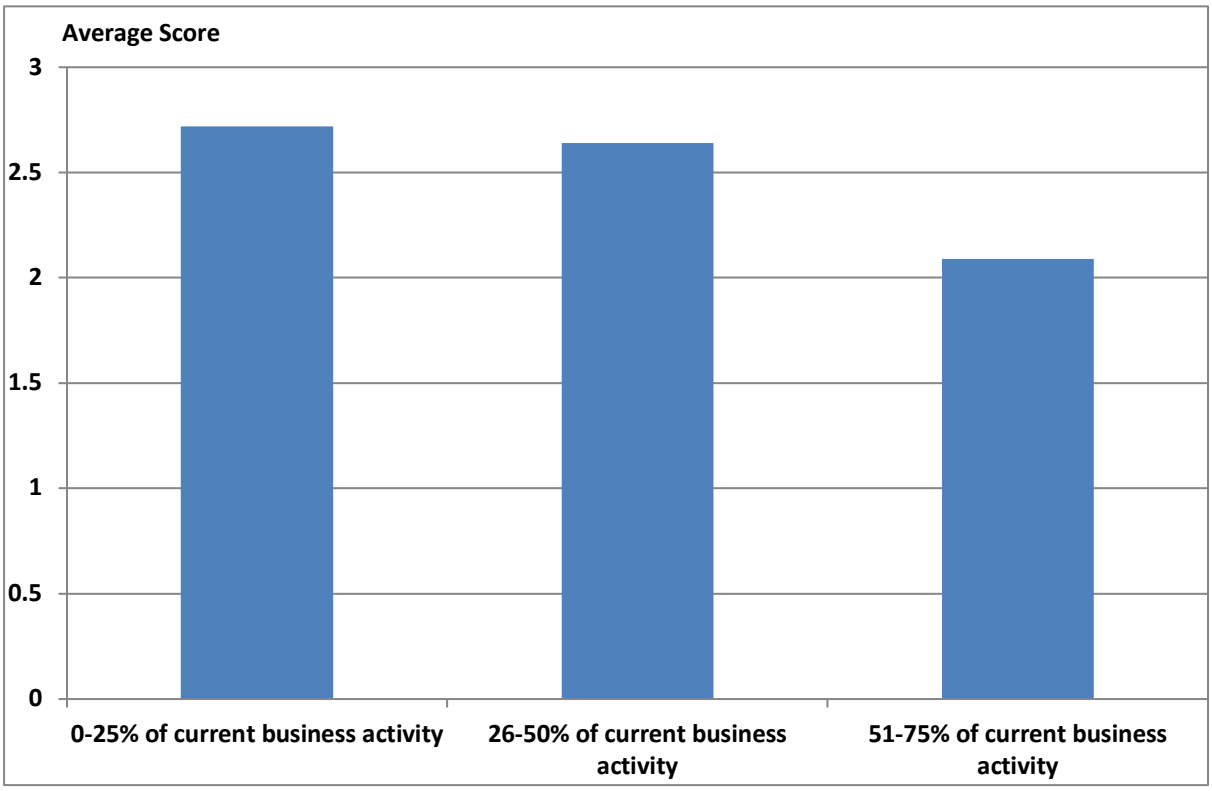
Source CEA Ltd

Views on what would have happened in the absence of the Campus

7.16 The stakeholders in the innovation system were asked for their views on whether they considered businesses on the Campus would have developed if BRC had not established its infrastructure. Figure 7.7 below shows that views were largely split by degree of possible business development. Overall it shows a slight preference for the belief that only 0-25% of development would have occurred. Overall, though, in all cases the relative average score

was quite low.

Figure 7.7 If the BRC had not developed its infrastructure in recent years how much do you consider the businesses on the campus would have developed (Average scores)



NB: Average score based on range where 1 was 'Not likely' to 5 'Highly likely'

Source CEA Ltd

7.17 Table 7.7 below sets out the full results from the survey with a breakdown of the respondent groups. There are not many differences from the aggregate scores though the pharmaceutical companies indicate a greater belief that 26-50% of current business activity would still have taken place.

Table 7.7 If the BRC had not developed its infrastructure in recent years how much do you consider the businesses on the campus would have developed (Average scores)

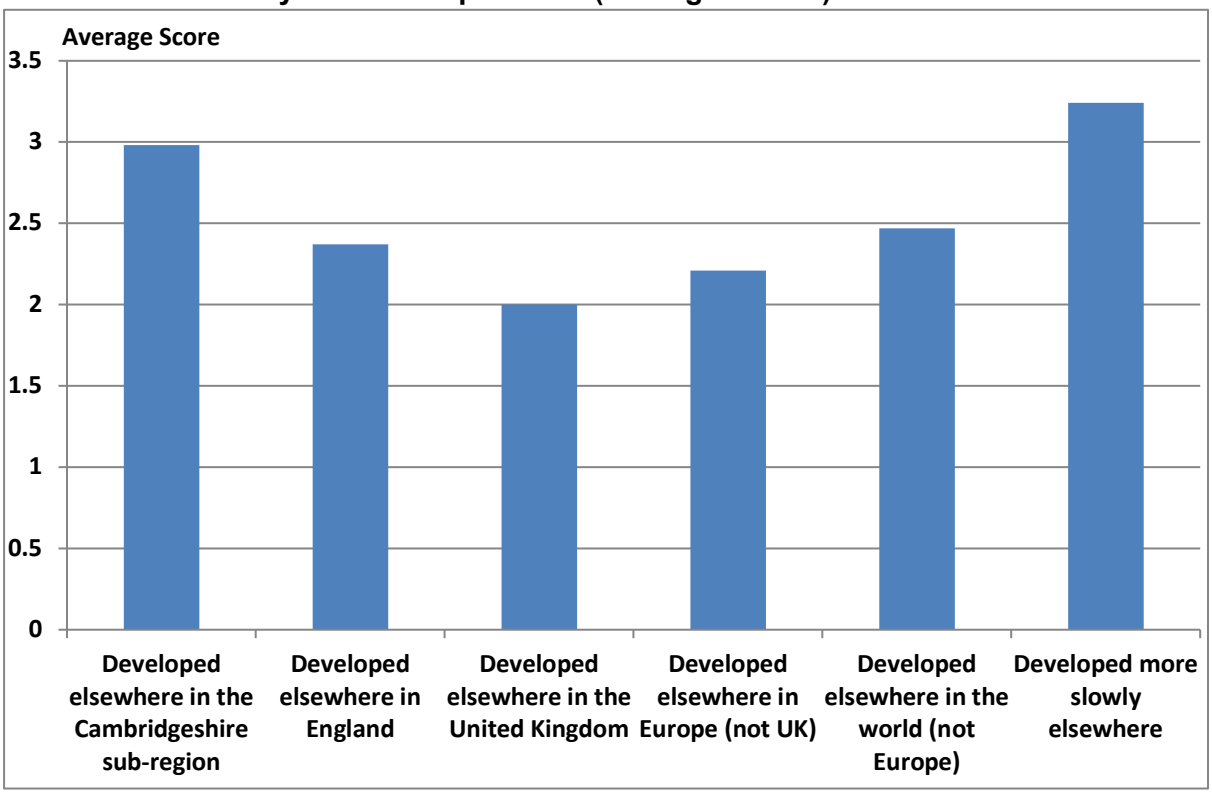
Respondent group	Investors	Pharma Cos	Science Comm	Policy & Others	All
0-25% of current business activity	2.44	2.8	2.5	3.1	2.72
26-50% of current business activity	2.22	3.8	2.11	2.9	2.64
51-75% of current business activity	2.22	2	1.63	2.4	2.09

NB: Average score based on range where 1 was 'Not likely' to 5 'Highly likely'

Source CEA Ltd

7.18 Figure 7.8 below looks at responses about where the current businesses that are on the BRC Campus would most likely to have developed without the recent BRC infrastructure development. In terms of areas the highest score just below 3 was the belief that it would have located elsewhere in the Cambridgeshire sub-region. With a score of 3.24 respondents also felt it quite likely that business development would have been slower.

Figure 7.8 If the BRC had not developed its infrastructure in recent years would the businesses currently on the campus have (Average scores)



NB: Average score based on range where 1 was ''Not likely' to 5 being 'Highly likely'

Source CEA Ltd

7.19 Table 7.8 below shows these results broken down for the respondents groups. The results largely mirror the aggregate results mentioned above.

Table 7.8 If the BRC had not developed its infrastructure in recent years would the businesses currently on the campus have (Average scores)

Respondent group	Investors	Pharma Cos	Science Comm	Policy & Others	All
Developed elsewhere in the Cambridgeshire sub-region	2.78	2.88	2.91	3.2	2.98
Developed elsewhere in England	2.6	2.38	2.27	2.29	2.37
Developed elsewhere in the United Kingdom	2.3	1.88	1.91	1.93	2
Developed elsewhere in Europe (not UK)	2.3	1.75	2.09	2.5	2.21
Developed elsewhere in the world (not Europe)	2.3	2.13	2.36	2.86	2.47
Developed more slowly elsewhere	3.6	3.13	3.33	2.9	3.24

NB: Average score based on range where 1 was ''Not likely' to 5 being 'Highly likely'

Source CEA Ltd

8. Assessing impact on the Cambridge Property Market

The Babraham Research Campus (BRC) has made a significant contribution to the Cambridgeshire property market, providing specialised start up and scale up space, with access to world-class facilities (e.g. laboratory space) and on lease terms tailored to the needs of start-up space. Combined with world-class biotechnology research via the Babraham Institute, the BRC provides a unique bioscience ecosystem that differentiates it from the many privately funded business parks that rely on purely commercial finance.

The BRC provides a unique service to the market, providing a mix start-up space designed for start-ups on flexible lease terms, which vary from what a commercial landlord would offer. Start up space within the BRC is designed to support early stage life-science ventures by providing laboratory and office space in units of circa 600 sq.ft and above on short-term flexible lease terms.

The evidence points to the public investment in BRC helping to overcome a clear market failure the removal of which has led to faster growth in the Life Science sector in Cambridge. In addition to the BRC, other research locations play a key role in anchoring the research clusters within Cambridge and providing start-up space to businesses developing technologies or products relevant to human healthcare and the pharmaceutical sector.

Property market context

8.1 In addition to providing access to world-class biotechnology research and facilities via the Babraham Institute, the BRC provides premises that allow bioscience enterprise to start and scale up. The BRC provides a unique service to the market, providing a mix of start-up space designed for SMEs on flexible lease terms, which vary from what a commercial landlord would offer. Providing specialised space, co-located with the Babraham Institute with access to world-class facilities on lease terms tailored to the needs of start-up space, has led to the creation of multiple scaled up biotechnology companies. This impact is a form of economic benefit is relevant to the provision of public funding, as it benefits the local economy in the following ways:

- Development of premium, fully serviced and fully fitted A-Grade space
- Rental premium and yield of surrounding office space
- Structurally lower vacancy surrounding the campus
- Increase in take-up / net absorption over time.

8.2 The purpose of this section is to capture the economic impact associated with the effect of the BRC on its surrounding Property Market Area (PMA). This has been done by assessing the BRC's property impact by identifying its role and function within the local Cambridgeshire office market. The objective is to assess any uplift within the BRC's PMA compared to the

broader Cambridgeshire market and comparable Cambridgeshire research clusters. The research has involved the following stages:

1. Identify the key constraints on the provision of office and R&D space within Cambridge and the rationale for the Babraham 'intervention'.
2. Identify the other 'locations' within the Cambridge office market, offering R&D, laboratory and standard B-class office space
3. Benchmark the performance of the BRC against comparable campuses and other key office clusters within Cambridgeshire, identifying:
   - Rental premium
   - Vacancy
   - New deliveries
   - Take-up / net absorption.
4. Identify the different Cambridge sub-markets and clusters containing Cambridgeshire's business parks and research campuses.
5. Assess the performance of the BRC's PMA against other Cambridge office sub-markets and research clusters:
   - Rents
   - Vacancy
   - New deliveries
   - Take-up / net absorption
   - Development pipeline.
6. Compare the performance of office stock within the BRC's PMA to the Cambridgeshire market, identifying any uplift in performance.
7. Assess the performance of the BRC and its sub-market, against key investment and funding milestones for the BRC.
8. Analyse the property impact of investment and funding into the BRC's campus.

The Rationale for the Babraham Research Campus in the context of the constraints facing the provision of R&D and office space in the Cambridgeshire market

8.3 A key focus of the BRC is on the innovative biotechnology and pharmaceutical sectors. The BRC is set within the wider South Cambridge Biotech cluster which is one of the world's leading life sciences clusters. This benefits from proximity to institutes of excellence including the Wellcome Sanger Institute, Cancer Research UK, the MRC Laboratory of Molecular Biology and Cambridge University.

8.4 The first research science park established was the Cambridge Science Park in the 1970s. Since then the development St John's Innovation Centre, Peterhouse Technology Park, the Cambridge Judge Entrepreneurship Centre (including Accelerate Cambridge) and the ideaSpace Enterprise Accelerator have further expanded and consolidated the Cambridge R&D cluster. According to Cambridge Econometrics[25] approximately 50% of the scientific

[25] Economic Growth Potential of the Cambridge Norwich Technology Corridor, 2017

R&D in Cambridge is dedicated to life science and med-tech research. The Cambridge life science cluster consists of 430 life science companies, a specialized workforce of approximately 15,500 and generates annual GVA worth more than £2.9 billion[26].The cluster is underpinned by a number of key anchoring research institutes and universities including the two universities of Cambridge and Anglia Ruskin, four non-university research institutes including the Babraham Institute, Sanger Institute (located at the Wellcome Trust campus), European Bioinformatics Institute and MRC Laboratory Molecular Biology and three NHS Foundation Trusts including Cambridge University Hospitals, Papworth Hospitals, Cancer Research UK and Cambridgeshire & Peterborough.

8.5 Almost half of all companies are based in a science, technology or research locations, of which the BRC is the leader in terms of number of companies[27] with 46 current tenants (based on Babraham Bioscience Technologies leasing information).

8.6 A recent research project reviewed the provision of Wet Lab Space and Incubator Space for the Life Sciences in the Cambridge Area[28] and identified Cambridge as a "globally competitive location (high quality research and people at a lower cost than key US locations) with strong potential for further rapid growth", with a clear clustering of life science businesses driven by:

- *'*Access to labour pool/ source of entrepreneurs'
- 'Supplier base (technical, financial etc.)'
- 'Knowledge spill overs and informal learning'

8.7 This clustering of businesses underpins demand for a range of office and R&D space throughout Cambridgeshire. Despite these strengths driving interest by occupiers and investors in the Cambridge area, the report identified a number of constraints on future growth:

- 'Insufficient supply of space for new start-ups and early stage firms – demand has outstripped supply – leading to both start-ups and expansions being delayed.'
- 'Early stage firms are unwilling (unable) to commit to conventional leases (5 years+) and have rapidly changing requirements.'

[26] AstraZeneca, Cambridge: driving growth in life sciences, 2017

[27] Bidwells the Cambridge BioPharma Cluster, March 2016

[28] (Mansley, N, Cambridge Real Estate Research Centre). Review of Wet Lab Space and Incubator Space for the Life Sciences in the Cambridge Area. 2018.

- ‘Returns available on multi-occupancy buildings for early stage firms are insufficient to justify new supply, even before taking account the costs of supporting infrastructure e.g. genuine “incubator” environment. In particular, wet-fully-fitted, lab space is significantly more expensive to build than office space whilst the income flows generated from space aimed at early stage firms typically have shorter duration and lower credit strength.’
- ‘The supply response needs to maintain the cluster benefits e.g. accessibility is critical.’

8.8 The research indicated a failure of the private sector to deliver sufficient start up and lab space with lease terms suitable for start-up businesses. The key viability challenge for the private sector delivering new lab space specifically for start-ups, were identified as:

- Short-term lease terms result in a less predictable and consistent income and therefore return on cost.
- Incubator lab space typically have a lower gross-net efficiency ratio.
- Higher construction cost associated with highly specialised equipment.

8.9 This private sector funding gap, has created demand for public funding to underwrite new start-up lab space. Campuses such as Wellcome Trust Genome Campus (Biodata Innovation Centre), Babraham (Accelerate@Babraham) are examples of research institutes that provide specialised start up space. The Cambridge Science Park provides similar start-up lab space (Innovation Centre and Bio-Innovation Centre).

8.10 These aspects of property market ‘failure’ have been argued to underpin the rationale for the substantial public sector investment that was made in the BRC. The institutes that anchor and manage campuses utilise public funding to provide lease terms, lab space and start up space tailored to R&D start-ups. The subsequent benefits of this come as these businesses develop, expand their operations, jobs, research / patent production. From a property perspective, this is realised through the take-up of additional space, anchoring the development of additional a grade office development (e.g., centrally located, with large floorplates, high quality services and fitted out (and higher rents.

Cambridgeshire - Research Clusters and Sub Markets

8.11 The Babraham Research Campus (BRC), and other research locations, play a key role in anchoring the research clusters within Cambridge and providing start-up space to businesses developing technologies or products relevant to human healthcare and the pharmaceutical sector.

8.12 The combination of start up space, with lab facilities, co-located with the Babraham Institute, creates an ecosystem that has attracted substantial development into the local

market, both on the campus and within the nearby area.

8.13 This section seeks to identify the different submarkets and clusters within Cambridgeshire, specifically:

- How the different clusters of research campuses are distributed throughout Cambridgeshire.
- Identify key office and R&D submarkets.
- Compares the headline performance of the property market across the different research campuses and business parks.
- Identify the BRC's Property Market Area (PMA).
- Differentiating the various offer of each campus, including whether they include publically funded research institutes, lab space and / or start-up space (e.g., space that is suitable for small start-up businesses on flexible leases).

Cambridge Office / R&D submarkets Overview

8.14 Five, key submarkets within the broader Cambridge office market were identified (Figure 8.1). These were:

- Prime Central submarket
- City Centre Periphery submarket
- Northern Research Cluster
- Southern Research Cluster
- Southern Cambridgeshire submarket.

8.15 The Southern Cambridge sub market is differentiated from the remainder of the market, in that it is primarily made up of town centres, research campuses and business parks surrounding Cambridge's urban centre. Cambridge Prime Central comprises a consolidated urban centre, containing the Cambridge Train Station, amenity and retail services and the majority of the area's housing stock. Prime Central constitutes the Cambridge market's premium price point, offering A grade space at the centre of the CBD.

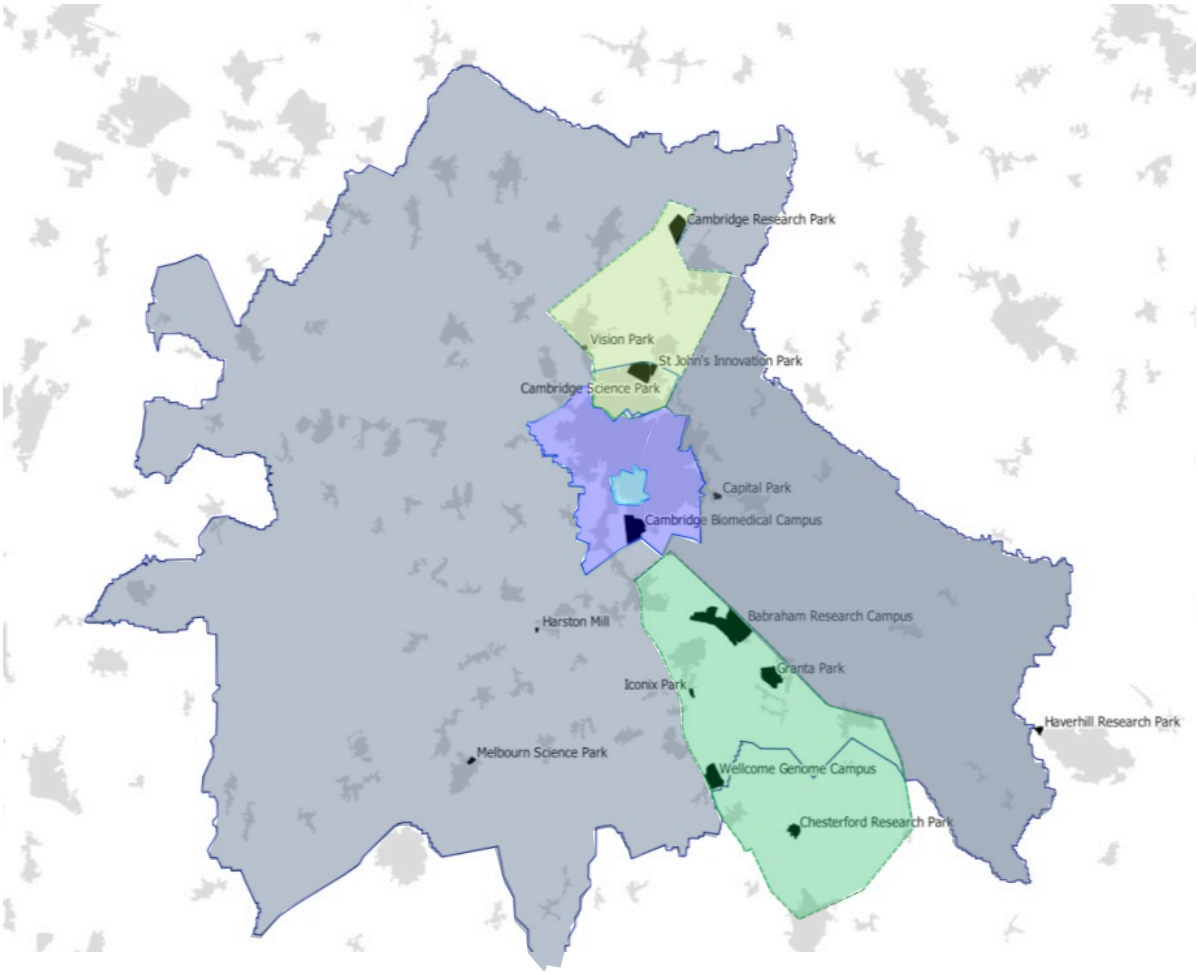
8.16 The City Centre Periphery immediately surrounds the Cambridge Prime Central submarket. It contains Cambridge University Campus, Cambridge International Airport and a number of key business parks such as the Cambridge Biomedical Campus.

8.17 The Northern and Southern Research Clusters can be differentiated from the other submarkets due to their concentration of research institutes, business parks and research campuses. Similar to the South Cambridgeshire market in the sense that they are non-urban, however they accommodate the following clusters of research campuses and business parks:

- Southern Research Cluster, including the Babraham Research Campus, Wellcome Genome Campus, Iconix Park, Granta and Chesterford.

- Northern Research Cluster, including Cambridge Research Park, Vision Park, Cambridge Science Park and St Johns Innovation Park.

Figure 8.1 Cambridge Submarket and Clusters.



Source: Savills 2019

8.18 Table 8.1 below outlines the varying performance of each of these markets. It shows that Prime Central and City Periphery locations have stronger headline office rents (£59 and £42 per sq.ft respectively) than the research clusters (£39 per sq.ft in the Southern Cluster and £36 per sq.ft in the Northern Clusters), however they appear to have a wider spread between their headline and average rental rates.

Table 8.1. Property Market Performance by Market.

	Southern Research Cluster	Northern Research Cluster	South Cambridge-shire (excluding Research Clusters)	Prime Central	City Centre Periphery
Headline Rent (effective, last 5 years)[1]	£39	£36	£31	£59	£42
Average Rent (last 12 months)	£25	£29	£21	£34	£25
Average Vacancy (average last 12 months)	4.7%	2.7%	11%	2.4%	3.2%
Average Annual Net Absorption (2010 - 2018)	6.9%	1.3%	-0.1%	3.9%	-0.1%
Deliveries (last 5 years)	474,294 sq. ft	121,377 sq. ft	47,629 sq. ft	214,259 sq. ft	2,107 sq. ft
Occupied (Q1 2019)	1,900,076 sq. ft	2,319,742 sq, ft	4,080,238 sq. ft	1,008,255 sq. ft	2,920,396 sq. ft

Source: CoStar 2019

[1]Headline rent for office space >500 sq. ft

8.19 This indicates that the research clusters are delivering a more consistent type of stock, while the Prime and Periphery Cambridge submarkets contain a mix of quality. Net absorption (the difference between tenants taking up new space and space being vacant) is highest in the Southern Research Cluster, with an average of 6.9% net absorption rate achieve per annum. This is higher than the 3.9% achieved in the prime central market, which contains the best located office stock in terms of transport, amenity and proximity to the University.

8.20 The Southern Research Cluster over the last 5 years has delivered more than all the other markets combined, developing approximately 474,300 sq.ft of stock compared to 385,400 sq.ft to the rest of the market.

Co-Location and Agglomeration

Many tenants surveyed have noted the agglomeration benefits associated with the BRC. These benefits include both co-locating on-campus with the Babraham Institute and other starts ups, and the campus' strategic location within the Cambridge life-sciences cluster.

Tenant A notes that the BRC's proximity to 'Addenbrookes and the technology park associated with the LMB, CRI and AZ all within a few miles' were key benefits of locating at the BRC. Tenant B states that 'the main advantages are the proximity to Cambridge and the associated scientific community.' Tenant C notes that 'proximity to Cambridge' and 'Babraham based companies' as a benefit, while Tenant D have more specifically identified that their 'proximity to Cambridge has been helpful for meetings with collaborators/contractors based in Cambridge as well as for other services we employ, such as our accountants.'

This indicates there are a range of agglomeration benefits associated with the BRC. These include both direct on-campus agglomeration with other start ups and the Babraham Institute, and more broadly within the southern research cluster.

Tenant E is a case study of the agglomeration benefits of locating on-campus, stating that the 'Babraham Research Campus is home to XXXX, once of the leading providers of out-sourced drug development services (now not only in the UK but worldwide), and our start-ups rely heavily on XXXX services to drive forward our projects.' Tenant F notes similarly that 'exposure to excellent science within academic institute and biotechs based at Babraham. Ability to network and meet scientist and senior management teams at the Babraham.'

8.21 While the Southern Research Cluster has ample land supply when compared to more land constrained markets such as the Prime Central and City Centre Periphery, so does the Northern Research Cluster and the broader Southern Cambridgeshire submarket. This indicates that the Southern Research Cluster has attracted more investment than other Cambridge markets despite having comparable land supply and proximity to Cambridge as other clusters/submarkets.

8.22 **North and South Research Clusters Campuses**

8.23 We have collected data on the characteristics and performance of the different business parks and research campuses within the Cambridge market. Table 8.2 overleaf outlines the major parks outside the Cambridge Prime and Periphery markets in terms of:

- Total floorspace (sq.ft)
- Headline rent (highest signed / asking rent)
- Occupied (%)
- New floorspace Deliveries (sq.ft)
- Proposed floorspace (sq.ft)

8.24 Campuses anchored by a research institute typically offer a range of smaller spaces, with more flexible lease terms, which results in a stronger headline rent per sq.ft than other business parks within their respective cluster/submarket. For instance the BRC, achieved an average rent of £31 per sq.ft, significantly above other campuses in the Southern Cluster such as Chesterford which achieved an average rent of £25 per sq.ft and Granta Park which achieved £18 per sq.ft.

8.25 The Northern Research Cluster's average rental rate has varied significantly year to year. In 2018 Q4 business parks further north from the city periphery had a much lower average market rent at £13-16 per sq.ft (Vision Park and Cambridge Research Park), while the campuses directly adjacent to the city periphery (Cambridge Science Park and St John's Innovation Centre), with which they are comparable, had average market rents of £23-24 per sq.ft. This level of rental variation is driven by the different levels proximity to the infrastructure and amenity in the Cambridge town centre. Similarly, co-location with research institutions and innovation centres such as the St John's Innovation Centre and Cambridge Science Park Innovation is likely to attract a rental premium above the office market average.

8.26 Average rents within the Southern Research Cluster are more consistent ranging from £18 - £31 per sq.ft.

8.27 The other consistent feature of higher average market rents is the availability of lab space. Within Cambridge those research locations that provide lab space typically achieve higher rents. For example Vision Park in the North Research cluster doesn't provide lab space. Its rents are much lower than other research locations in the Northern Research Cluster. Incubator Space is another positive driver for achieving higher rents. BRC, Wellcome, Cambridge Science Park and St John's Innovation Park all provide incubator space and achieve the highest rent levels in their respective PMAs. While these spaces are occupied by smaller tenants, on shorter leases, they achieve higher rents, stronger occupancy rates and a higher net absorption rate because they are fully fitted.

Start-up and Scale Up Lab Space

Retaining businesses at different stages of the start up life cycle on-campus requires a diversity of office and lab space options. Not providing this space can lead to successful businesses seeking space at alternative locations.

The provision of diverse space options minimises the 'growing pains' of start-ups seeking to scale up their operations. Tenant G outlined why having these options are important to start ups:
'The ability to grow organically was very important to the company's development. We started as a virtual hot desking entity. Following seed investment, we then moved to a single office lab. We then outgrow the single office lab and now occupy several labs with dedicated office space. The ability to grow on a single site minimises the downtime associated with relocation and this significantly assists business continuity both operationally and in terms of staff retention which is significant for a small technology based company where the most valuable resource are skilled people rather than capital equipment.'

The importance of having available space for start-ups to scale up into was noted by Tenant H who stated that 'Although difficult to achieve, having some excess space across the campus, even if just a few labs and some offices for incumbents would make sense.' Tenant H went on to state that the cost and disruption of relocation could be particularly difficult for start-ups 'Priority for expansion also needs to be given to existing companies on site before bringing new tenants in who may have a wider choice of locations compared to incumbents where split sites or re-location of whole business would cause upheaval.' This illustrates a potential tension between providing space for existing businesses, and attracting new tenanst to the BRC.

Tenant I and Tenant J both cite flexibility as a key benefit to being at the BRC. Tenant LLLL stated 'Being at Babraham has enabled us to grow quickly, attract key staff. The campus is a great community for our growing team. We would like more space in future and we feel Babraham is the right place for LLLL to grow.' Tenant UUUU identifies 'flexible facilities/space on site that are modular – so you can increase or decrease lab and office space depending on needs' as a key benefit of being located at the BRC.

Building in flexibility to the property offer of the BRC is key to its retention of tenants as they scale up and grow.

Table 8.2 – Northern and Southern Clusters and South Cambridgeshire - Research Campuses, Science Parks and Business Parks

	Babraham Campus	Wellcome Genome Campus	Chesterford Research Park	Granta Park	Cambridge Science Park	St John's Innovation Park	Cambridge Research Park	Vision Park	Capital Park	Cambourne Business Park	Melbourn Science Park	Harston Mill	Iconix Park
Office sq.ft	215,000	100,000	230,000	1,200,000	1,600,000	241,000	602,000	224,114	158,000	32,759	112,000	78,000	84,000
Occupied %	100%	100%	100%	97%	97%	87%	76%	94%	91%	87%	100%	100%	100%
Headline Rent	£38	N/a	N/a	£30	£36	£35	£29	£27	£31	£25	N/a	£20	N/a
Average Market Rent[1]	£31	N/a	£25	£18	£23	£24	£16	£13	£24	£25	£20	£19	£15
Proposed sq.ft	108,000	-	20,250	-	-	-	-	-	-	-	-	-	35,800
Lab space	Yes	Yes	Yes	Yes	Yes	Yes	Yes	-	-	-	Yes	Yes	Yes
Incubator	Accelerate @Babraham	Biodata Innovation Centre	-	-	Cambridge Science Park Innovation Centre	St John's Innovation Centre	-	-	-	-	-	-	-
Institute / University	Babraham Institute	Sanger Institute	-	-	Cambridge University	-	-	-	-	-	-	-	-
Sub-Market / PMA	South Research Cluster	South Research Cluster	South Research Cluster	South Research Cluster	Northern Research Cluster	Northern Research Cluster	Northern Research Cluster	Northern Research Cluster	South Cambridgeshire	South Cambridgeshire	South Cambridgeshire	South Cambridgeshire	South Cambridgeshire

[1]*CoStar average achieved rent*

Property Impact Analysis

8.28 The objective of this section is to quantify the impact of the BRC on the broader office market, to isolate the value it adds above the provision of standard competing B-class office space.

8.29 To measure this effect, we utilised BRC office market data, as well as office leasing and development data for the Southern Research Cluster. Measuring the Southern Research Cluster provides an indication of the indirect effect of the BRC, both in terms of producing start up and scale up businesses through its ecosystem and by attracting businesses into the Southern Research Cluster.

8.30 To measure the property impact on the local market, we benchmark the BRC and the Southern Research Cluster against key comparator markets:

- The wider South Cambridgeshire submarket, excluding both the Northern and South Research Clusters. This represents a comparable geography being located outside the main urban areas of Cambridge but does not contain comparable publically funded research institutes, making it base level control to benchmark the Southern Research Cluster and BRC against. The business parks that comprise the wider South Cambridgeshire submarket market typically offer commercial terms, and are privately funded. Therefore any uplift above the South Cambridgeshire market provides an indication of the value add of research campuses within the Southern Research Cluster and BRC, compared to purely commercial delivered office space.
- The Northern Research Cluster, which based on earlier analysis appears to be comparable to the Southern Research Cluster, provides an additional benchmark that measures how the Southern Research Cluster and BRC's compares to a comparable research cluster.

8.31 The market indicators used to benchmark the BRC, Northern Research Cluster, Southern Research Cluster and the broader Southern Cambridgeshire submarket include:

- Net Absorption % (net take up of space as a % of total stock)
- Vacancy % (% of stock that is unoccupied)
- Rent and average lease term
- Delivery of new office space
- Average rental growth.

8.32 Benchmarking the performance of the BRC and the Southern Research Cluster against the broader market illustrates the relative strength of their office markets. However, an additional effect of the BRC, is its indirect property impact on the Southern Research Cluster. To isolate this, we have undertaken additional analysis that excludes the BRC development and leasing data from the Southern Research Cluster, and then compared this to the funding and development milestones within the BRC.

Southern Cluster, Northern Cluster and Southern Cambridgeshire Submarket

8.33 The Northern and Southern Research Clusters are mostly contained within the Southern Cambridgeshire Submarket. The key differentiating factor between the research clusters and the Southern Cambridgeshire submarket is the presence of public funded research institutes offering specialised space for start-up, incubator, lab space and proximity to research institutes.

8.34 Comparing the two research clusters with the wider Southern Cambridgeshire submarket, provides an indication of the impact of the concentration of research campuses on the property market.

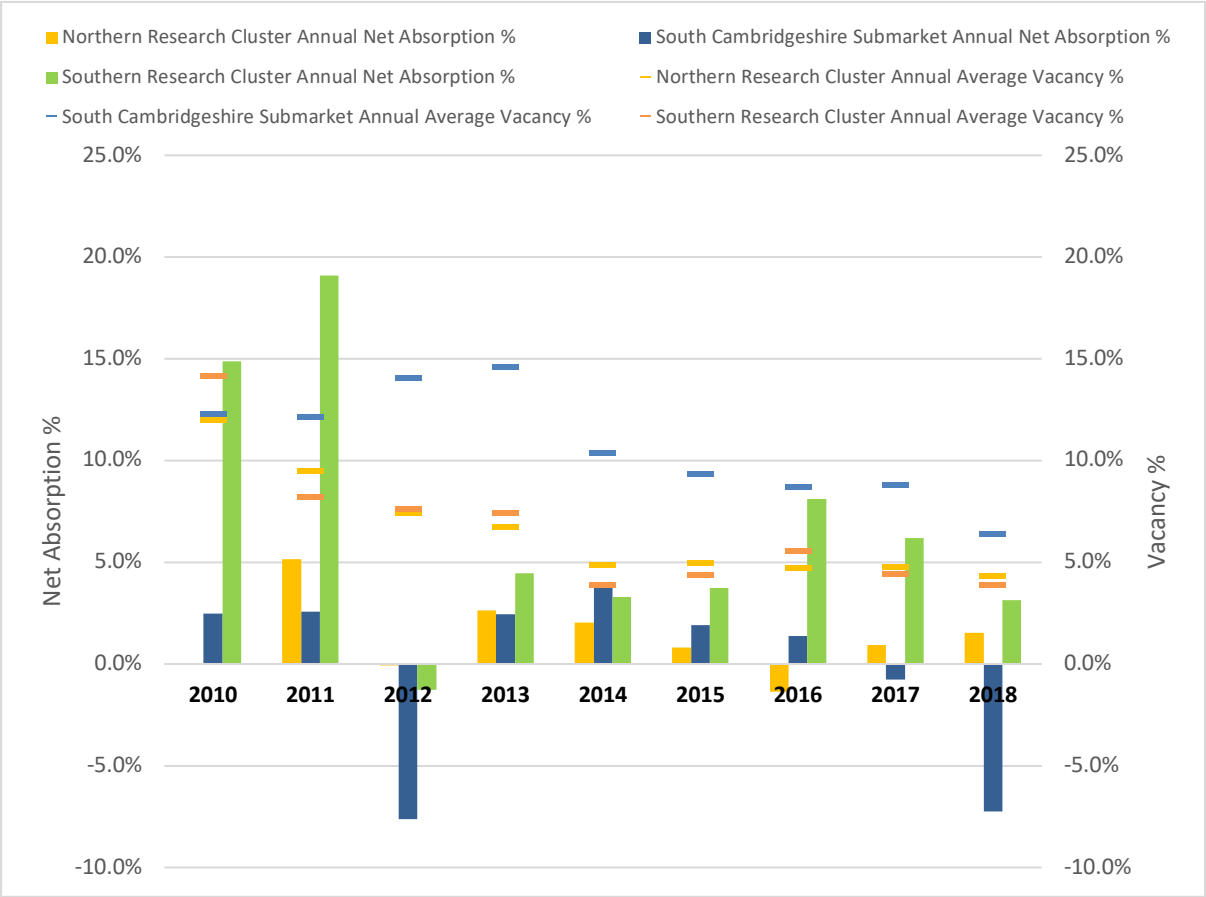
8.35 The varying performance of different businesses and research locations identified in Figure 8.1 below are reflected in the performance of the identified research clusters. Figure 8.1 outlines the net absorption and vacancy rate from 2010 to 2018:

- Southern Research Cluster has a consistently stronger annual net absorption %, than both the Northern Cluster and the wider Southern Cambridgeshire market.
- Between 2010-2018 the Southern Research Cluster achieved an average annual net absorption of 6.9%, compared to 1.3% in the Northern Cluster and -0.1% in the South Cambridgeshire market (though the South Cambridgeshire market had positive net absorption in the majority of years).
- Vacancy rate of the Northern and Southern Clusters appear to be highly correlated, while the Southern Cambridgeshire market appears to be structurally higher.
- The South Cambridgeshire market has 2010-2018 average vacancy rate of 10.7%, higher than the Northern Cluster at 6.6% and Southern Cluster at 6.6%.

8.36 The concentration of research institutes in both the Northern and Southern Cluster has a positive impact on the surrounding commercial markets though reduced vacancy levels. It also indicates that the Southern research Cluster has experienced stronger tenant take-up of space.

8.37 Further analysis of net absorption demonstrates that excluding the BRC from the net absorption analysis still results in the Southern Cluster achieving an average annual net absorption of 6.3%, marginally lower than 6.9% when the BRC is included. The Southern Research Cluster's office market, even discounting the direct impact of the BRC, has stronger demand than both the Northern Cluster and South Cambridgeshire submarket.

Figure 8.1 – Net Absorption % and Vacancy %



Source: CoStar 2019, Babraham Research Campus 2019.

8.38 One of the differentiating factors setting the BRC and Southern Cluster apart from the wider Southern Cambridgeshire submarket is the provision of lab and incubator space, co-located with a public funded institute. Figure 8.2, outlines the average market rent and average lease term for the BRC, Southern Cluster (excluding the BRC), Northern Cluster and South Cambridgeshire submarket.

8.39 The lease term provided at the BRC is much shorter than the commercial lease term offered in other markets including the wider South Research Cluster within which the BRC is located. This directly contributes to correcting the failure of the private sector to supply shorter term leases for lab, incubator and R&D space, highlighted in section 2.4 of this report.

The BRC has an average lease term of 2.7 years, while achieving a £31 per sq.ft rent. This lease term is lower than all the comparator markets and clusters outlined in Figure 8.2 below:

- Northern Cluster has an average lease term of 7.6 years
- South Cambridgeshire Submarket has a lease term of 6.1 years
- Southern Research Cluster (excluding BRC) has a lease term of 7.2 years.

8.40 The lease term offered in the BRC is reflective of its mandate to provide space for research and development projects. Despite this, the BRC also achieves a higher market rent than the average across the Southern Research Cluster, South Cambridgeshire and the

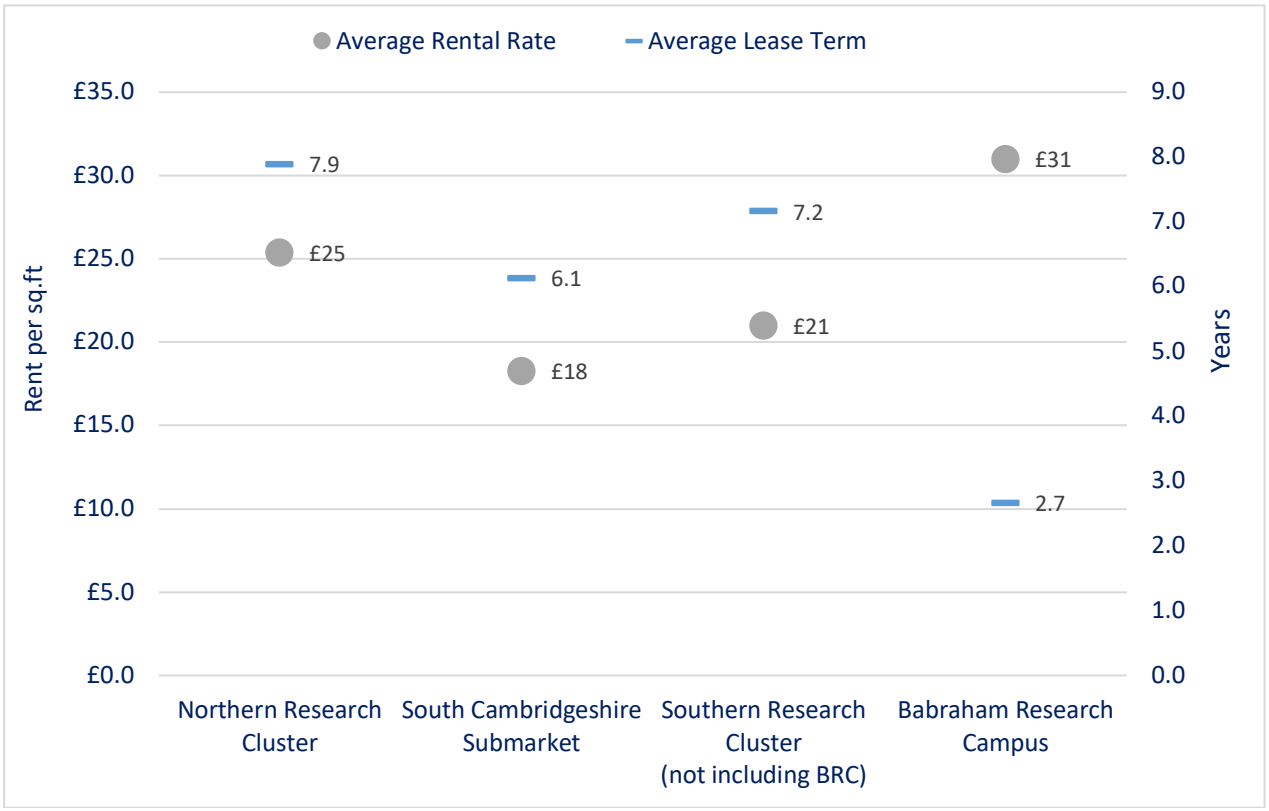
Northern Cluster. It also attracts a higher net absorption rate and has higher occupancy than the market average.

8.41 These lease terms are reflected in the recently developed start-up space. The BBSRC invested £58.8 million to enhance campus facilities and infrastructure and enable the development of the following buildings:

- Development of Moneta (approximately 17,500 sq.ft), average lease term of 1.96 years.
- Building 580, average lease term 2 years (excluding long-term lease to BI).
- Development of Jonas Webb building (approximately 14,500 sq.ft), average lease term 2.5 years.
- Development of Bennett building (building number 930) (approximately 20,000 sq.ft), average lease term of 5 years.

8.42 A rental rate also above all other comparator markets, and 100% occupancy in 2019, indicates that the BRC is providing space on lease terms not otherwise provided for the by private development market.

Figure 8.2 – Average Rent per sq.ft and Average Lease Term



Source: CoStar, 2019; Babraham Bioscience Technologies Ltd

Lease term flexibility

Flexible lease terms have been identified as a necessity for start-up spaces to attract early stage biotech start-ups. Crescendo Biologics have stated the main property related reason for locating at the BRC were the 'short lease terms which allows for additional flexibility.'

The BRC's average lease term of 2.7 years, is reflective of its offer's compatibility with start-ups, while the difference in its average lease term relative to competing science, research and business parks reflects the unique roles it plays within the Cambridgeshire R&D start-up ecosystem.

KKKKK have stated that the key property related reason for its decision to located at the BRC was 'flexibility of lease terms i.e. 5 years of key importance to a start-up, plus the ability to access labs that had a basic fit out reducing the up front capital expenditure requirements.'

Having flexible lease terms that allows tenants to expand and contract space was identified by CCCCC 'Availability of small units and the flexibility of space with the potential, (without guarantee) of expansion. Short lease length is good. Rents higher than available elsewhere.'

FFFF illustrate the importance of flexible lease terms to early stage start-ups, 'flexible, high quality space in the Cambridge Cluster is at a premium… which Babraham Research Campus was uniquely positioned to provide. Without access to such facilities it would have been impossible to establish such a small, early-stage drug discovery business.'

ZZZZZ indicate that flexible lease terms appeal to further developed start-ups too indicating that one of the key property related reasons for locating at the BRC was the 'availability of lease on terms suitable for Series B funded organisation.' This indicates that the appeal of flexible lease terms extend beyond very early life stages and appeals to businesses going through their second round of private sector funding.

This illustrates that lease term flexibility is an important element to the BRC offer to a range of start-ups at varying stages of their development.

8.43 Figure 8.3 outlines delivery of new office development for each respective market. It shows that:

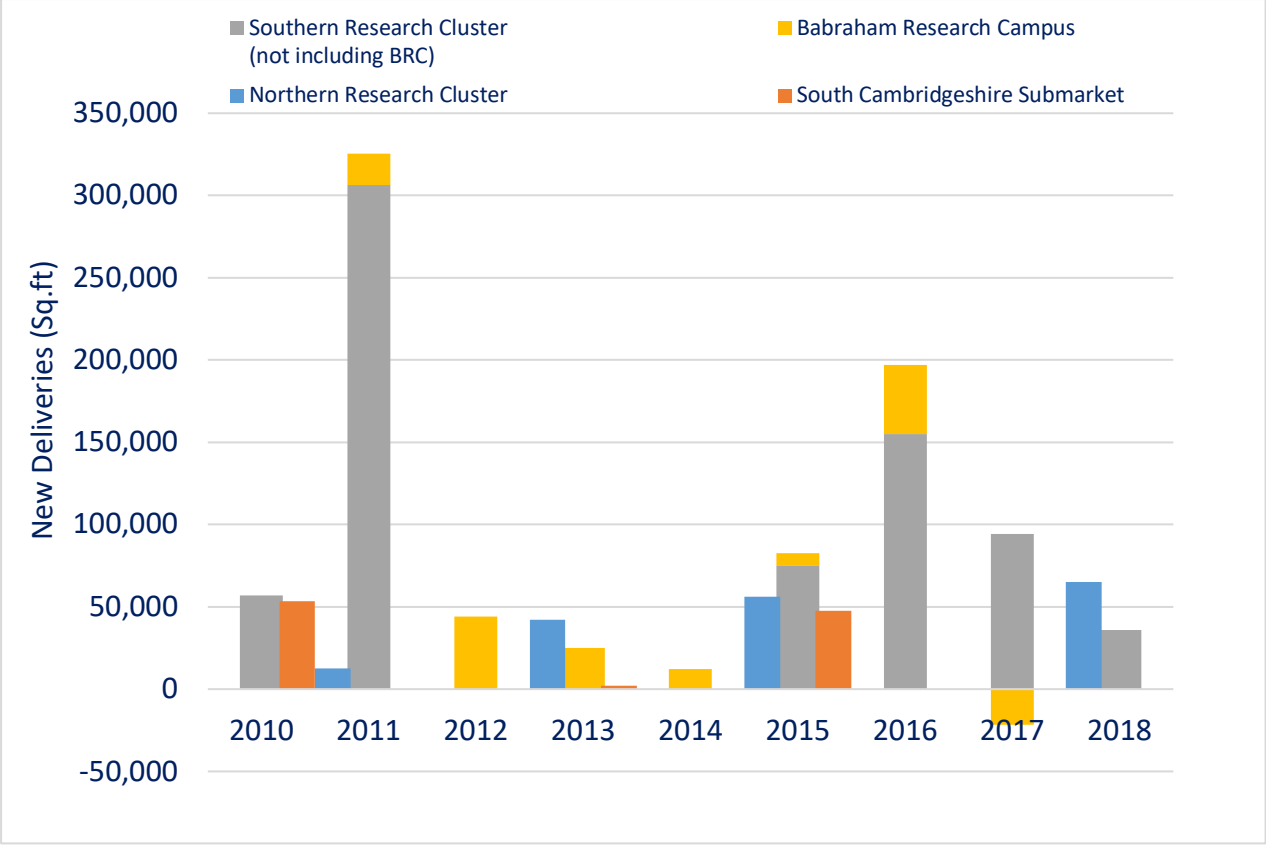
- Southern Research Cluster (excluding the BRC) has added on average 72,400 sq.ft (6.2% of total 2010 stock) per annum since 2010.
- The BRC delivered 16,000 sq.ft (25% of total 2010 stock) per annum since 2010. The Southern Research Cluster (including BRC), is 88,300 sq.ft per annum (6.2% of total 2010 stock), for a total of 851,900 sq.ft since 2010.
- The South Cambridgeshire submarket, despite covering a much wider area, delivered 10,200 sq.ft per annum (0.6 % of total 2010 stock) equivalent to 103,000 sq.ft in total since 2010.

8.44 This indicates that the Southern Research Cluster (ex BRC) has delivered +621,200 sq.ft above the broader Southern Cambridgeshire Submarket since 2010, equating to +62,120 sq.ft per annum uplift above the wider Southern Cambridgeshire submarket.

8.45 If the Southern Research Cluster delivered stock at the rate of the Southern Cambridgeshire Submarket (0.6% of total 2010 stock), it would have delivered 7,600 sq.ft per annum since 2010 some 1.2% of what was actually delivered (of the 621,200 specified above).

8.46 The Southern Research Cluster's higher delivery of new office stock, is partly a reflection of the agglomeration associated with its proximity to the BRC.

Figure 8.3 – New Deliveries (sq.ft)

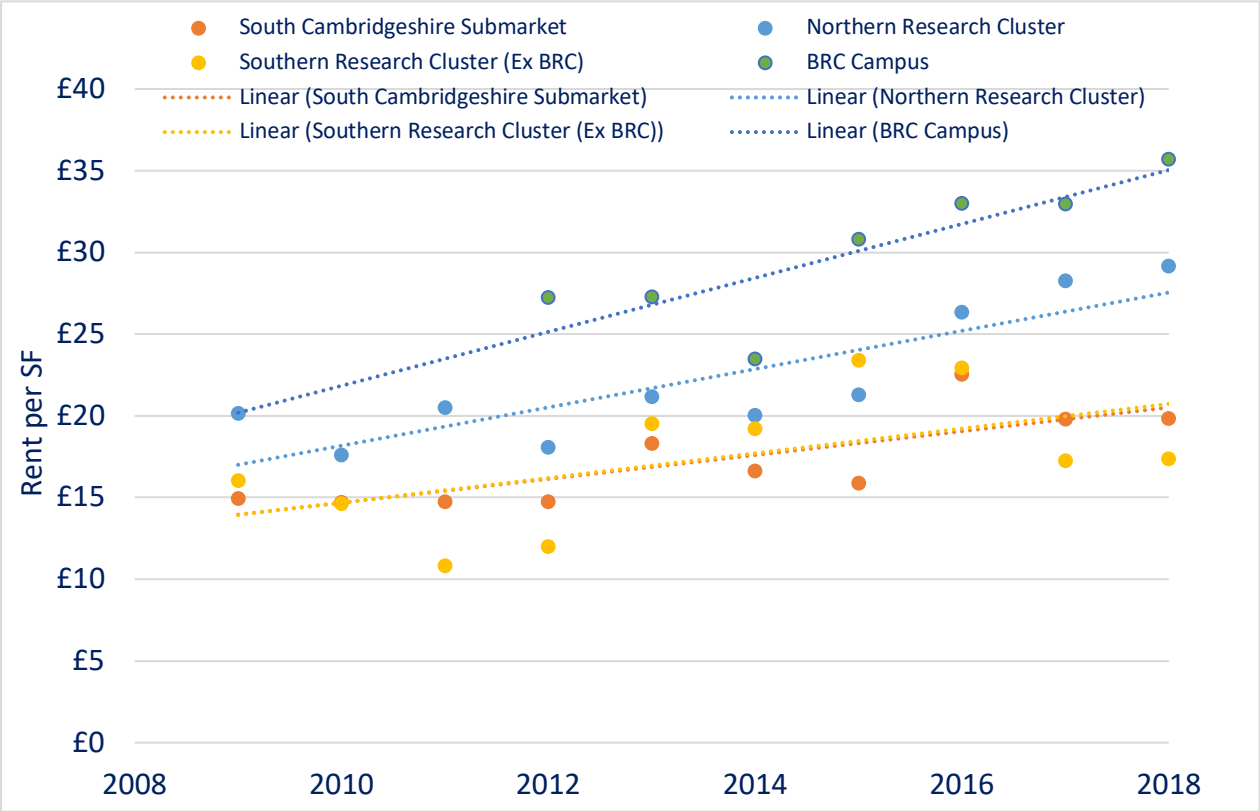


Source: CoStar, 2019; Babraham Bioscience Technologies Ltd

8.47 Figure 8.4 shows that the BRC has achieved a consistently higher average rental rate than the broader Southern Research Cluster, Northern Research Cluster and the wider Southern Cambridgeshire sub market. However while Figure 8.4 shows that the rental growth rate for the BRC is lower than other markets (3.9% per annum since 2012). This can be partly explained by it coming off a higher rental rate base of £27 per sq.ft. Since 2012 market rents grew by:

- 7.1% in the Northern Research Cluster.
- 4.3% in the South Cambridgeshire.
- 5.4% in the Southern Research Cluster.

Figure 8.4 – Average Market Growth %



Source: CoStar, 2019; Babraham Bioscience Technologies Ltd

Property Impact of BRC Funding and Development on the Southern Research Cluster

8.48 In addition to the direct impact of funding campus development, the effect of further concentrating R&D facilities in the BRC will also enhance the quality of the Southern cluster.

8.49 This section seeks to identify the flow on impact of BRC funding and development on the Southern Research Cluster. To quantify this flow-on effect, the net absorption and vacancy rates of the Southern Research Cluster were benchmarked against the Southern Cambridgeshire submarket, identifying any uplift. This uplift was compared to key BRC development and funding milestones. To make sure this analysis measures the flow on effect of development, rather than the development and leasing of the buildings themselves, the BRC's leasing and development activity were excluded from this analysis.

8.50 Figure 8.5 compares the vacancy rate within the Southern Research Cluster (ex BRC), and the wider Southern Cambridgeshire market, against the key BRC funding and development milestones, and illustrates that the agglomeration impact of on-campus funding of development of new facilities on its surrounding property market:

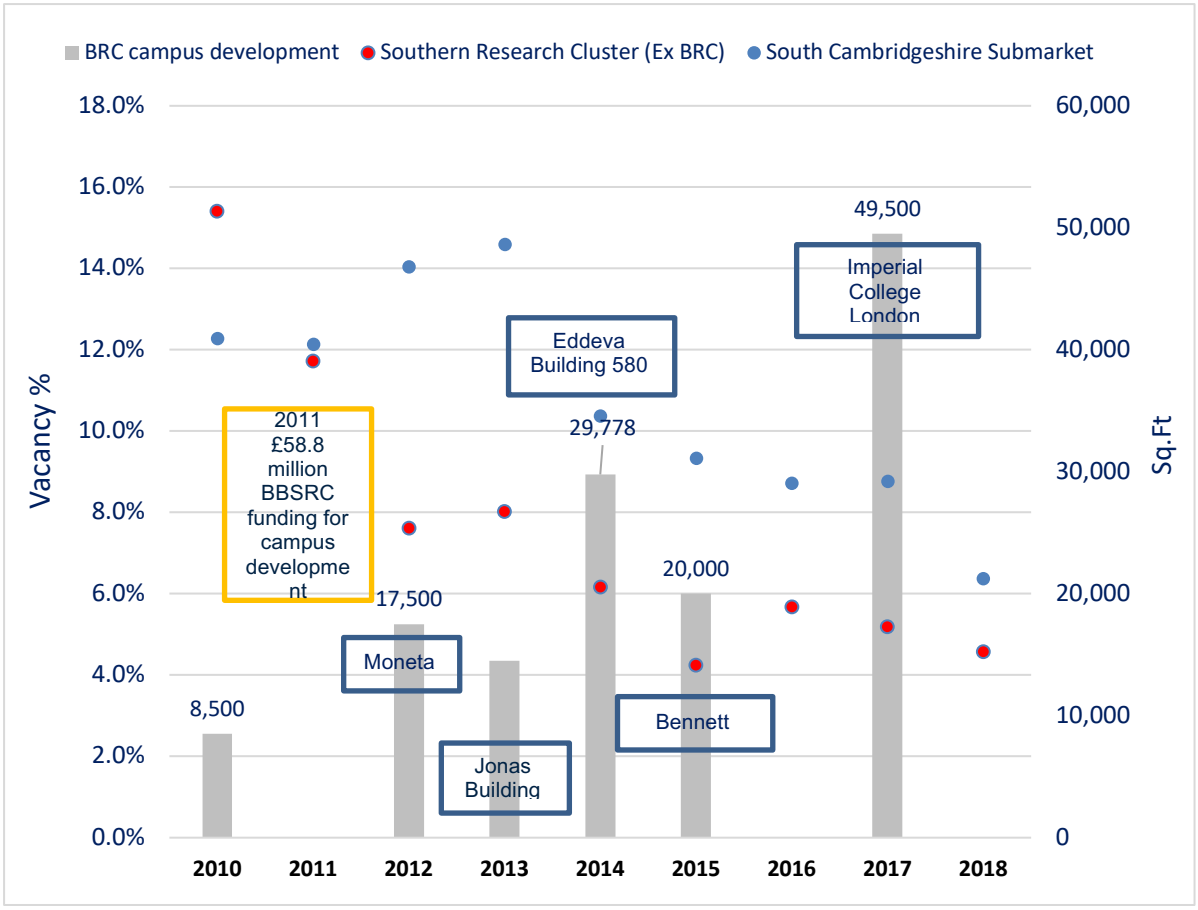
- In 2010 the Southern Research Cluster (ex BRC) had a vacancy rate of 15.4%, while the broader Southern Cambridgeshire Submarket had a vacancy of 12.3%.
- From 2010 to 2013, the Southern Research Cluster (ex BRC) saw a fall in its vacancy rate from 15.4% to 8%, compared to the Southern Cambridgeshire Submarket whose vacancy rate remained approximately the same as 2010.
- Over this period, the Southern Research Cluster (ex BRC) went from a vacancy rate 3.1% higher than the broader Southern Cambridgeshire Submarket, to having a vacancy rate 6.6% below the Southern Cambridgeshire Submarket.
- Chart 4.5 illustrates that over this period, the BRC received £58.8 million in funding, and developed approximately 40,500 sq.ft of new office and lab space.

8.51 This included a mix of different formats that were adapted to meet the needs of start-up and scale-up phase businesses. Two examples of the spaced delivered include:

- Maia (completed in 2010), which delivered 8,500 sq.ft of small lab and office units.
- Moneta (completed in 2012), which delivered 17,500 sq.ft of space subdivided into 600 sq.ft units designed for start-ups.

8.52 From 2013 to the end of 2018 the Southern Cambridgeshire Submarket's vacancy continued to fall to 6.4%, while the Southern Research Cluster (ex BRC), continued fall to 4.6%. Over this period a further 99,300 sq.ft of office and lab space was delivered on the BRC. While the Southern Research Cluster (ex BRC) and the wider Southern Cambridgeshire Submarket both saw falls in vacancy, the Southern Research Cluster's (ex BRC) vacancy rate (NIA) was still 1.8% lower than the wider Southern Cambridgeshire Submarket.

Figure 8.5 – Key BRC development / funding milestones, compared to vacancy rate



Source: Savills 2019, CoStar, Babraham Research Campus, 2019

Net absorption

8.53 Figure 8.6 compares the net absorption rate (%) within the Southern Research Cluster (ex BRC), and the Southern Cambridgeshire market, against the key BRC funding and development milestones.

8.54 Between 2010 and 2018, the average net absorption for the Southern Research Cluster (ex BRC) was 6.3% per annum, while the Southern Cambridgeshire Submarket was approximately 0% (though this varied year to year).

8.55 In 2011 the Southern Research Cluster (ex BRC) saw a significant net take up of stock, achieving a 25% net absorption rate coinciding with £58.8 million public funding of BRC development, while the Southern Cambridgeshire Submarket saw net absorption of 2.6% of its stock..

8.56 As the funding between 2012 and 2018 was spent on campus development, the Southern Research Cluster (ex BRC) averaged a net absorption rate of 3.2% per annum, while the broader South Cambridgeshire Submarket saw a -0.9% net absorption rate indicating that

demand for office floorspace contracted within this market over this period.

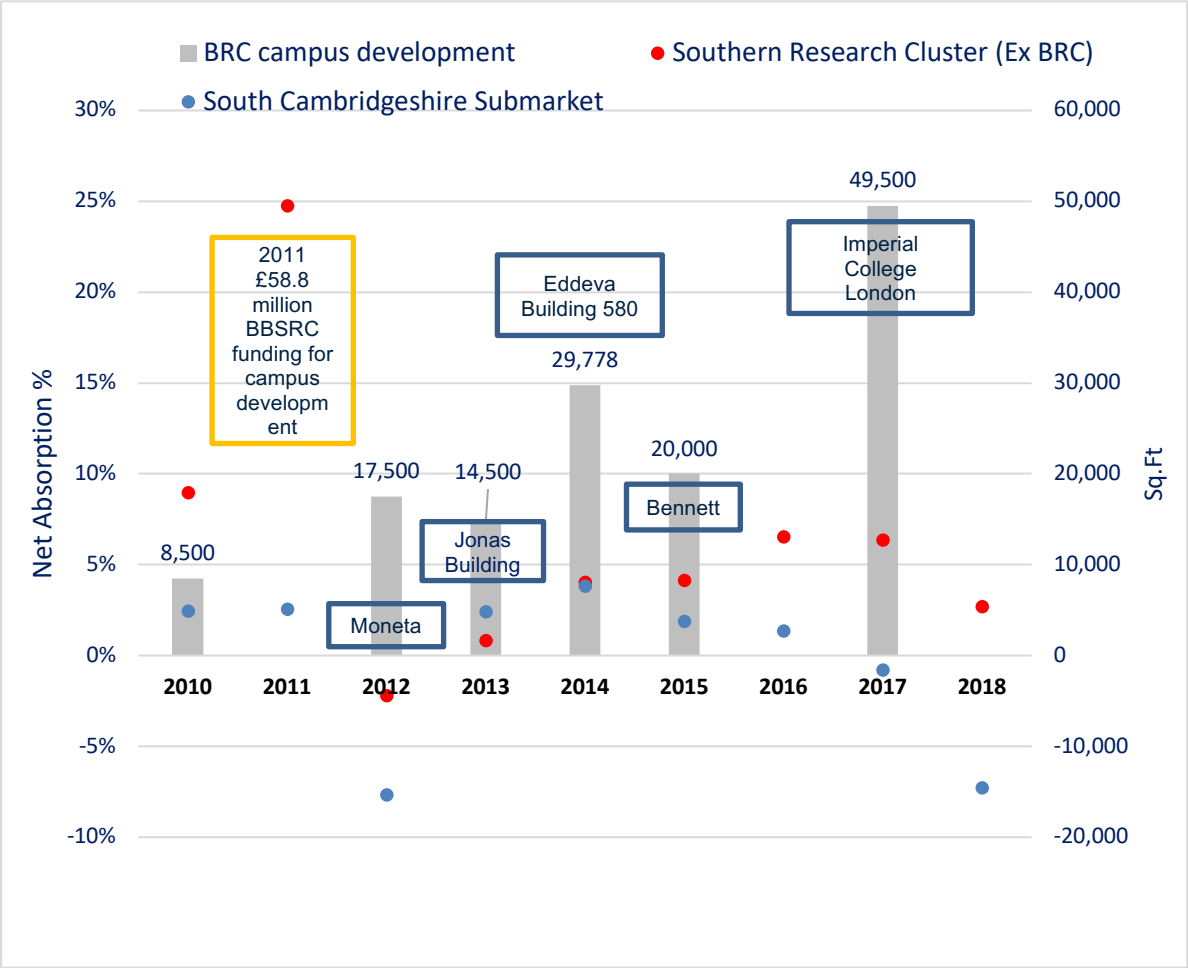
8.57 The contrasting performance of the Southern Research Cluster (ex BRC), and the Southern Cambridgeshire Submarket indicate that these two markets receive varying levels of interest from prospective tenants.

8.58 As mentioned earlier in this report, businesses that are started and then developed through the BRC have graduated from the campus, once they outgrew their premises. This is one source of impact the BRC has on the surrounding property market, producing R&D start-ups that scale up and take-up space in nearby business parks. The BRC have advised that the primary locations for previous BRC start-ups are Granta, Chesterford Research Park, Wellcome Genome Campus and Cambridge Science Park.

8.59 Out of the companies that graduated from the Babraham Bioincubator (since 1999), and are tracked by the BRC and still operating (excluding companies that failed, relocated out of the UK or were acquired), 39% relocated to nearby by research locations (Granta, Chesterford and Sanger Centre), while 18% to the Cambridge Science Park in the Northern Research Cluster.

8.60 It is likely that the start-up ecosystem at the Wellcome Genome campus has had a similar effect on the Southern Research Cluster (though this has not been accounted for in our analysis). The development of start-up and scale-up space further concentrates R&D activity within the Southern Research Cluster. This will likely continue to have an agglomeration effect, attracting market interest not just in the BRC, but within other Southern Research Cluster campuses.

Figure 8.6 – Net Absorption % and BRC development



Source: Savills 2019, CoStar, Babraham Research Campus, 2019

Summary

8.61 The Babraham Research Campus (BRC) has made a significant contribution to the Cambridgeshire property market, providing specialised start up and scale up space, with access to world-class facilities (e.g. laboratory space) and on lease terms tailored to the needs of start-up space.

8.62 One of the key characteristics, which differentiates the BRC from the broader market, is the provision of fully fitted and serviced lab space, co-located with a public funded institute and flexible lease terms tailored to R&D start-ups. The BRC average lease term of 2.7 years is significantly below the average for other markets, while it achieves a rental rate (£31 per sq.ft) above other submarkets and research clusters:

- Northern Cluster has an average lease term of 7.6 years at rent of £25 per sq.ft.

- South Cambridgeshire Submarket has a lease term of 6.1 years at rent of £18 per sq.ft.
- Southern Research Cluster (excluding BRC) has a lease term of 7.2 years at rent of £21 per sq.ft.

8.63 The lease term offered in BRC is reflective of its mandate to provide start up and scale up space for R&D SMEs. In 2011, BBSRC invested £58.8 million in the Babraham Research Campus, enabling the development of following buildings:

Development of Moneta (approximately 17,500 sq.ft), average lease term of 1.96 years.
Building 580, average lease term 2 years (excluding long-term lease to BI).
Development of Jonas Webb building (approximately 14,500 sq.ft), average lease term 2.5 years.
Development of Bennett building (approximately 20,000 sq.ft), average lease term of 5 years.

8.64 Comparing the Southern Research Cluster with the South Cambridgeshire sub market provides a counterfactual benchmark and indicator of the 'value added' associated with the Southern Research Cluster and the BRC

8.65 The Southern Research Cluster has achieved significant uplift in net absorption and structurally lower vacancy than the South Cambridgeshire sub market.

8.66 This analysis indicates that the Southern Research Cluster consistently performs better than its key counterfactual, the Southern Cambridgeshire Submarket across net absorption (+7.0% per annum), vacancy (-4.0% on average) and delivery of new stock (+62,120 sq.ft per annum).

8.67 This reflects the agglomeration effect of the concentration of R&D space and research institutes in the Southern Research Cluster (and tenants seeking to occupy and co-locate the BRC), compared to the broader South Cambridgeshire submarket:

- The Southern Research Cluster achieved an average annual net absorption of 6.9% per annum, compared to 1.3% per annum in the Northern Research Cluster and -0.1% per annum in the South Cambridgeshire submarket.
- The Southern Research Cluster and the Northern Research Cluster have the same long-term vacancy rate of 6.6%, lower than the Southern Cambridgeshire submarket of 10.7%.
- The vacancy rate of the Northern and Southern Clusters is correlated, while the Southern Cambridgeshire market appears to be structurally higher.
- The Southern Research Cluster and South Cambridgeshire sub market have comparable amenity, infrastructure and are located outside the Cambridge urban area. The key differentiator is the presence of start-up, lab, incubator and research institutes in the Southern Research Cluster.

8.68 The Southern Research Cluster is attracting higher levels of private sector development than the South Cambridgeshire Submarket. This demonstrates that the Southern Research Cluster is attracting significant interest from private developers and investors, relative to the South Cambridgeshire sub market:

- The Southern Research Cluster has delivered on average 88,300 sq.ft per annum, a 6.9% per annum expansion of 2010 stock, for equating to a total of 851,900 sq.ft since 2010.
- In comparison the South Cambridgeshire Submarket, despite covering a much wider area, has delivered a much lower 10,200 sq.ft per annum, a 0.6% per annum expansion of 2010 stock, equivalent to 103,000 sq.ft in total since 2010.
- This quantifies the value added associated with the Southern Research Cluster and the BRC, which has attracted substantially higher development of new office stock, delivered +748,500 sq.ft above the broader Southern Cambridgeshire Submarket since 2010, equating to +74,900 sq.ft per annum uplift above the broader Southern Cambridgeshire submarket.

8.69 The combination of this public funding and investment in BRC, and the presence of the Babraham Institute, has an impact on the property market outside the campus. We can estimate this impact, by excluding the BRC's leasing and development data from the broader Southern Research Cluster and then benchmarking this against the Southern Cambridgeshire submarket.

8.70 The Southern Research Cluster (excluding on-campus BRC leasing and development data) achieved an uplift above the Southern Cambridgeshire submarket that corresponds with key BRC funding and development milestones:

- From 2010 to 2013, the Southern Research Cluster (ex BRC) saw a fall in its vacancy rate from 15.4% to 8%, compared to the Southern Cambridgeshire Submarket whose vacancy rate increased from 12.3% to 14.6%.
- Over this period, the BRC received £58.8 million in funding, and developed approximately 40,500 sq.ft of new office and lab space. This included a mix of different formats that were adapted to meet the needs of start-up and scale-up phase businesses.
- From 2013 to the end of 2018 the Southern Cambridgeshire Submarket's vacancy fell to 6.4%, while the Southern Research Cluster (ex BRC), continued to fall to 4.6%. Over this period a further 99,300 sq.ft of office and lab space was delivered on the BRC.
- While the Southern Research Cluster (ex BRC) and the Southern Cambridgeshire Submarket both saw falls in vacancy, the Southern Research Cluster (ex BRC)'s vacancy rate was still 1.8% lower than the broader Southern Cambridgeshire Submarket.

8.71 This indicates that the funding of new facilities on the BRC appears to have an agglomeration impact on the broader Southern Research Cluster B-class office stock, adding to the critical mass of space supporting R&D start up and scale up businesses.

8.72 As the funding between 2012 and 2018 was spent on campus development, the

Southern Research Cluster (ex BRC) averaged a net absorption rate of 3.2% per annum, while the wider South Cambridgeshire Submarket saw a -0.9% net absorption of office stock.

8.73 Businesses that started and developed through the BRC have left the campus once they outgrew their premises. This is one source of impact the BRC has on the surrounding property market by producing companies that take-up space in nearby business parks. The development of start-up and scale-up space that further concentrates R&D activity within the Southern Research Cluster will likely continue to have an agglomeration effect, attracting market interest and investment not just in the BRC, but within other campuses located within the Southern Research Cluster.

9. Findings from the Case Studies

The BRC caters to a segment of companies (those in the early stage for incubation and with a view to an IPO) that is under-served both in the locale and UK. The uncertain viability and higher risk profile of such companies makes them unattractive as tenants of more commercially oriented science parks. Conversely, such science parks' offerings, of shell and core buildings on long leases, are unfavourable and unappealing to the companies. In that respect, a BBSRC-funded research campus such as the BRC fills what is otherwise a largely unoccupied niche in the UK innovation system. As a publicly funded venture, there would appear to be a market failure that the BRC is helping to address.

Consequently, when asked, the interviewees were of the view that growth would have been more difficult in the absence of the BRC because of the likely lack of available space and/or the greater time and effort needed to find space. Other advantages of a campus like the BRC were noted, if not acknowledged, but these appear largely secondary to access to appropriate facilities.

Given the cited difficulties in finding appropriate space, interviewees were on common ground about the need for the BRC to simply provide more similar space, rather than consider branching out to support other parts of the UK bioscience innovation pipeline. The nature of the constraints at the present time leads to sheer lack of space that interviewees consider as a priority to be addressed. Moreover, there was some suggestion that diversification may, possibly, dilute some of the secondary benefits of the BRC, especially in terms of how a group of companies at a similar stage of development might be fostering an appealing working environment for company employees.

For now, the uniqueness of the BRC in the current ecosystem would seem to be that it provides something that remains in short supply in the area (as well as the wider UK): space for early-stage companies that is fit for purpose and available on reasonable lease terms.

Introduction

9.1 This section presents the findings from interviews with representatives of companies either located on the BRC or companies that have previously been located there. The aim of the interviews was to elicit, in more depth, companies' experience and the extent to which the BRC has supported their growth and performance (as a way to gauge the additionality of the BRC). In this chapter we present the key themes that emerged from those interviews.

Approach

9.2 The aim of the interviews was to collect more information on individual companies, building on their earlier survey responses (as detailed in Chapter 4). The companies interviewed all returned completed responses to the survey in May or July 2019. These

companies formed the initial sample of interview candidates on the basis that by responding to the survey they had already demonstrated engagement with the study. From those survey responses, we identified companies of potential interest for follow-up interviews. The final list of approaches was agreed with BBT before proceeding.

9.3 We approached six companies, of which four were eventually interviewed over August-September 2019. Each interview was conducted as a telephone call of up to one hour in duration between a representative of the company and a member of the research team.

9.4 The interviews were semi-structured in nature, with interviewees sent a list of questions to reflect on prior to the interview itself:

1. What other sites did you consider before moving to the Babraham Research Campus? Do you think that has borne out positively?
2. How might your company's growth and direction have differed had you not located to the Babraham Research Campus?
3. What do you feel the Babraham Research Campus does better than others (if not uniquely)?
4. With reference to the Campus, what do you see as the challenges for company growth?

9.5 Nevertheless, as a semi-structured interview, interviewees were encouraged to elaborate on points of particular importance to them and, these were explored in the conversations.

9.6 As well as the questions above, other areas of interest in the interviews included:

- The potential additionality of the BRC (as defined and discussed elsewhere), insofar as a hypothetical counterfactual (in which the BRC had not been available) may have seen different outcomes for the companies.
- The extent to which the BRC and tenant companies may help to augment the (local) labour pool.

9.7 As a mixed-methods study, the interviews provide an additional source of evidence with which to understand the BRC's impact. These are insights which are not easily identified in, for example, outturn data and quantitative analysis. Instead, information must be discerned qualitatively, drawing on the experiences of the interviewees.

9.8 From the interviews, the following key themes emerged:

1. The BRC occupies a vital niche in the UK bioscience innovation system.

2. The above niche in UK bioscience remains underdeveloped, both locally and nationally.
3. The availability of suitable space for bioscience start-ups, and on reasonable terms, is the BRC's principal source of value. Views were more mixed on the direct value of other features of the BRC and what else it might offer in the future.
4. The local labour market is seemingly strong but with some suggestion that worker mobility is lower than in, say, the US. The cost of housing and the quality of (and restrictions on) surrounding transport infrastructure may also be a hindrance.
5. The US remains the centre of gravity for bioscience, with UK bioscience particularly constrained by the availability of suitable space (as above, corroborating the first two points in this list). This continues to put the UK at a disadvantage. This situation is perhaps in part a consequence of planning regulations and other local constraints. More broadly, the UK bioscience innovation pipeline suffers from geographical fragmentation but it is less clear from the interviews that this is something the BRC could (or should) address directly.

9.9 The following sections explore these themes in more detail, drawing on the findings from the interviews.

The BRC's niche in the UK bioscience innovation system

9.10 The interviews emphasised the importance of the BRC as a place where early-stage bioscience companies could find pre-fitted space and facilities on more suitable lease terms, of 3-4 years. This contrasts with the norm for most commercial property, in which leases are longer-term (e.g. ten years) and companies must completely fit out the space themselves. Such arrangements better suit start-ups because they better acknowledge the riskier nature of the ventures (there is less certainty that such companies will still be around in ten years' time) and help lower the barrier to starting up, by avoiding companies having to spend as much money to get their facilities fit for purpose (though some outlay may still be required to modify the space).

9.11 The interviewees agreed that the consequence of having access to such space is that companies can focus on the research more quickly. This is conducive to their development, especially given their funding and risk. Such flexibility is vital to these companies and this also extends to the ability to rent equipment and, if needed, operators.

9.12 The availability of pre-fitted space on shorter leases contrasts with more conventional offerings elsewhere in Cambridgeshire and the East of England, such as at Granta Park and Chesterford Research Park. One interviewee noted that this reflected differences in the business models of science parks and how this shaped their offer and the kinds of companies that might locate there:

- Science parks such as Granta Park and Chesterford Research Park are privately financed. The underlying business model is to seek a consistent, stable financial return over time. Accordingly, tenant companies must themselves be more certain of their futures to be able to commit to longer leases. That stability is typically a product of size and proven market performance such that companies are better equipped to fit out their (larger) space to meet their specific needs.

- The BRC, on the other hand, has a different mission supported in part by public funds i.e. from the BBSRC. This reflects a differing willingness to bear the risks associated with early-stage companies, whose futures are less certain. This manifests as investment to accommodate tenants in pre-fitted facilities and on more favourable lease terms.

9.13 The implication is that the BRC caters to a different market (a different link in the innovation chain) to other, more commercially oriented offerings. In drawing attention to this distinction, the interviewee emphasised the importance of an actor who can (is willing and able to) bear the risks of providing space to tenants with less certainty. In this regard, the role of government was emphasised as critical to ensure this part of the innovation system is adequately supported. This is further reinforced in the section, on the limited availability of such space.

9.14 Interviewees further highlighted the differing orientation of the BRC as helping them to more quickly develop their ability to carry out research and testing. The view from interviewees was that the terms offered by more commercially oriented science parks ('shell and core' facilities to fit out themselves on longer lease terms) drove them to be, to paraphrase one interviewee, more like 'property companies'. By this, companies must make heavier outlays of time and resources to ensure their facilities are fit for purpose. This comes at the risk of not being able to carry out research, hindering development. The availability of equipment such as mass spectrometers and for *in vivo* work was also cited as a benefit.

9.15 The implication is that the availability of suitable space on favourable terms helps to avoid financial and administrative distractions that might come at the expense of the science. This in turn risks reducing companies' chances of success. In the UK, this was also considered important given the more limited funding available to companies compared to, for example, those in the US. More limited financial resources elevate the need to use those resources more carefully and the difference in funds is substantial between completely fitting out a space and modifying existing space.

9.16 The interviews point strongly to the importance of the BRC's niche as providing for early-stage companies in the UK bioscience innovation system. More commercially oriented science parks have different incentives/objectives which lead to them favouring an offer that targets later-stage companies. In that sense, the BRC caters to a different segment of the

market than many other science parks. This is a source of differentiation on the part of the BRC because the private sector does not serve this segment well. The role of the BBSRC (and, by extension, the government) as a funder and public bearer of risk was considered pivotal in focusing the BRC's offer. As our property market analysis shows, the availability of this space is low both in the area and in the UK more generally. In the UK, the kind of space offered by the BRC remains extremely limited.

9.17 While the circumstances by which the interviewees' companies came to be on the BRC are quite specific, it was clear that the decision to locate for start-ups is heavily constrained by a lack of choice. For companies at this (early) stage of development there were, and are, few alternatives to the BRC in the vicinity of Cambridge and London; as well as in the UK more generally. As mentioned in the previous section, while there are various science parks around the UK, few are appropriate (in terms of facilities and leases) for firms at the early / Venture Capital stage.

9.18 A consequence of this situation is that competition for space can be intense and, for companies looking for space (including to move as they grow), significant time and resources may be spent during that search, possibly to no avail. The extent to which this might prove to be a constraint varied in our interviews, possibly owing to differences in company size. A representative from a larger company that was outgrowing its current space felt this constraint acutely. In contrast, a representative from a smaller company felt more comfortable that, *should* the need arise, larger space was likely to be available.

9.19 With appropriate space at a premium for firms at this stage of development, interviewees made clear that there is a pressing need for more space of this type. Short-term, modular space of the kind that the BRC has historically provided (and thus specialises / is strong in) is considered a priority. Some degree of potential 'growing pains' were noted by one interviewee, though as a comparatively minor friction at this stage. This interviewee currently manages multiple, non-coinciding leases on the BRC (they are spread over multiple units). In their view, there was something of a gap between the short- and long-term space, for companies not quite ready to graduate to a shell and core model. Such medium-term space on terms of, say, 3-5 years would have been of interest. While finance might be available in principle to fund the fit-out of a shell and core, given the difference in cost compared to modifying a fitted-out space, it is not seen as a desirable route for companies at this stage of development.

9.20 Given the importance (and apparent near-uniqueness) of the BRC's offer to early-stage companies in the UK, expansion along the innovation chain was not seen as so desirable:

- While the lack of co-located/nearby space such as lab hotels is seen as something of an impediment to the vibrancy of UK bioscience (compared to the US, for example; see later in this section), it was not clear that the BRC's geographical location would

be conducive to such developments 'upstream' of its current segment. While there are advantages to encouraging academic links to the BRC and the tenant companies, such earlier-stage space would ideally be located in the city of Cambridge, nearer the academics who might want to explore potential ideas at low cost, and as a precursor to setting up a company.

- In contrast, the 'downstream' segment of companies who are beyond the stage of most existing BRC tenants was considered well-served already. The feeling (among early-stage companies on the BRC) was that the existing science parks elsewhere in the area already covered this segment. The interviewees were not especially enthusiastic about the BRC competing with the more commercially oriented science parks in the area through the development of shell and core buildings over pre-fitted space (though one interviewee did suggest some need for space of intermediate size; as detailed above). A further point made was that such developments may also affect the positive and community environment that has been fostered by the BRC. It may also detract from the BRC's focus. A later-stage company (e.g. on the order of 300-400 employees) has a more obvious and different need for large, self-contained buildings. There was a feeling that such companies were likely better off moving at that point.

9.21 One interviewee also highlighted some concerns that the potential for the BRC to expand may be inhibited by planning restrictions and at least some desire for residential developments in the area. Similarly, concerns about infrastructure and connectivity around the BRC (i.e. between the campus and nearby residential areas) may impede companies' ability to grow on the site. Another interviewee considered transport links between London and Cambridge to be good, however. The degree to which accessibility is or is not a problem varies by circumstance and company structure.

9.22 The overall feeling was that the BRC occupies a niche in the innovation system and the market, and that the expansion of that provision should be a priority as evidenced by the lack of choice and constraints on existing space. One might conclude that there is a continued gap in the market for such space and, by extension, a continued market failure.

Other aspects of the BRC's offer are secondary to the availability of suitable space.

9.23 Compared to the availability of suitable space on favourable terms, other aspects of the BRC were generally viewed positively but not perhaps as critical i.e. not as primary benefits.

- The availability of communal facilities not otherwise easily accessible to small companies (both core services and, for example, conference facilities) was viewed positively. For companies with limited resources, the 'pay-as-you-go' charging model scales well for them in the early stages of growth. This charging model helps to avoid

these companies making large (lumpy) outlays themselves on facilities and equipment such that costs increase more smoothly with company size/activity. Particularly for smaller companies, the shared purchasing power afforded by ordering supplies through the BRC was also considered valuable.

- One interviewee pointed to the value of a critical mass of companies at a similar stage of development as helpful to foster a positive working environment for employees. This was considered to be something that the BRC did especially well. Following on from the points in the previous section, it was also thought that catering to companies at different (later) stages might jeopardise this. However, it was less clear that this network facilitated on-site partnerships and interactions that could not have happened otherwise. Moreover, the horizons of many of these companies extend both beyond the campus and beyond the UK. Geographically, companies put somewhat less weight on the location of the BRC.

- The potential links to the academic community in Cambridge were acknowledged as helpful but considered unexploited, at least to some degree. Geographical distance from the heart of the University of Cambridge continues to present a barrier and there remained some sense of a divide between the University in the centre and the science parks on the city's periphery. The co-location of the Babraham Institute was, however, considered to be potentially beneficial for research collaborations and a unique feature of the BRC.

9.24 By virtue of its business, an interviewee highlighted a potential opportunity to promote start-ups at the intersection of biosciences and digital sciences. Such developments, to promote at least some co-location (with office space) are likely to be low cost relative to investment in traditional facilities on the BRC. There was a suggestion that there may be a missed opportunity in this regard but also an acknowledgment that the institutional setup of research councils (MRC for medical research, BBSRC for bioscience, EPSRC for engineering etc.) may continue to preclude this. Such decisions are, in all likelihood, beyond the remit of the BRC and a question for stakeholders in UK research.

The local labour market appears strong

9.25 The consensus was that the local labour market was strong and that the pool of talented candidates was healthy, if competitive. One interviewee emphasised the concomitant importance of retaining staff. However, it was also noted that any apparent improvements in the strength of the labour market are not easily disentangled from increasing success and profile on the part of the companies over the same period. However, beyond bioscience, there was perhaps greater competition for data scientists, reflecting a differing emphasis in London compared to Cambridge.

9.26 There were some concerns that labour is not as mobile in the UK and between companies as it is in the US (see next section on further comparisons with the US) but this is a structural issue that is not in the BRC's power to affect. More importantly from the BRC's perspective, and what might be needed to support continued growth in the Cambridge cluster as a whole, were concerns about the availability and cost of housing, and the cost and quality of transport links in the area.

9.27 In terms of infrastructure, high housing costs mean that workers tend to move to the villages surrounding the city of Cambridge and then commute to the BRC. However, transport options are problematic in the sense that the available options are by bus or car. Connections are relatively limited by the former and there are constraints on the amount of available parking space by the latter.

Differences to the US, especially Boston, are instructive

9.28 A notable feature of the interviews was the frequency with which interviewees drew parallels between their experiences of operating in the UK and the US. In particularly, Boston, Massachusetts was considered a benchmark. This is reflective of the view that Boston and the West Coast of the US remain the centre of gravity for bioscience. Most activity takes place there and the UK is a satellite by comparison.

Key strengths of the US relative to the UK included:

1. The comparative ease with which space can be found, which was attributed to a greater openness to development (e.g. in residential and commercial areas) and less restrictive planning regulations. The sense is that these factors limit both the scope for expansion of science parks in the UK, like the BRC, and the surrounding infrastructure. Consequently, the supply of space is more responsive, expanding quicker when it needs to. This underscores the lack of choice and difficulty for early-stage companies in obtaining suitable space in the UK.

2. The proximity of companies both to each other and with universities e.g. the Kendall Square area in Cambridge, Massachusetts. This contrasts with the situation certainly in Cambridge, UK, where science parks are mostly out of town i.e. on the periphery. There seems to be a greater sense of a divide between different stages of the bioscience innovation life cycle. There is a much more integrated pipeline for innovation in the US with the notable presence of, for example, lab hotels. A lack of integration arguably hinders the UK innovation pipeline but, as mentioned in an earlier section, there was some resistance to the idea that the BRC was best-equipped and best-placed as a site to provide such co-location.

Conclusion

9.29 From the interviews, the BRC caters to a segment of companies (those in the early stage for incubation and with a view to an IPO) that is under-served both in the locale and UK. The uncertain viability and higher risk profile of such companies makes them unattractive as tenants of more commercially oriented science parks. Conversely, such science parks' offerings, of shell and core buildings on long leases, are unfavourable and unappealing to the companies. In that respect, a BBSRC-funded research campus such as the BRC fills what is otherwise a largely unoccupied niche in the UK innovation system. As a publicly funded venture, there would appear to be a market failure that the BRC is helping to address.

9.30 Consequently, when asked, the interviewees were of the view that growth would have been more difficult in the absence of the BRC because of the likely lack of available space and/or the greater time and effort needed to find space. Other advantages of a campus like the BRC were noted, if not acknowledged, but these appear largely secondary to access to appropriate facilities.

9.31 Given the cited difficulties in finding appropriate space, interviewees were on common ground about the need for the BRC to simply provide more similar space, rather than consider branching out to support other parts of the UK bioscience innovation pipeline. The nature of the constraints at the present time leads to sheer lack of space that interviewees consider as a priority to be addressed. Moreover, there was some suggestion that diversification may, possibly, dilute some of the secondary benefits of the BRC, especially in terms of how a group of companies at a similar stage of development might be fostering an appealing working environment for company employees.

9.32 For now, the uniqueness of the BRC in the current ecosystem would seem to be that it provides something that remains in short supply in the area (as well as the wider UK): space for early-stage companies that is fit for purpose and available on reasonable lease terms.

10. Bringing the Impacts Together and Assessing Additionality

The research finds that being located on the BRC has brought additional value to Campus companies by increasing both the speed and scale of their activity through the provision of flexible and affordable space. Table 1 summarises the impact.

Table 1. Impact of the location on the Babraham Research Campus: virtuals vs. other companies

	Virtual companies Average effect			Other companies Average effect	
	Mean	Median		Mean	Median
Accelerated scientific discovery by	6.5	6	Months	4.6	3
Accelerated fundraising by	5.5	4.5	Months	5.1	3
Increased fundraising to date by	19.5	12.5	%	7.9	10
Increase the number of employees by	4.2	0	%	28.1	20

Number of responses: 25 (6 virtual companies and 19 other companies)

Source: CBR.

Additional GVA and employment associated with the Campus

Additionality is the real increase in social value that would not have occurred in the absence of the intervention being evaluated, where in this case the intervention supported is the Babraham Research Campus. There are benefits to society, and thus an increase in social value, from increased scientific discovery since this will translate into improvements in health and the welfare of people in society in the United Kingdom, but also around the world. Increased quality of life and reduced mortality result. These can be valued. It is also the case that additional activity created on the Campus translates into GVA and employment.

A strict, *narrow* interpretation, of additionality would focus simply on whether the activity would otherwise have occurred with zero (no additionality) representing all of the activity would otherwise have occurred to 100% where all of the activity is totally additional. However, a *broader* interpretation should also include enhancements to quality of outcome and the ability of the intervention to speed things up. The evidence suggests that the Babraham Campus has been able to increase both *scale* and *speed* of delivery of the life-science product. It would be very unsurprising if it had not also improved *quality* as well, but that is inherently difficult to assess.

The study provided an assessment of the increase in GVA and employment associated with the Campus for the United Kingdom as a whole over broadly the period 2012-2018. This amounted to an *increase* in gross GVA of £206 million and increased employment of 800. On the basis of the *narrow* measure of additionality based on the views of the businesses on the Campus, *additional*

GVA would be of the order of £27 million. Evaluation Guidance varies on how long the GVA might be expected to persist and thus what should be the NPV. Research on the valuation land and property market benefits created or supported by Government intervention has adopted a ten year profile but it is obviously possible to adopt different profiles and adjust the NPV accordingly with a lower option being only five years. Using a ten year profile, which would seem appropriate given that the floorspace on the Campus is expected to continue to provide longer term benefit streams by its very nature, would suggest a NPV of about £198 million assuming discount rate of 6%.

This is the gross increase in GVA and employment and it is normal to allow for any displacement that might be associated with support for companies on the Babraham Campus leading to reduced activity on competing companies elsewhere in the local area and the rest of the United Kingdom. Given the nature of the high technology life science activity taking place on the Babraham Campus and considering it with other locations in the sub-region did not suggest that there was a high level of displacement in the standard sense as might be associated with manufacturing activity as an example. There are arguments that it is very low indeed at the local regional level-perhaps 10%. It is also not clear given the nature of the science being developed and its relative uniqueness to the Cambridge location that the displacement increases substantially at the level of the United Kingdom. Perhaps something like 20% might be appropriate. Taking an average of 15% and applying to the gross estimates of impact suggest benefits of around 169 million.

The public sector contribution to the Campus and its development

The Babraham Research Campus has been in public sector ownership since 1948. The switch to its current biological research specialisation of epigenetics, signalling and lymphocyte signalling occurred in 1993 and the move to the provision of more commercially orientated premises to accommodate bioscience companies dates from 1998. The BBSRC have invested around £66 million (and provided loans of approx.. £5.6 million) in research, people and vital national capabilities to further scientific knowledge, promote economic growth and job creation in important UK economic sectors.

It is not straight forward to assess the true level of overall public sector support that has underpinned the development of the Campus. A number of issues arise. The public sector has provided grants and loans to encourage the development of research and, in recent years, the economic development potential of the site (as in the case of the grant from the Regional Development Agency in 2002 (EEDA) for £1.95 million). The land is owned by the public sector and as the landowner the public sector could accrue ground rent, but is understood that this has only been at a pepper corn level to-date and there has thus been a level of public subsidy in this. On the credit side of the account the public sector has seen a very substantial increase in the value of the site compared to when it was used for agriculture and thus its return on the investment should it ever seek to realise it. It is also the case that the increased commercial development of the site has generated increased tax revenue to HM Exchequer.

A further important issue for is the period of time over which the payback from the public sector should be considered. It is to be remembered that part of the rationale for public sector support has been to encourage research that will provide health care benefits. Another part has been to enhance the economic development of the Life-Science sector and the benefits it provides to the Cambridge and United Kingdom economy. In both cases these benefits will emerge over many years. The evidence from the fourteen companies with established market value suggests that the total market

value of the campus companies has risen to over £4.1bn. The values range from £2.6 bn down to less than £5m. The largest fourteen companies in terms of market value have 10 in the range £15m to £99m; 3 between £100m and £500m; and one valued at £2.6bn. These values represent significant potential returns to the investors. The total market value of these largest fourteen companies at £4.1bn represents a 7.2 times return for investors, who have put in £636m in total. This ratio varies between 0.7 and 18.6 across the fourteen.

If the estimate of net economic impact of £169 million NPV is taken and put alongside the £61 million of direct research council grant the Benefit Cost Ratio is around 3 which is impressive. However, this estimate does not value the wider medical and health benefits that are and will continue to benefit society and is subject to the basic assumptions and limitations referred to above that the Campus may have helped increase the value of the companies on the Campus by £191m – a sizeable achievement. The research confirms that considerable value that can be realised by well targeted public sector investment in this extremely important sector to the future of the British economy and its citizens.

Introduction

10.1 The objective of this study has been to capture the benefits (economic, societal, people and business) that arise from the operation of the *whole* Babraham Research Campus, clearly identifying the role that it plays in the local and, where possible, national and international innovation landscape.

10.2 To assess the impact of the Babraham Research Campus has required a considerable amount of evidence to be collected and analysed. The approach has been to adopt an in-depth analysis of the companies that are based on the Campus and/ or use the Campus services. The contribution of the Campus to the local property, labour market, and the wider Cambridge innovation system has been assessed. A key focus has been to assess performance over time and to benchmark where possible performance using data from the local business cluster data base. Extensive use has been made of local property market data. The research has sought evidence from the Bioscience research community, University and other relevant Knowledge Based Institutes, Venture capitalists and funding organisations, representatives from local and central government, relevant support industries and representatives from the local community. In-depth case studies were also undertaken.

10.3 A key feature of the methodology adopted was to understand how the Campus and its development has created *additional* activity that would not otherwise of occurred in the absence of the Campus and the new public investment that was provided since 2012. The activity is additional if the public support provided to the Campus, and in particular since 2012, has overcome market and/ or institutional failures that would otherwise prevent it happening. If these market/institutional failures are generic to the whole of the United Kingdom in which case they could have been overcome by public policy support elsewhere. However, if the Cambridge location has attributes that are totally unique to it and not transferable elsewhere,

overcoming them in Cambridge provides genuinely additional outcomes to the United Kingdom economy and society overall.

10.4 This section brings together the study findings on the key impacts of the Campus presented in each Section of this Report. It considers the contribution of the Campus in relation to:

- The provision of high technology and commercial floorspace;
- The acceleration of the scientific discovery process;
- The acceleration of fundraising for life science companies;
- Increased GVA and employment.

Augmenting the provision of high technology and commercial floorspace

10.5 The Babraham Research Campus (BRC) has made a significant contribution to the Cambridgeshire high-technology and commercial property market, providing specialised start up and scale up space, with access to world-class facilities (e.g. laboratory space) and on lease terms tailored to the needs of start-up space. The evidence shows that combined with world-class biotechnology research via the Babraham Institute, the BRC provides a unique bioscience ecosystem that differentiates it from the many privately funded business parks that rely on purely commercial finance. It provides a mix start-up space designed for start-ups on flexible lease terms, which vary from what a commercial landlord would offer.

10.6 Comparing the Cambridge Southern Research Cluster with the South Cambridgeshire sub market provides a counterfactual benchmark and indicator of the 'value added' associated with the Southern Research Cluster and the BRC. The Southern Research Cluster has achieved significant uplift in net absorption and structurally lower vacancy than the South Cambridgeshire sub market. This analysis indicates that the Southern Research Cluster consistently performs better than its key counterfactual, the Southern Cambridgeshire Submarket, in net absorption (+7.0% per annum), vacancy (-4.0% on average) and delivery of new stock (+62,120 sq.ft per annum). This reflects an agglomeration effect arising from the concentration of R&D space and research institutes in the Southern Research Cluster (and tenants seeking to occupy and co-locate the BRC), compared to the broader South Cambridgeshire submarket:

10.7 One of the key characteristics, which differentiates the BRC from the broader market, is the provision of lab space, co-located with a public funded institute and flexible lease terms tailored to R&D start-ups. The BRC average lease term of 2.7 years is significantly below the average for other markets, while it achieves a rental rate (£31 per sq.ft) above other submarkets and research clusters. Thus, the Northern Cluster has an average lease term of 7.6 years at rent of £25 per sq.ft. The South Cambridgeshire Submarket has a lease term of 6.1 years at rent of £18 per sq.ft and the Southern Research Cluster (excluding BRC) has a lease term of 7.2 years at rent of £21 per sq.ft.

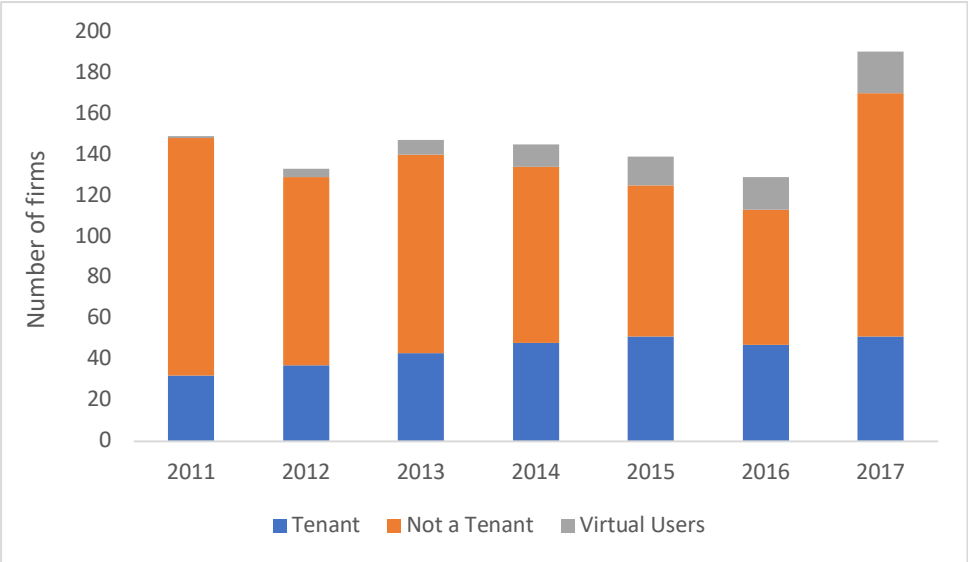
10.8 The combination of this public funding and investment in BRC, and the presence of the Babraham Institute, has had an impact on the property market outside the campus. *The evidence points to the public investment in Babraham helping to overcome a clear market failure the removal of which has led to faster growth in the Life Science sector in Cambridge.* In addition to the BRC, other research parks play a key role in anchoring the research clusters within Cambridge and providing start-up space to businesses developing technologies or products relevant to human healthcare and the pharmaceutical sector.

10.9 Businesses that started and developed through the BRC have left the campus once they outgrew their premises. This is one source of impact the BRC has on the surrounding property market by producing companies that take-up space in nearby business parks. The development of start-up and scale-up space that further concentrates R&D activity within the Southern Research Cluster will likely continue to have an agglomeration effect, attracting market interest not just in the BRC, but within other campuses located within the Southern Research Cluster.

Build-up of activity and economic impact (Evidence presented in Section 3).

10.10 A total of 577 companies were included in the impact study. Of these, some have joined after 2011 and some have already graduated and moved off the Campus. Figure 10.1 shows the profile of the companies on the Campus from 2011-17, illustrating the evolution of the Campus over time. On average, 30% of the firms associated with the Campus over 2011-17 are tenants on the Campus, while the majority are non-tenants. The proportion of non-tenants, however, fell from 78% to 63% over the last seven years, while the number of virtual users has increased from 1 user in 2011 to 20 users in 2017.

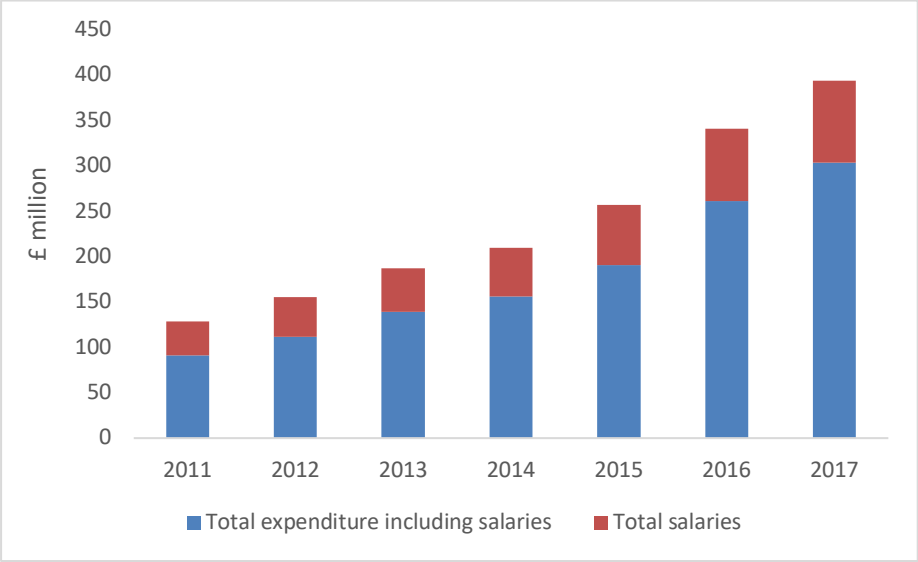
Figure 10.1 Types of companies on Babraham Research Campus, 2011-2017.



10.11 The operational impact of the Campus is estimated based on the total operational expenditure of the companies associated with the Campus, including the total salaries paid to

on-site employees. Figure 10.2 below shows how these expenditures have increased over time, with total expenditure from all companies associated with the Campus increasing from £91.1m in 2011/12 to £303.5m in 2017/18.

Figure 10.2. Evolution of the Campus expenditures from 2011-2017



Operational impact of the Campus

10.12 Table 10.1 presents the total gross economic impacts on the UK economy of the combined expenditure of tenants, non-tenants and virtual users from 2011-2017. In 2017/18, the companies associated with the Campus spent £303.5m on their operational activities, resulting in £119.9m direct GVA impact, which generated an additional £165.7m (indirect and induced) GVA impact of further activity elsewhere in the UK economy. The Campus directly supported 1,720 jobs on site, which, by generating activity elsewhere, supported an additional 2,555 jobs in the wider economy.

10.13 People working in sectors where the direct and indirect impacts took place going on to spend their wages and salaries is estimated to have created a large GVA (induced) impact (£111.4m). The composition of the direct, indirect and induced impacts are similar in the previous years.

Table 10.1. Total UK economic impacts from 2011-2017

	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18
GVA (£m)							
Direct	29.2	37.3	51.2	58.0	69.8	102.3	119.9
Indirect	14.3	18.1	23.3	26.3	31.7	46.1	54.3
Induced	36.1	43.6	52.8	59.0	72.5	96.5	111.4

Total	**79.6**	**99.1**	**127.2**	**143.3**	**173.9**	**244.9**	**285.7**
Employment (FTEs)							
Direct	870	996	1,131	1,211	1,348	1,481	1,717
Indirect	240	304	400	454	543	794	935
Induced	525	634	768	858	1,054	1,402	1,620
Total	**1,636**	**1,934**	**2,298**	**2,523**	**2,945**	**3,678**	**4,271**

10.14 The employment and GVA impacts can be summarised in terms of Type I and Type II multipliers. Type I multipliers captures the ratio of direct and indirect impacts to direct impacts, while Type II multipliers also include induced effects. Table 10.2 shows that this study finds that the operational activities of the Campus has a 1.5 Type I multiplier and 2.4 Type II multiplier. This means that every £1 of direct GVA associated with the Campus, generates an additional £0.50 in the rest of the economy through indirect impacts and an additional £1.40 through indirect and induced impacts. Table 10.3 compares the BRC multipliers with the estimated multipliers in other campus studies[29]. While the nature of each of these campuses are different and their impacts cannot be directly compared, the multipliers provide some comparison of the ability of the campuses to generate additional impacts in the wider economy. The table shows that the BRC has a similar Type I multiplier to the other campuses, but a much stronger Type II multiplier. This highlights that the indirect and induced impacts from every £1 of GVA associated with the BRC are estimated to be much larger than for the other campuses.

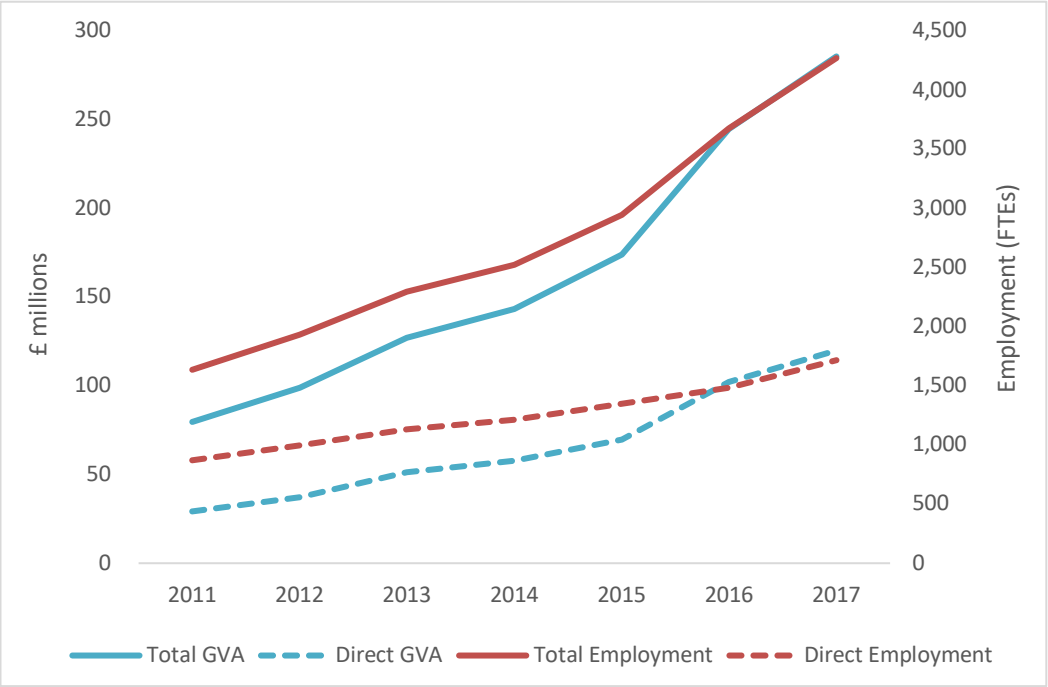
Table 10.3 Multipliers in comparator studies

	Type I multiplier	Type II multiplier
Babraham Research Campus (2017/18)	**1.5**	**2.4**
Babraham Institute (2011/12)	1.8	2.2
Sci Tech Daresbury Campus (2014/15)	1.4	1.6
Institute of Biology, Environmental and Rural Sciences (IBERS) (2012/13)	1.2	1.6
John Innes Centre (2011/12)	1.5	1.6
The Roslin Institute (2011/12)	1.5	1.2

[29] See Table 3 in Annex 1 for a comparison of economic impacts in the other studies.

10.15 The total gross GVA impact of the operational activities of the Campus on the UK economy has more than tripled over 2011-17, from £80m in 2011/12 to £286m in 2017/18. This is driven by a large increase in the direct GVA impacts over this period from £29m to £120m, and the number of on-site employment increasing by over 90% from 870 employees to 1,720 employees. Figure 10.3 shows that the direct employment and GVA impact of the Campus accounts for about 40-50% of the total employment and GVA impacts. The indirect and induced impacts from the additional activity generated from supply chains and income effects contribute to the majority of the total GVA impact of the Campus on the UK economy.

Figure 10.3 Evolution of GVA and Employment impacts over time



10.16 Spending on 'Scientific research and development services' has been the major driver of the GVA impacts on Campus, accounting for more than 40% of the overall direct GVA impact over 2011-17. Another important driver of GVA impacts in most of the years is 'Education services', which accounts for 10% of the total direct GVA impacts. Other sectors that have been estimated to benefit directly from the operations on the Campus include 'Financial services' and 'Computer programming, consultancy and related services', contributing 7% each to the direct GVA impact.

10.17 In 2017/18, a total spending of £303.5m by all the companies associated with the Campus supported 1,720 jobs on site and generated an additional 2,555 (indirect and induced) jobs elsewhere in the economy. 11% (295 jobs) of the indirect and induced jobs were in the 'Retail trade services' sector, an increase from 95 jobs in 2011/12. Another sector that benefited largely through the supply chain and the income impacts is 'Food and beverage serving services', which was estimated to deliver an additional 50 jobs in 2011/12 and 165 jobs in 2017/18. Other sectors that have also been estimated to receive a modest increase in employment from the indirect and induced impacts include 'Services to building and landscapes' (accounting for almost 6% of indirect and induced employment impacts) and 'Employment services' (accounting for 5%).

10.18 As mentioned in the introduction, the analysis estimates the gross economic impact of the Campus through its operational activities on the UK economy. Depending on the extent of the additionality of the Campus, the net impact is likely to be lower. These issues of additionality are discussed in the second part of this Section.

Impacts on business

Responses to the survey of Campus companies point to the support structure provided by the BRC as a key factor enabling these companies to make an impact in local, national and international ecosystems. The co-location of a vibrant community of start-up and scale-up companies with world-leading academic research from BI, as well as the opportunity for these companies to access a range of state-of-the-art scientific facilities made available by the Institute, are unique features of the BRC that differentiate it from other life sciences campuses in the UK.

The qualitative and quantitative analysis shows that companies located on the BRC have achieved remarkable growth over the past years and performed well against companies on other business and science parks in the Cambridge region. All of the R&D activity on the BRC is carried out by companies operating in the Life Science sector, with the Campus having one of the highest total R&D spend in Life Science in the entire Cambridge region over the last three years. Overall, R&D spend by companies on the BRC represents 15% of total R&D spend by Life Science companies located on any of the parks.

Impacts on the business

10.19 The BRC caters to a segment of companies (those in the early stage for incubation and with a view to an IPO) that is under-served both in the locale and UK. The uncertain viability and higher risk profile of such companies makes them unattractive as tenants of more commercially oriented science parks. Conversely, such science parks' offerings, of shell and core buildings on long leases, are unfavourable and unappealing to the companies. In that respect, a BBSRC-funded research campus such as the BRC fills what is otherwise a largely unoccupied niche in the UK innovation system. As a publicly funded venture, there would appear to be a market failure that the BRC is helping to address.

10.20 Consequently, when asked, the interviewees were of the view that growth would have been more difficult in the absence of the BRC because of the likely lack of available space and/or the greater time and effort needed to find space. Other advantages of a campus

like the BRC were noted, if not acknowledged, but these appear largely secondary to access to appropriate facilities.

10.21 Given the cited difficulties in finding appropriate space, interviewees were on common ground about the need for the BRC to simply provide more similar space, rather than consider branching out to support other parts of the UK bioscience innovation pipeline. The nature of the constraints at the present time leads to sheer lack of space that interviewees consider as a priority to be addressed. Moreover, there was some suggestion that diversification may, possibly, dilute some of the secondary benefits of the BRC, especially in terms of how a group of companies at a similar stage of development might be fostering an appealing working environment for company employees.

10.22 The uniqueness of the BRC in the current ecosystem would seem to be that it provides something that remains in the short supply in the area (as well as the wider UK): space for early-stage companies that is fit for purpose and available on reasonable lease terms.

Evidence in relation to the investor community

10.23 BRC has played a central role in facilitating the fundraising activity of Campus companies. The results from our follow-up survey on additionality show that four out of five respondents view their location on the BRC as either a slightly important, important, very important or critically important factor in facilitating their fundraising. These companies estimate that being located on the Campus has accelerated their fundraising by three months and increased the amount of funds they have been able to raise to date by 10.0%.

10.24 These findings suggest that the supportive experience provided by the BRC has had important benefits for the fundraising activity of Campus companies. Among the different ways through which the Campus provides support to companies in accessing finance is the Babraham Investor Conference (BIC), a one-day conference for investors taking place on the Campus. BIC, which has now reached its 10th edition and is organised by BBT, is aimed at investors with a focus on early-stage and scale-up life science and med-tech companies from across the UK and Europe.

10.25 In light of the impact that their location on the BRC has had on Campus companies' fundraising, it is useful to examine how the Campus compares with other business and science parks in the Cambridge region with regard to the fundraising activity of the companies that are located on them. Among business and science parks in the Cambridge region, the BRC has the highest amount of funding raised by companies over the past three years. This amount accounts for over a quarter of the total funding that has been raised by companies on business and science parks during that period.

10.26 Over the last three years, around two-thirds of Campus companies have raised funds, compared with an average across the whole group of 38%. Similar figures are found

for Chesterford Research Park (65%), Cambridge Research Park (67%) and Cambridge Science Park (61%), while significantly lower is the proportion of companies raising funds that are located on the St John's Innovation Centre (38%). Together with Chesterford Research Park and Cambridge Research Park, the average annual amount raised by Campus companies in the past three years is one of the highest among all business and science parks.

10.27 The funds raised by Campus companies during the last three years are concentrated in the Life Science sector, with the BRC alone contributing approximately 47% of total funding raised by Life Science companies operating on business and science parks. Similar are the figures for the Wellcome Genome Campus (100%) and Chesterford Research Park (99%), though companies located on these parks have raised a considerably lower amount of funds compared with those on the BRC.

10.28 Two parks. that appear to be substantially different from the BRC in relation to the sectoral composition of their companies are the Cambridge Science Park and St John's Innovation Centre. Funding raised on these parks tends to come primarily from companies operating in the ICT and Other KI sectors.

10.29 Collectively, our findings point to the key role that the BRC plays in attracting large commercial investment into the wider Cambridge life science cluster.

Evidence on the scale of investment in Campus companies and investor returns

10.30 The evidence from the fourteen companies with established market value suggests that the total market value of the campus companies has risen to over £4.1bn. The values range from £2.6 bn down to less than £5m. The largest fourteen companies in terms of market value have 10 in the range £15m to £99m; 3 between £100m and £500m; and one valued at £2.6bn. These values represent significant potential returns to the investors. The total market value of these largest fourteen companies at £4.1bn represents a 7.2 times return for investors, who have put in £636m in total. This ratio varies between 0.7 and 18.6 across the fourteen.

10.31 The question of the scale of the value-added provided to the companies by their location on the Babraham Campus is even more difficult to answer. However, our estimates suggest a contribution to the growth in value of these companies at £191m – a sizeable achievement.

10.32 The BRC has attracted a significant amount of commercial investment over the last decade. Overall, our survey of Campus companies shows that they have raised over £1.2bn to date, of which more than £300m funding was received in the last year. There is evidence that the attractiveness of Campus companies among life science and other investors has increased over time.

10.33 Our analysis suggests that, for the majority of the companies selected, ownership has become more dispersed during the last five years. These results can be taken as evidence that companies on the BRC have been able to raise funds from an increasing number of investors, who are attracted by the returns that these companies may generate. The results show that companies on the BRC have been able to attract funding from a wide range of world-leading life science and technology investors, including IP Group, Atlas Venture, Merck Ventures, SV Health Investors and Index Ventures. These investors have supported Campus companies at different stages of their growth, from seed financing to Series B and C rounds.

10.34 Fundraising by the largest Campus companies has been facilitated further by the extensive support provided by the University of Cambridge, primarily through Cambridge Enterprise, its commercialisation arm, and Cambridge Innovation Capital, a preferred investor for the University.

Evidence on scientific impact

10.35 According to its mission, the Babraham Institute "undertakes world-leading research into understanding the biology of how our bodies work, including what changes as we age and during disease." This is in line with the BBSRC Strategic Priority 'Bioscience for Health'. It is a bioscience research institute engaged in fundamental research with a clear 'academic' culture of discovery. A critical expertise is focused on three Institute Strategic Programmes (ISPs) in **Immunology, Signalling, and Epigenetics.** This is driven by scientific advisory boards and a pragmatic top-down control of the direction of research, with the ability to recruit a critical number of world leading and emerging group leaders with the desired scientific focus, moderated by the freedom in their research to be innovative. The Institute's research is serviced by world class facilities and core expertise that is an essential component in the make-up and success of BI. The body of new knowledge and innovation, as evidenced by publication, IP agreement and translation (including through Campus Company set up) combines to create an output and contribution to the understanding of ageing that is greater than the sum of the parts.

Evidence on impact on innovation system

The contribution of the Babraham Campus to the overall Cambridge innovation system was assessed by consulting widely across the Bioscience research community, University and other relevant Knowledge Based Institutes, Venture capitalists, public and charitable funding organisations, Campus tenants and selected other businesses, representatives from local and central government and relevant support industries.

- The contribution of the Campus in the provision of new start-up and accelerator space was widely acknowledged and it was considered that it was overcoming constraints in the provision of space and facilities;
- In relation to finance, its ability to enhance the flow of funds going into life science companies was considered to be very extensive, particularly in attracting funds from Research Councils;

- The Campus was regarded as providing a strong contribution to the commercialisation of Life Science research, but also the Life Science knowledge base were the most highly rated factors. Enabling entrepreneur driven businesses to form, enabling collaboration and new academic spin-outs were highlighted;
- The Campus was considered to be making a strong contribution to UK Life Sciences, particularly in generating jobs, enhancing the sector skill base and increasing the global impact and value from UK science;
- When compared with other UK campuses Babraham compared very favourably, particularly in relation to its support Life Science businesses which was most highly rated;
- In terms of its contribution to the overall Cambridgeshire sub-region, building the capacity of the overall Life Science cluster was considered the most important effect overall with expanding the Life Science knowledge base also highly rated by all respondents;

Estimating the additionality of the BRC to business growth

10.36 A key component of the overall research methodology was to assess the extra business activity associated with the Campus and thus the public investment that helped build its infrastructure. The evidence from the in-depth analysis of the Cambridgeshire property market is clear that the Campus has met a market need that was being imperfectly addressed. The views from the core stakeholders in the innovation system reinforce this view and so does the evidence summarised in Section eight from the Case Study companies. This section examines the full set of results obtained from the study survey of tenants on the Campus to establish their views. The response from tenants to the business survey was very high and this provides a high level of confidence in the reliability of the responses. This section analyses the views of the tenants on the additionality of the BRC to the start-up and scale-up companies that are located on it. And it considers perceived additionality in relation to four main outcomes. These are:

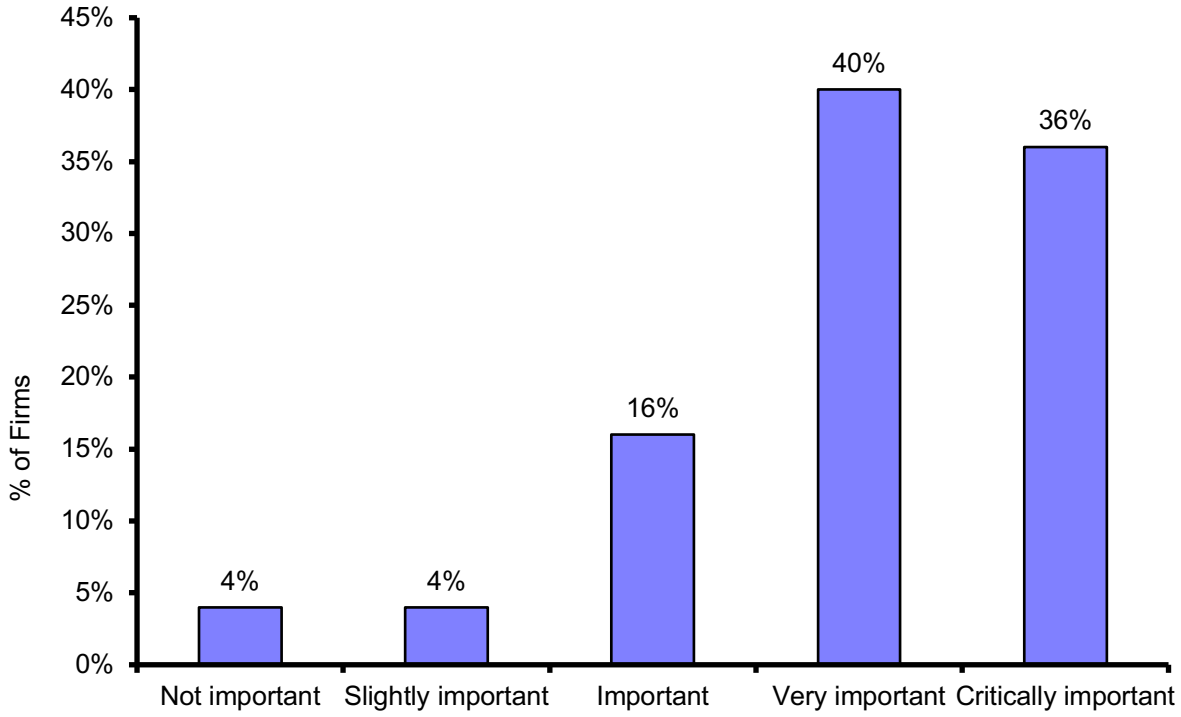
- Providing flexible and affordable space.
- Accelerating scientific advances.
- Facilitating fundraising.
- Increasing the number of employees.

10.37 Campus companies were asked to reflect on how being located on the BRC has benefited their business in relation to each of the four outcomes listed above. The importance of each outcome was measured on a scale of 1 (Not important) to 5 (Critically important).

Providing flexible and affordable space

10.38 The extent to which the BRC has made a difference to Campus companies through the provision of flexible and affordable premises has been examined. The responses to this question are presented in Figure 10.4.

Figure 10.4 Importance of being on the Babraham Research Campus for flexible and affordable space



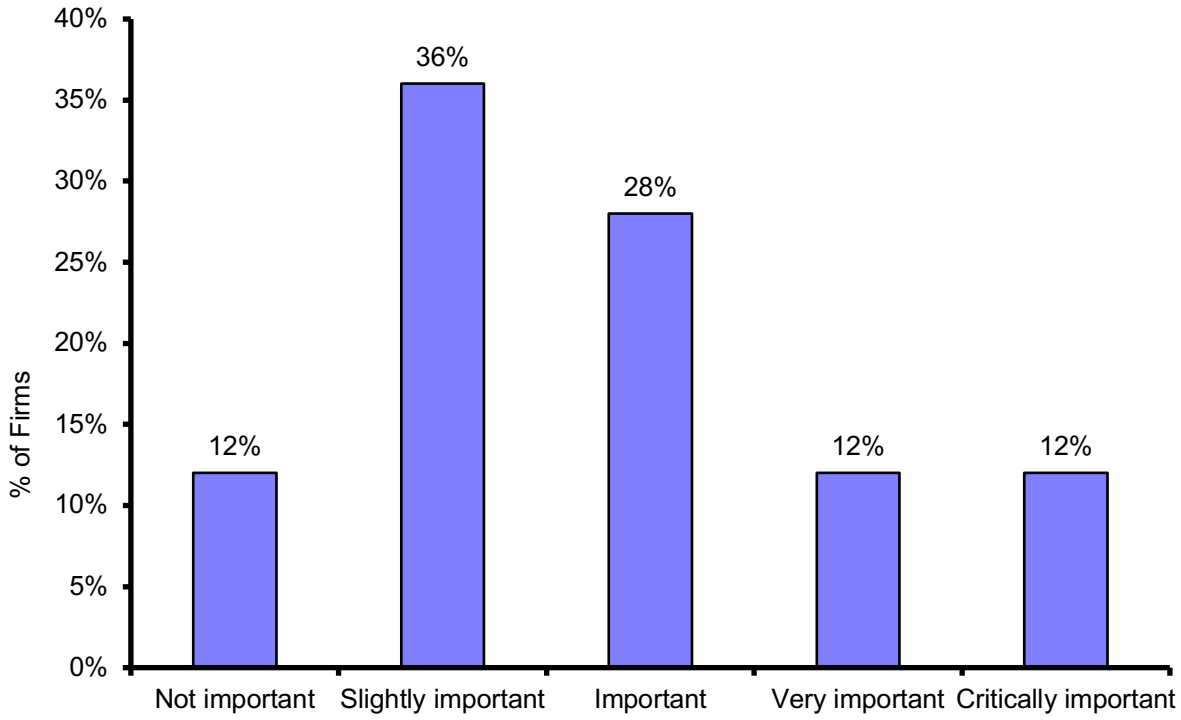
Number of responses: 25
Source: CBR.

10.39 Over 75% of Campus companies consider their location on the BRC as either a very important or critically important factor in helping them access laboratory and office space on flexible and affordable terms. This result reinforces the findings from our main survey of Campus companies, which point to the availability of suitable premises on flexible lease terms as one of the major benefits these companies derive from being located on the Campus.

Accelerating scientific advances

10.40 About 88% of survey respondents indicated that being located on the BRC has had some importance in accelerating their scientific advances, with more than half of respondents stating that the their location has been either an important, very important or critically important factor for the speed of their scientific discovery process (Figure 10.5).

Figure 10.5 Importance of being on the Babraham Research Campus for accelerating scientific advances

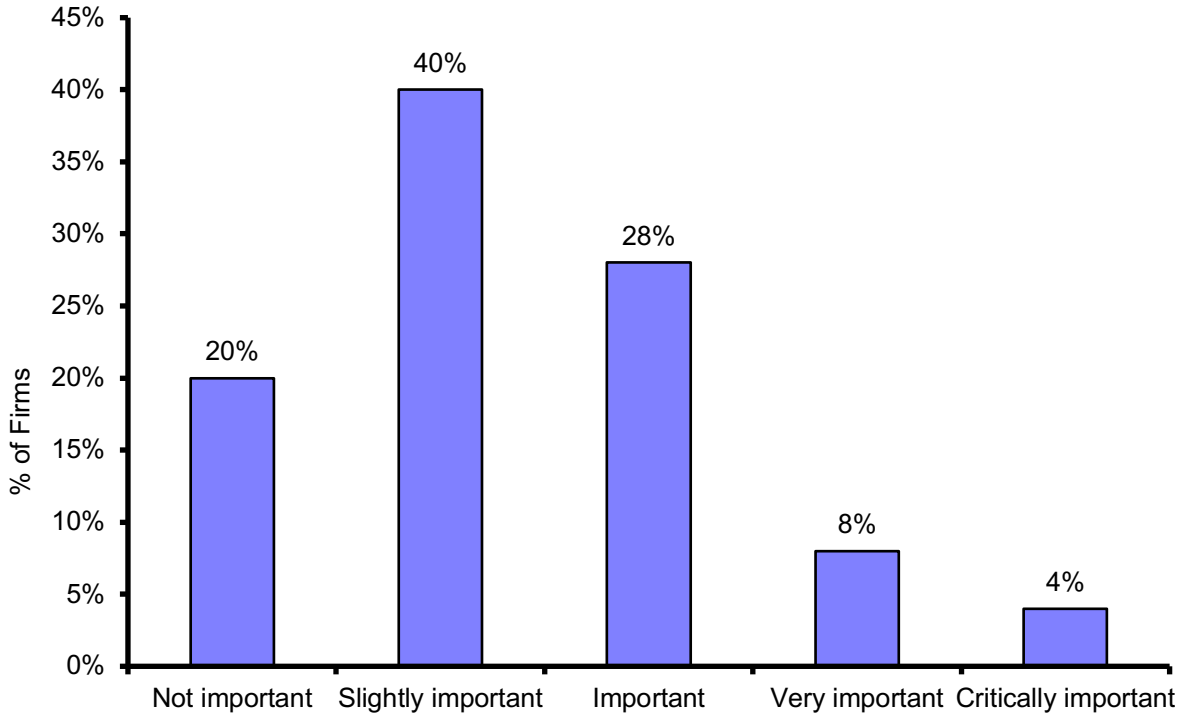


Number of responses: 25
Source: CBR.

Facilitating fundraising

10.41 The importance of being located on the BRC for facilitating fundraising as identified by Campus companies is illustrated in Figure 10.6. Four out of five respondents perceive that operating on the BRC has facilitated their fundraising activity. Their location on the Campus is regarded as either a very important or critically important factor by 12% of respondents, suggesting that the supportive experience provided by the BRC and being at the heart of the Cambridge cluster may have made access to finance by Campus companies easier than it would have been otherwise.

Figure 10.6 Importance of being on the Babraham Research Campus for facilitating fundraising

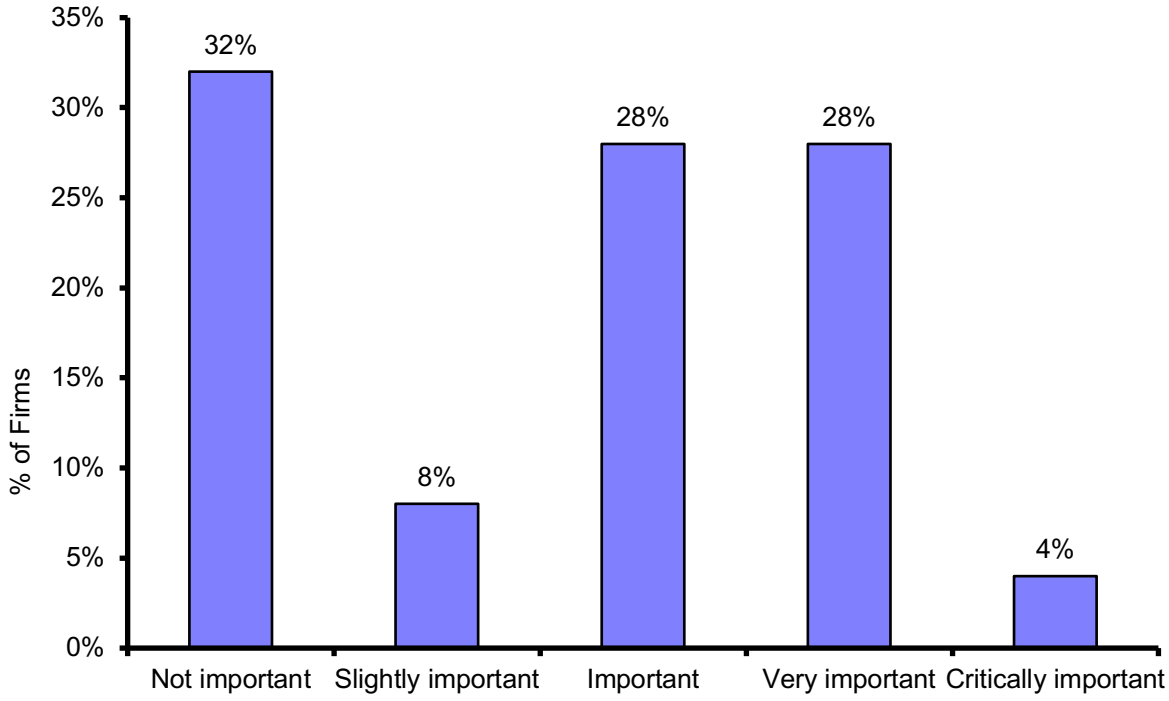


Number of responses: 25
Source: CBR.

Increasing the number of employees

10.42 Figure 10.7 shows the extent to which Campus companies feel their location on the BRC has been important in increasing their number of employees. Approximately two out of three respondents view their location as either a slightly important, important, very important or critically important factor in supporting their employment growth. About a third of respondents do not perceive that being located on the BRC has enabled them to increase the number of employees, though this figure tends to reflect responses from virtual companies with no physical presence on the Campus. Collectively, these results suggest that being located on the BRC has benefited Campus companies' ability to grow and attract talent.

Figure 10.7 Importance of being on the Babraham Research Campus for increasing the number of employees



Number of responses: 25
Source: CBR.

Summary of findings

10.43 Table 10.2 provides the mean and median values for each of the four outcomes assessed in this study, considering all companies that replied to our follow-up survey together.

Table 10.2 Impact of the location on the Babraham Research Campus: all companies

	Average effect		
	Mean	Median	
Accelerated scientific discovery by	5.1	3	months
Accelerated fundraising by	5.2	3	months
Increased fundraising to date by	11.4	10	%
Increase the number of employees by	21.6	10	%

Number of responses: 25

Source: CBR.

10.44 Focusing on median values, the 25 companies that returned our additionality questionnaire estimate that being located on the BRC has accelerated both their scientific discovery process and fundraising activity by three months. Along with the speed with which

they have been able to raise funds, their location on the Campus has benefited companies by increasing their amount of fundraising by 10.0%. A similar effect is found in terms of employee numbers, with the average impact reaching 21.6% if one looks at the mean rather than the median value.

10.45 Since the average effects for employment may be affected by responses from virtuals, Table 10.4 below splits the estimates made by Campus companies of the impact of the BRC on their business into those from virtuals and those from other companies.

Table 10.4 Impact of the location on the Babraham Research Campus: virtuals vs. other companies

	Virtual companies Average effect			Other companies Average effect	
	Mean	Median		Mean	Median
Accelerated scientific discovery by	6.5	6	Months	4.6	3
Accelerated fundraising by	5.5	4.5	Months	5.1	3
Increased fundraising to date by	19.5	12.5	%	7.9	10
Increase the number of employees by	4.2	0	%	28.1	20

Number of responses: 25 (6 virtual companies and 19 other companies)

Source: CBR.

10.46 The results show that both virtuals and other companies feel their location on the BRC has benefited their scientific discovery process and fundraising activity significantly. The estimates of impact are particularly large for virtual companies, which may be explained by the fact that these companies tend to be younger compared with other companies on the Campus. Once virtuals are excluded from the sample, the number of employees is estimated to be 20% larger as a consequence of being located on the BRC than it would be otherwise.

10.47 Taken together, our findings suggest that being located on the BRC has brought additional value to Campus companies by increasing both the speed and scale of their activity through the provision of flexible and affordable space.

Additional GVA and employment associated with the Campus

10.48 Additionality is the real increase in social value that would not have occurred in the absence of the intervention being evaluated, where in this case the intervention supported is the Babraham Research Campus. There are benefits to society, and thus an increase in social value, from increased scientific discovery since this will translate into improvements in health and the welfare of people in society in the United Kingdom, but also around the world.

Increased quality of life and reduced mortality result. These can be valued. It is also the case that additional activity created on the Campus translates into GVA and employment.

10.49 A strict, *narrow* interpretation, of additionality would focus simply on whether the activity would otherwise have occurred with zero (no additionality) representing all of the activity would otherwise have occurred to 100% where all of the activity is totally additional. However, a *broader* interpretation should also include enhancements to quality of outcome and the ability of the intervention to speed things up. The evidence suggests that the Babraham Campus has been able to increase both *scale* and *speed* of delivery of the life-science product. It would be very unsurprising if it had not also improved *quality* as well, but that is inherently difficult to assess.

10.50 The study provided an assessment of the increase in GVA and employment associated with the Campus for the United Kingdom as a whole over broadly the period 2012-2018. This amounted to an *increase* in gross GVA of £206 million and increased employment of 800. On the basis of the *narrow* measure of additionality based on the views of the businesses on the Campus, *additional* GVA would be of the order of £27 million. Evaluation Guidance varies on how long the GVA might be expected to persist and thus what should be the NPV. Research on the valuation land and property market benefits created or supported by Government intervention has adopted a ten year profile but it is obviously possible to adopt different profiles and adjust the NPV accordingly with a lower option being only five years. Using a ten year profile, which would seem appropriate given that the floorspace on the Campus is expected to continue to provide longer term benefit streams by its very nature, would suggest a NPV of about £198 million assuming discount rate of 6%.

10.51 This is the gross increase in GVA and employment and it is normal to allow for any displacement that might be associated with support for companies on the Babraham Campus leading to reduced activity on competing companies elsewhere in the local area and the rest of the United Kingdom. Given the nature of the high technology life science activity taking place on the Babraham Campus and considering it with other locations in the sub-region did not suggest that there was a high level of displacement in the standard sense as might be associated with manufacturing activity as an example. There are arguments that it is very low indeed at the local regional level-perhaps 10%. It is also not clear given the nature of the science being developed and its relative uniqueness to the Cambridge location that the displacement increases substantially at the level of the United Kingdom. Perhaps something like 20% might be appropriate. Taking an average of 15% and applying to the gross estimates of impact suggest benefits of around 169 million.

The public sector contribution to the Campus and its development

10.52 The Babraham Research Campus has been in public sector ownership since 1948. The switch to its current biological research specialisation of epigenetics, signalling and lymphocyte signalling occurred in 1993 and the move to the provision of more commercially orientated premises to accommodate bioscience companies dates from 1998 as the timeline

of development in Figure 2.1 Section 2 showed. Chart 10.1 provides an indication of development since 1998, showing when the public sector has provided funding to assist the development process. The BBSRC have provided grants and of around 61 million and loans of around £5.6 million.

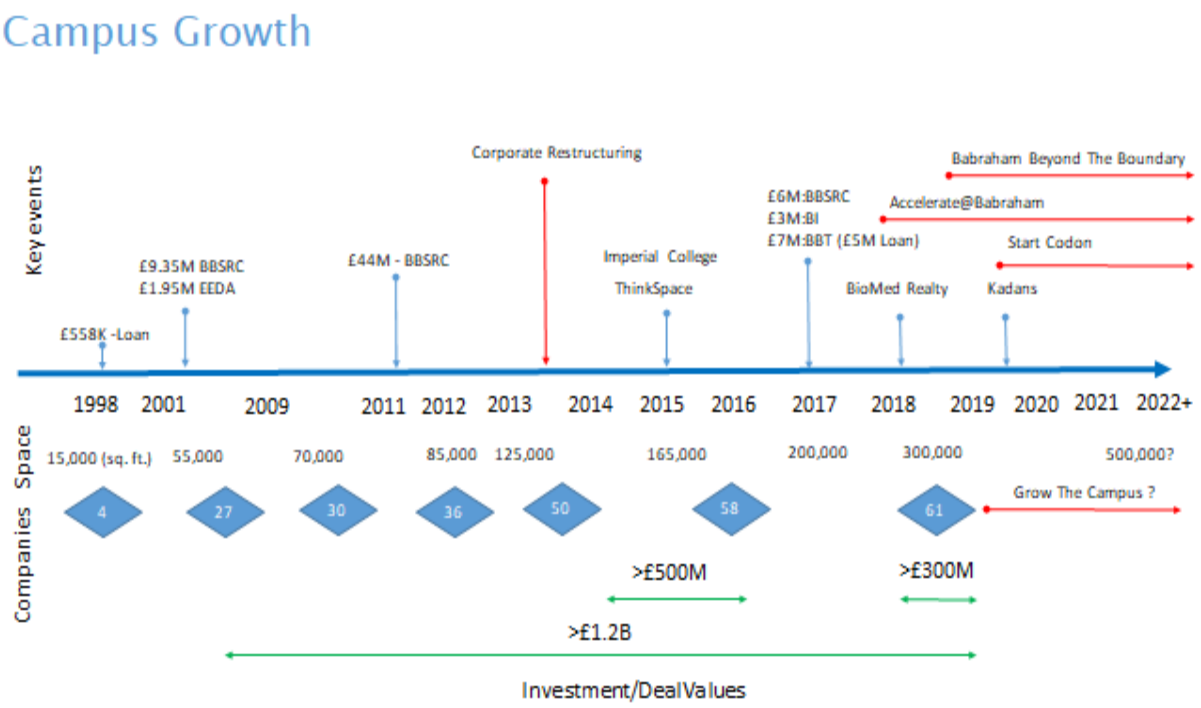
10.53 It is not straight forward to assess the true level of overall public sector support that has underpinned the development of the Campus. A number of issues arise. The public sector has provided grants and loans to encourage the development of research and, in recent years, the economic development potential of the site (as in the case of the grant from the Regional Development Agency in 2002 (EEDA) for £1.95 million). The land is owned by the public sector and as the landowner the public sector could accrue ground rent, but is understood that this has only been at a pepper corn level to-date and there has thus been a level of public subsidy in this. On the credit side of the account the public sector has seen a very substantial increase in the value of the site compared to when it was used for agriculture and thus its return on the investment should it ever seek to realise it. It is also the case that the increased commercial development of the site has generated increased tax revenue to HM Exchequer.

A further important issue for is the period of time over which the payback from the public sector should be considered. It is to be remembered that part of the rationale for public sector support has been to encourage research that will provide health care benefits. Another part has been to enhance the economic development of the Life-Science sector and the benefits it provides to the Cambridge and United Kingdom economy. In both cases these benefits will emerge over many years. The values range from £2.6 bn down to less than £5m. The largest fourteen companies in terms of market value have 10 in the range £15m to £99m; 3 between £100m and £500m; and one valued at £2.6bn. These values represent significant potential returns to the investors. The total market value of these largest fourteen companies at £4.1bn represents a 7.2 times return for investors, who have put in £636m in total. This ratio varies between 0.7 and 18.6 across the fourteen.

10.54 If the estimate of net economic impact of £169 million NPV is taken and put alongside the £61 million of direct research council grant the Benefit Cost Ratio is around 3 which is impressive. However, this estimate does not value the wider medical and health benefits that are and will continue to benefit society and is subject to the basic assumptions and limitations referred to above that the Campus may have helped increase the value of the companies on the Campus by £191m – a sizeable achievement.

10.55 The research confirms the considerable value can be realised by well targeted public sector investment in this extremely important sector to the future of the British economy and its citizens.

Chart 10.1 The Growth of the Babraham Campus 1998-2019 and the Scale of Public Sector Investment.



11. Moving Forward: Issues for Future Strategy and the Assessment of Campus Performance and Impact

Issues of relevance for the future strategic development of the Campus

The Babraham Research Campus (BRC) has made a significant contribution to the Cambridgeshire property market, providing specialised start up and scale up space, with access to world-class facilities (e.g. laboratory space) and on lease terms tailored to the needs of start-up space. Combined with world-class biotechnology research via the Babraham Institute, the BRC provides a unique bioscience ecosystem that differentiates it from the many privately funded business parks that rely on purely commercial finance. The role of the BBSRC (and, by extension, the government) as a funder and public bearer of risk was considered pivotal in focusing the BRC's offer. As our property market analysis shows, the availability of this space is low both in the area and in the UK;

The overarching conclusion is that the BRC occupies a vital niche in the UK bioscience innovation system. There does not seem evidence that this is being filled in the same way elsewhere and the conclusion is that the basic model is generating additional outcomes for the Cambridge Life Science cluster and gains to the overall UK Life Science sector. This finding suggests that there are significant gains to the UK from seeking to expand activity on the Campus;

It is important to emphasise, however, that during the research a number of other factors were identified by companies that have an influence of their possible future expansion, some of which cannot be directly influenced by BBT. Thus, the local labour market is seemingly strong but with some suggestion that worker mobility is lower than in, say, the US. The cost of housing and the quality of (and restrictions on) surrounding transport infrastructure may also be a hindrance. Moreover, the Cambridge Life science innovation system is physically fragmented across a considerably number of sites compared to a location like Kendall Square in Boston. Babraham's close proximity to the Addenbrookes's Bioscience Campus and others would be much enhanced if there was a better overall integrated transport system, perhaps involving a significant element of rail.

A performance measurement system for the Campus

One of the objectives of the Study was to make recommendations on how the performance and impact of the Campus might continue to be monitored and assessed in the future. Having now completed the Impact Study the consultants have been able to review the information that is currently collected and the existing monitoring systems. In moving forward, it is recommended that an output and impact measurement framework is put in place that builds on the core pathways identified in this study. Namely:

- Quantifying the direct, indirect and induced economic impact of the Campus
- Quantifying wider business impacts
- Assessing the scale of investment in Campus companies and Investors returns
- Assessing contribution to science, knowledge and health
- Assessing impact on the Cambridgeshire innovation system
- Assessing impact and relationship to the Cambridge property market.

Introduction

11.1 During the course of the study it has been possible to identify a number of key issues that are of relevance for the future strategic development of the Campus. The first part of this Section considers these.

11.2 The second part of this Section makes recommendations as to how BBT might continue to assess the performance of the Campus and its impact on Cambridge and the development of the UK Life Science sector.

Issues of relevance for the future strategic development of the Campus

In considering the direction of future strategy for the Campus we would point to the following key conclusions reported in this impact study.

- The Babraham Research Campus (BRC) has made a significant contribution to the Cambridgeshire property market, providing specialised start up and scale up space, with access to world-class facilities (e.g. laboratory space) and on lease terms tailored to the needs of start-up space. Combined with world-class biotechnology research via the Babraham Institute, the BRC provides a unique bioscience ecosystem that differentiates it from the many privately funded business parks that rely on purely commercial finance;
- BRC is a place where early-stage bioscience companies can find pre-fitted space and facilities on more suitable lease terms, of 3-4 years, than on offer on other, more privately institutionally funded campuses, where the leases are longer (e.g. ten years) and companies must completely fit out the space themselves. The Babraham arrangements better suit start-ups because they recognise the riskier nature of the high-technology based ventures (there is less certainty that such companies will still be around in ten years' time), the relatively long-pay back periods involved and help lower the barrier to starting up by avoiding companies having to spend as much money to get their facilities fit for purpose (though some outlay may still be required to modify the space). This consequence of having access to such space is that companies can focus on the research and its possible commercialisation more quickly. This is conducive to their development, especially given their funding and risk. Such flexibility is vital to these companies and this also extends to the ability to rent equipment and, if needed, operators. We would point to the findings from the survey of tenants:

  'The availability of premises suited to their needs is regarded by Campus companies as the most important property-related reason behind their decision to locate on the BRC (75.8%). The flexibility of lease terms also scores highly (48.5%), whereas the affordability of Campus premises does not tend to be regarded as a major reason attracting companies to the site (15.2%). These results suggest that Campus companies may be willing to pay a relatively high rent to have suitable laboratory and office space on flexible lease terms on the BRC' (Section 4, this Report).

- The implication is that the availability of suitable space on favourable terms helps to avoid financial and administrative distractions that might come at the expense of the science and its commercialisation. This is even more important to such companies in the United Kingdom given the more limited funding available to them compared to their US counterparts. More limited financial resources elevate the need to use those resources more carefully and the difference in funds is substantial between completely fitting out a space and modifying existing space;

- Science parks such as Granta Park and Chesterford Research Park are privately

financed. The underlying business model adopted there is to seek a consistent, stable financial return over time and the tenants. Accordingly, tenant companies must themselves be more certain of their futures to be able to commit to longer leases. That stability is typically a product of size and proven market performance such that companies are better equipped to fit out their (larger) space to meet their specific needs.

- Responses to our Business survey of Campus tenant companies also point to the support structure provided by the BRC as a key factor enabling them to make an impact in local, national and international ecosystems. The co-location of a vibrant community of start-up and scale-up companies with world-leading academic research from BI, as well as the opportunity for these companies to access a range of state-of-the-art scientific facilities made available by the Institute, are unique features of the BRC that differentiate it from some of the other life sciences campuses in the UK;

- The role of the BBSRC (and, by extension, the government) as a funder and public bearer of risk was considered pivotal in focusing the BRC's offer. As our property market analysis shows, the availability of this space is low both in the area and in the UK;

- Our qualitative and quantitative analyses show that companies located on the BRC have achieved remarkable growth over the past years and performed well against companies on other business and science parks in the Cambridge region. All of the R&D activity on the BRC is carried out by companies operating in the Life Science sector, with the Campus having one of the highest total R&D spend in Life Science in the entire Cambridge region over the last three years. Overall, R&D spend by companies on the BRC represents 15% of total R&D spend by Life Science companies located on any of the parks (Section 4, this Report).

- The overarching conclusion is that the BRC occupies a vital niche in the UK bioscience innovation system. There does not seem evidence that this is being filled in the same way elsewhere and the conclusion is that the basic model is generating additional outcomes for the Cambridge Life Science cluster and gains to the overall UK Life Science sector. This finding suggests that there are significant gains to the UK from seeking to expand activity on the Campus;

- It is important to emphasise, however, that during the research a number of other factors were identified by companies that have an influence of their possible future expansion, some of which cannot be directly influenced by BBT. Thus, the local labour market is seemingly strong but with some suggestion that worker mobility is lower than in, say, the US. The cost of housing and the quality of (and restrictions on) surrounding transport infrastructure may also be a hindrance. Moreover, the Cambridge Life science innovation system is physically fragmented across a considerably number of sites compared to a location like Kendall Park in Boston. Babraham's close proximity to the Addenbrookes's Bioscience Campus and others would be much enhanced if there was a better overall integrated transport system, perhaps involving a significant element of rail.

A performance measurement system for the Campus

11.3 One of the objectives of the Study was to make recommendations on how the performance and impact of the Campus might continue to be monitored and assessed in the future. Having now completed the Impact Study the consultants have been able to review the information that is currently collected and the existing monitoring systems. In moving forward, it is recommended that an output and impact measurement framework is put in place that builds on the core pathways identified in this study. Namely:

- Quantifying the direct, indirect and induced economic impact of the Campus
- Quantifying wider business impacts
- Assessing the scale of investment in Campus companies and Investors returns
- Assessing contribution to science, knowledge and health
- Assessing impact on the Cambridgeshire innovation system
- Assessing impact and relationship to the Cambridge property market.

Quantifying the direct, indirect and induced economic impacts

11.4 The objective is to track and up-date on an annual basis Figure 3.1, in Section 3 and repeated in Section 10, on the direct, indirect and induced economic impacts from the Campus and its activities. Section 3 outlined the data currently collected by BBT and other data that the Consultants had to seek from other sources. There are therefore areas where there is a need to augment the data and where some further data acquisition might be appropriate. Annex 5 refers.

Quantifying Business impacts

11.5 Section 4 of the Report showed how a Business Survey Research tool could be used to acquire an extensive body of data that enables considerable insight into the economic behaviour of the companies on the Campus. Much of the information was derived from questionnaires completed by the companies. Appendix 3 shows the questionnaire that was used. The advantage of the approach was that the data obtained could be helpfully compared with other data that has now been compiled in the Cambridge Cluster Mapping system.

11.6 We recommend that the main questionnaire should be completed by new tenant companies and updated by others every few years (perhaps associated with lease renewals). The only information that we recommend should be updated annually are those derived from questions 4, 12 and 15 concerning current and future employment; funding raised; and R&D spent. The last two elements can be discerned from company accounts, or from the companies.

11.7 This approach would allow the database and associated tables to be updated. The relevant tables and figures in this Report that could be updated in this way are: Tables 4.1, 4.2, 4.3 and 4.8; and Figures 4.1 to 4.12 inclusive (with the exception of Figure 4.5).

Assessing scale of investment and investor returns

11.8 As Section 5 of this Report showed, it is also possible to use the Tenant Business Survey to obtain information on tenant investment. The survey is combined with information publicly available as described in Section 5, some of which is currently obtained by BRC from an existing Company Data provider. Again, information can be compared with data emerging from the Cambridge Business Cluster Map data base.

Contribution to science, knowledge and health

11.9 The evaluation of the Babraham Institute brought together a number of performance indicators under five broad headings:

1) Academic contribution (including Publications, Researchers, Citations of Group Leaders and Academic Collaboration)
2) Commercial contribution (including BI Annual Income, Grant Funding, Commercial Collaboration and Key Consultancy, Collaboration & IP)
3) Science services (Income from Outside for BI Facilities Etc. and Internal Use of Science Facilities)
4) Contribution to people and skills (Destination of Leavers, Training and Public Engagement Events)
5) Other (Other KEC)

11.10 Our recommendation is that these indicators should be continued (perhaps with some minor pruning) since they provide robust long-run measures of the performance of the Babraham Institute. The measures are summarised in the Appendix 5 in this Report.

Impact on Cambridgeshire innovation system

11.11 Section 7 presented the findings from an on-line Survey Based Survey tool that enabled a considerable amount of evidence to be obtained from stakeholders in the Local Innovation System. It is recommended that at two yearly intervals this survey be up-dated. However, a clear finding from the Scoping Study research that was undertaken in preparation for this Impact Study was the need to have agreed data sharing protocols in place between BBT and the Consultants. This is essentially in the light of the new GDPR requirements.

11.12 Sections 2 and 8 of this Report presented the relevant property market data on E1 – Office / R&D Clusters in the Cambridgeshire sub-region broken down according to Cambridge Prime Central, City Centre Periphery, South Cambridgeshire and further differentiation Southern Research Cluster (including the BRC) and a Northern Research Cluster. The Consultants suggest that it would be helpful if BBT continued to track property market trends using this mapping.

Annexes

Annex 1. Details of the Input Output Methodology

Direct, indirect and induced effects; terminology.

The Multiplier tool is developed by Cambridge Econometrics (CE) based on the multiplier effect theory which suggests that output and employment in one sector (the direct effect) creates additional output and employment in its supply chain (the indirect effect) as well as other parts of the economy in which workers spend their wages and salaries (induced effect).

Employment in the subsectors of Bioscience was converted into direct output using ratios calculated by CE from the UK Input-Output Table. Coefficients used in the tool to quantify backward linkages between sectors were also calculated from the Input-Output Table by dividing intermediate demand by gross output to get the breakdown of inputs to one unit of output.

Using the direct output data and the Type I and Type II Leontief Inverse Matrices, the tool calculates the economic impacts of Bioscience on gross output, GVA and employment in all sectors of the economy. The tool calculates three types of effects for each of these variables: the direct effect, the Type I affect and the Type II effect. The direct effect, as discussed above, measures the size of the sector. The Type I affect includes the direct and indirect effects; in addition, the Type II effect includes the induced effect. The ratio between the Type II effect and the direct effect is known as the expenditure multiplier.

Table 1 Sectors used to split out R&D expenditure not captured by the BBT data

I-O sectors
19: Coke and refined petroleum products
20A: Industrial gases, inorganics and fertilisers (all inorganic chemicals)
20B: Petrochemicals
20C: Dyestuffs, agro-chemicals
20.3: Paints, varnishes and similar coatings, printing ink and mastics
20.4: Soap and detergents, cleaning and polishing preparations, perfumes and toilet preparations
20.5: Other chemical products
21: Basic pharmaceutical products and pharmaceutical preparations
22: Rubber and plastic products
23OTHER: Glass, refractory, clay, other porcelain and ceramic, stone and abrasive products
26: Computer, electronic and optical products
27: Electrical equipment
28: Machinery and equipment n.e.c.
31: Furniture
32: Other manufactured goods
46: Wholesale trade services, except of motor vehicles and motorcycles
61: Telecommunications services
62: Computer programming, consultancy and related services
63: Information services
64: Financial services, except insurance and pension funding
65: Insurance and reinsurance, except compulsory social security & Pension funding
69.1: Legal services
69.2: Accounting, bookkeeping and auditing services; tax consulting services
72: Scientific research and development services
74: Other professional, scientific and technical services
75: Veterinary services
77: Rental and leasing services
82: Office administrative, office support and other business support services
85: Education services
86: Human health services

Table 2 Total UK economic impacts from 2011-2017 – R&D expenditure disaggregated to all 129 I-O sectors

	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18
GVA (£m)							
Direct	27.5	35.1	48.1	54.4	65.4	95.7	112.2
Indirect	15.8	20.0	25.9	29.4	35.4	51.7	60.9
Induced	35.7	43.1	52.2	58.3	71.6	95.1	109.8
Total	**79.0**	**98.3**	**126.1**	**142.1**	**172.4**	**242.6**	**282.9**
Employment (FTEs)							
Direct	870	996	1,131	1,211	1,348	1,481	1,717
Indirect	270	342	452	515	619	907	1,068
Induced	512	618	747	835	1,025	1,362	1,573
Total	**1,652**	**1,956**	**2,330**	**2,561**	**2,992**	**3,751**	**4,357**

Comparisons

The consultants have sought to compare the estimates of operational impact derived for the Campus using the Input Output modelling tool with that of derived for other Campuses in other recent research studies. Clearly, the approaches adopted in each individual study have varied but Table 3 brings the evidence from other studies together, including that provided in an earlier study of the Babraham Institute in 2011/12. Table 4 summarises the key assumptions adopted. The evidence from the earlier Babraham study was appeared to be in line with the results from the new research at what was the base line for the present research.

Table 3. Comparisons between the economic impacts (UK level) of other studies

Studies/Campus	GVA(£m)				Employment (FTEs)			
	Direct	Indirect	Induced	Total	Direct	Indirect	Induced	Total
Babraham Institute, (2011/12) (*Alacrita 2013*)	19.2	14.4	7.9	**41.5**	335	230	95	**660**
Sci Tech Daresbury Campus, (2014/15) (*SQW 2017*)	103.5	45.6	13.4	**162.5**	890	1,060		**1,950**
IBERS, (2012/13) (*BIGGAR Economics 2014*)	20.2	4.7	7.0	**31.9**	342	89	167	**598**
John Innes Centre, (2011/12) (*Brookdale Consulting 2013*)	19.1	9.1	2.2	**30.4**	346	193	97	**636**
The Roslin Institute, (2011/12) (*BIGGAR Economics 2013*)	16.1	7.5	10.9	**19.8**	435	156	226	**817**

Table 4. Snapshot of Studies

Studies	
Babraham Institute	The impacts reported above is based on: • Income – £50.4m (including BI's subsidiary entities); BI itself – £33.1m • Supplier expenditure – £31.3m (Babraham Group's) • Employment at BI – 335 staff
Sci Tech Daresbury Campus	For the 60 (out of 100) surveyed tenants: • Employment – 339 people • Turnover – £56m • Exports – £13m • 300 jobs created over the last 3 years 1/3 employees of tenant firms earn £40-59k per year; a small number earning over £100k. Estimated *gross* impact of all 100 companies: • Direct GVA – £94.1m • Direct employment – 528 FTEs
IBER	The impacts reported above are based on: • Operational income – £28.3m (out of £31.3m total income, £3m on capital) • Supplier expenditure – £8.1m • Employment – 358 members of staff or 342 FTEs • Students – 1,551
John Innes Centre	The impacts reported above are based on: • Income – £35.2m • Supplier expenditure – £12.3m (construction was a major element of the expenditure (38%)) • Employment – 346 staff • Students – 86 • Visiting scientists – 128 • Salaries paid – £13.1m; total direct and indirect salaries accrued to household were £23.6 (forms basis for JIC's induced impact).
The Roslin Institute	The impacts reported above are based on: • Income – £25.4m • Supplier expenditure – £9.4m • Employment – 293 FTEs staff

- Post-graduate students – 142

Sources:

- The Babraham Institute. Alacrita, 2013.
- The impact of the John Innes Centre (Brookdale Consulting);
- The economic impact of IBERS (Biggar Economics);
- The Economic Impact of the Roslin Institute (Biggar Economics);
- Sci-Tech Daresbury Campus Impact Study (SQW);

Annex 2. Business Case Studies

This appendix provides brief portraits of the companies interviewed as part of the business case studies.

BenevolentAI

- BenevolentAI is a global leader in the creation and application of AI technologies to transform the way medicines are discovered, designed, developed and brought to market. The Company has developed a leading platform, the Benevolent Platform, for drug discovery which focuses on four key areas: Knowledge and Reasoning, Target Identification, Molecular Design and Precision Medicine.

- The company was founded in 2013 and focussed on the development of cross functional AI technology that could ingest, read and contextualised the world's available bioscience information. The business further developed to apply the technology in drug discovery and development. By 2019, BenevolentAI has created a unique AI-enabled research centre through the acquisition of a Cambridge research facility (Proximagen), raised significant institutional investments, as well as expanded its operations internationally.

- Revenue is generated from the sale of R&D programme assets and licence agreements. In 2018/19, BenevolentAI's operation on the Babraham Campus had a turnover of more than £8m. At the same time, more than £11m were spent on R&D activities.

- BenevolentAI has grown from less than 10 staff in 2013 to more than 200 in 2019, most of whom are based in London. Around 40 employees work on the Babraham Research Campus and the rest in New York.

Bicycle Therapeutics

- Bicycle Therapeutics is a Cambridge MRC spinout of the work of Sir Gregory Winter and Professor Christian Heinz at the MRC Laboratory of Molecular Biology in Cambridge. The core technology is a screening platform for molecules to be tested further for clinical effectiveness.

- The company develops a novel class of medicines, known as bicyclic peptides or Bicycles®, to treat diseases that are underserved by the existing therapeutics. The

company entered into a collaboration with AstraZeneca for the identification and development of Bicycles® in 2016, which further expanded in 2018.

- Bicycle Therapeutics also collaborates with biopharmaceutical companies and organizations in the therapeutic area for anti-bacterial, cardiovascular, haematology, ophthalmology and respiratory indications.

- The headquarters is in Cambridge, with 45 employees on the BRC in 2018/19 and 22 employees in Boston (Massachusetts). The size of the business, measured in terms of employment on the Campus, has quadrupled in the last seven years.

- In 2018/19, Bicycle Therapeutics generated over £6m turnover. The R&D and salaries expenditures were approximately £21.6m and £2m respectively.

Kymab

- Kymab is a spinout from the Wellcome Trust Sanger Institute based on the work of Professor Allan Bradley, focusing on the discovery and development of fully human monoclonal antibody drugs. Kymab has also established a pipeline of therapeutic assets covering immune diseases, immune-oncology, haematological and infectious diseases.

- Kymab was founded by Professor Allan Bradley and Dr Glenn A Friedrich in 2010. With a total of £20m equity financing from the Wellcome Trust Investment Division, the company was able to develop its antibody platform and therapeutic assets. Since 2014, further investment funds were obtained from the Trust and other organisations, including the Bill and Melinda Gates Foundation, which advanced Kymab's pipeline and its platform development. To date, Kymab has already raised $220m in equity financing from leading investors.

- In 2014, 14M Genomics, a cancer diagnostic company, was set up as a subsidiary of Kymab.

- Currently, Kymab has operations in both Cambridge and Taiwan. The company (excluding 14M Genomics) has grown to around 160 people, with a turnover of £5.6m in 2018/19 and a total R&D expenditure of almost £50m.

Crescendo Biologics

- Crescendo Biologics is a biopharmaceutical company involved in the development of Humabody® therapeutics in oncology, and a pipeline of novel differentiated medicines that focuses on a unique target T-cell engager.

- The company was founded in 2008 as a spinout from the Babraham Institute (BI), bringing together the technologies invented by Dr Marianne Bruggemann, Dr Mike Taussig and other scientists at BI. A seed funding of £4.5m, led by Sofinnova Partners with Aitua, Avlar BioVeentures and the Rainbow Seed Fund, allowed Crescendo Biologics to accelerate its development of fragment antibody technology platforms and its proprietary therapeutics.

- In 2016, Crescendo and Tekeda entered collaboration and licence agreement for Humabody®-based therapeutics and achieved its fourth in-licensing collaboration milestone in 2019.

- Crescendo Biologics is based on the BRC. It employed 52 employees in 2017/18 and it is not expected to expand in the short run. In 2018/19, the company generated more than £7.5m turnover and spent around £7m on R&D and over £3m on wages and salaries.

RxCelerate

- RxCelerate is an outsourced drug discovery and development platform that designs and delivers bespoke preclinical drug development programmes and project management services. The company provides drug development services using its unique model to guide projects from discovery to clinical use. Its clients range from virtual start-ups to global pharmaceutical giants.

- The company was founded in 2012 and has expanded its expertise rapidly from preclinical models of human diseases to high-quality drug discovery and development services. Since 2018, RxCelerate has acquired three companies, including Total Scientific, the Cambridge Partnership and Prosarix. These acquisitions have strengthened the ability of RxCelerate to provide its bespoke drug development services.

- RxCelerate has operations in Cambridge (UK), Boston (Massachusetts) and San Francisco, employing 45 people on the BRC, two elsewhere in the UK and two in the USA offices. In October 2018, the company also opened a UK-based chemistry operation at the University of Warwick, to reinforce the unique Rxcelerate offering.

- RxCelerate's R&D expenditure on the BRC was estimated to be less than £0.5m in 2017/18[30], while the operations on the BRC brought in over £1m of revenue to the company.

[30] The R&D expenditure on the BRC is estimated using the global financial data provided by CBR (see method of estimation in Chapter 3, Section 1.10)

Annex 3. Questionnaire for current Campus companies

The purpose of this questionnaire is to discover what your company has achieved so far, what it hopes to achieve, the importance of its collaborations and of its location on the Babraham Research Campus. We have pre-completed the questionnaire with the information we have been able to discover from public sources. Please amend or enhance those parts and complete those parts that we could not complete.

If you prefer we can arrange an interview with you to complete the questionnaire.

1 Business Name

2 Briefly describe your primary activities

3 What best describes your company's business model and current position?

4 Please give the number of the company's employees at each location for the years shown.

Location of company's employment:	FY 2018/19	FY 2017/18	FY 2016/17
On Babraham Research Campus……			
Not on Babraham Research Campus but within 20 miles of centre of Cambridge……			
Not within 20 miles of Cambridge but within the United Kingdom……			
Outside the United Kingdom……..			

5 What was the origin of your business? Who were the key founders? What was the original purpose of the business? What was the initial funding you received?

6 What were the main reasons for setting up / moving to the Babraham Research Campus?

(a) Property related (e.g. space availability and cost, lease terms etc.)

(b) Facilities related (e.g. scientific facilities, meeting rooms, cafeteria)

(c) Other reasons (e.g. proximity to Cambridge cluster and/or Cambridge University and/or BI)

7 What contributions to medical advances and scientific discovery has your business made so far and what are your future ambitions?

Contributions to medical advances and scientific discovery:

Ambitions for future contributions to science and medicine:

8 What have been the key achievements of your business to the present time (other than the contributions above)? In what ways do you feel your business is having an impact locally, nationally and globally?

9 What benefits have you received from and what value have you contributed to collaborations with the organisations shown below.

Babraham Bioscience Technologies
The Babraham Institute and Babraham Institute Enterprises
Other companies on the Babraham Research Campus
University of Cambridge
Other organisations and companies in the Cambridge area
Other organisations and companies outside the Cambridge area

10 What have been the benefits of your location on the Babraham Research Campus since your arrival (other than the collaborations above)? (E.g. space availability and terms; facilities, fundraising; proximity to Cambridge etc.)

11 How many times have you sought additional funding since your business was formed? Can you tell us about your successes (and failures) at raising funding for your business?

12 What are your objectives for your company in terms of employment and floor space occupied?

	Number of employees	Floor space occupied (sq ft)
In 2 years' time: ..... …….		
In 5 years' time: ..... …….		

13 What are the important challenges facing your company in attaining these objectives?

14 What factors might make your business consider moving off the Babraham Research Campus?

15 If your business were to move off the Babraham Research Campus, where would your business likely to be located?

	Definitely not	Unlikely	Possible	Likely	Certain
Within a 20 mile radius of Cambridge					
Outside 20 mile radius of Cambridge but within the United Kingdom					
Outside the United Kingdom - Europe					
Outside the United Kingdom – North America					
Outside the United Kingdom - Asia					
Outside the United Kingdom - Other					

YOUR NAME:

YOUR POSITION:

Telephone:

Email:

THANK YOU FOR FILLING IN THIS QUESTIONNAIRE

ANY QUESTIONS?

PLEASE TELEPHONE OR EMAIL US AT THE CENTRE FOR BUSINESS RESEARCH:

Giorgio Caselli	11.13	01223 765340	GC568@CAM.AC.UK
	11.14		11.15
Andy Cosh	11.16	07719 742202	ADC1@CAM.AC.UK

May we contact you again if we have further questions? **Yes** **No**

PLEASE RETURN THE COMPLETED QUESTIOONAIRE TO ANDY COSH

adc1@cam.ac.uk

Centre for Business Research, 12 Trumpington Street, Cambridge. CB2 1AG

Annex 4. Additional questions for Campus companies: additionality and impact on skill development

Part 1: Additionality

1.1. How important has your location on the Babraham Research Campus been for benefiting your company in the following ways? *Please mark the appropriate box in **each** row.*

	Not important	Slightly important	Important	Very important	Critically important
Accelerating scientific advances……					
Facilitating fundraising…….					
Increasing the number of employees……					
Providing flexible and affordable space...…….					
Other (Please specify)……..……....					

1.2. Overall and with your best estimate possible, what impact do you feel your location on the Babraham Research Campus had on the following?

Accelerated scientific discovery process by……	months
Accelerated fundraising by…….	months
Increased fundraising to date by……..…….	%
Increased number of employees by……..	%
Other impact (Please specify)……..…….	

Part 2: Impact on skill development

2.1. In what ways do you feel your business is making a contribution to your staff (including interns etc.)?

Annex 5. Babraham Institute Future Metrics

BABRAHAM INSTITUTE FUTURE METRICS	Period	Figures in Impact Study	Dataset name	Recommendation
1. ACADEMIC CONTRIBUTION				
PUBLICATIONS				
Research publications	)		)	)
Reviews	)		)	)
Book	)		)	)
Chapter	)	Figure 6.1	)	)
Comment	) 2011-12 to 2018-19 annual		) BI Overall Matrics	) Update annually
Comment/Editorial	)		)	)
Conference Proceedings	)		)	)
Other	)		)	)
Total	)		)	)
RESEARCHERS				
Number of Project Groups	) 2015-16 to 2017-18 annual		) BI Overall Matrics	) Update annually
Team members (all groups)	)		)	)
of which:				
Epigenetics				
Project Groups	) 2015-16 to 2017-18 annual		) BI Overall Matrics	) Update annually
Team members	)	Figure 6.1	)	)
Immunology				
Project Groups	) 2015-16 to 2017-18 annual		) BI Overall Matrics	) Update annually
Team members	)		)	)
Signalling				
Project Groups	) 2015-16 to 2017-18 annual		) BI Overall Matrics	) Update annually
Team members	)		)	)

CITATIONS OF GROUP LEADERS				
Research Programme	)		)	Update annually
% of publications with collaborators outside of BI	)		)	)
Number of publications	)		)	)
Average citations (publications whilst at BI)	)		)	)
Number of times cited (publications whilst at BI)	) 2014-19 aggregated	Figures 6.1, 6.2	) Babraham Impact Study	) Update annually
h-index (publications whilst at BI)	)	Figures 6.3, 6.5	) Citation data	) for latest 5 yrs
Number of citations (all publications)	)		)	)
h-index (all publications)	)		)	)
ACADEMIC COLLABORATION				
Active projects	)		)	)
Countries	) 2015-16 to 2017-18 annual		) BI Overall Matrics	) Update annually
Organisations	)		)	)

2. COMMERCIAL CONTRIBUTION

BI ANNUAL INCOME				
Core ISP and BBSRC funding	)		)	)
Competitive grants income	)	Fig 6.5	)	)
Income from services provided	) 2011-12 to 2018-19 annual		) BI Overall Matrics	) Update annually
Other	)		)	)
Total	)		)	)
GRANT FUNDING				
Grants from UK funders	)		)	)
International grants	) 2011-12 to 2018-19 annual		) BI Overall Matrics	) Update annually
Total	)		)	)
Key UK grants:				
BBSRC	)		)	)
MRC	) 2011-12 to 2018-19 annual		) BI Overall Matrics	) Update annually

Cancer Research UK	)		)	)
Wellcome Trust	)		)	)
COMMERCIAL COLLABORATION				
IP agreements	)		)	)
of which new this year	)		)	)
Consultancies	) 2011-12 to 2018-19 annual	Fig 6.6	) BI Overall Matrics	) Update annually
of which new this year	)		)	)
Collaborations	)		)	)
of which new this year	)		)	)
KEC CONSULTANCY, COLLABORATION & IP				
Number of consultancy contracts	)		)	)
Income associated with consultancy contracts	)		)	)
Number of other commercial services	)		)	)
Income associated with commercial services	)		)	)
Instances of use of intellectual property	) 2012-13 to 2018-19 annual		)	)
Income associated with intellectual property	)		)	)
Number of grants of free access to IP	)		)	)
Industry contribution for collaborative research	)	Fig 6.7, Table 6.1	) KEC Core Indicators	)
Number of new patents applications filed in year	) 2017-18 to 2018-19 annual		)	)
Number of new patents granted in year	) 2017-18 to 2018-19 annual		)	)
Cumulative patent portfolio	) 2017-18 to 2018-19 annual		)	)
Number of licences	) 2012-13 to 2018-19 annual		)	)
Number of licences generating income (to date)	) 2012-13 to 2018-19 annual		)	)
Income from these licences	) 2012-13 to 2018-19 annual		)	)
No of new licence agreements	) 2012-13 to 2018-19 annual		)	)
Number of spin-offs and start ups (to date)	) 2012-13 to 2018-19 annual		)	)
No of new spinout companies from BI science	) 2012-13 to 2018-19 annual		) KEC Core Indicators	) Reconcile with
No of collaborations with campus companies	) 2014-15 to 2018-19 annual		)	) above and

No of new collaborations with campus companies	) 2015-16 to 2018-19 annual		)	) update annually
No of new formal (contractual) collaborations	) 2012-13 to 2018-19 annual		)	)
No of CASE studentships	) 2012-13 to 2018-19 annual		)	)
No of consultancies	) 2012-13 to 2018-19 annual		)	)
No of research collaborations worth >£50k	) 2012-13 to 2018-19 annual		)	)
No of new relationships with existing partners	) 2012-13 to 2018-19 annual		)	)
No of BI-led KEC events	) 2017-18 to 2018-19 annual		)	)
Annual industry income	) 2012-13 to 2018-19 annual		)	)

3. SCIENCE SERVICES

INCOME FROM OUTSIDE FOR BI FACILITIES etc

Bioinform Camb Ep	)		)	)
Chemisty	)		)	)
Gene Targetting	) 2013-14 to 2018-19 annual		)	)
Antibody Sales	separated by source		)	)
Bioinformatics	Campus companies		)	)
BSU	MRC		)	)
Consultancy	*Within Cambridge area*		)	)
Corporate	University		)	)
Flow Cytometry	Research Institute	Fig 4.5, Table 6.1	) BIE 5 Year Income Summary	) Update annually
Flow Traing Course	Company		) v.2 rev	)
Health & Safety	Other		)	)
Imaging	*Within rest of UK*		)	)
IP Assign. & Lic.	University		)	)
Lab Services	Research Institute		)	)
Lipidomics	Company		)	)
Mass Spec	Other		)	)
Research Agreemts	*Overseas*		)	)

Sequencing	)	)	)
Vet Service	)	)	)
Grand Total	)	)	)
Income from use of BI scientific facilities	) 2012-13 to 2018-19 annual	) KEC Core Indicators	)
No of companies using BI science services	) 2013-14 to 2018-19 annual	)	)
INTERNAL USE OF SCIENCE FACILITIES			
Bioinformatics	)	)	)
BSU	) 2012-13 to 2018-19 annual	)	)
Chemistry	separated by research group	)	)
Flow Cytometry	R1000 - BI Self Funded Science	)	)
Imaging	R1100 - Epigenetics	) BI Internal Services	) Update annually
Lipidomics	R1200 - Nuclear Dynamics	) summary	)
Mass Spec	R1300 -Lymphocytes	)	)
Sequencing	R1600 - Signalling	)	)
Gene Targetting	)	)	)
Grand Total	)	)	)

4. SKILLS CONTRIBUTION

DESTINATION OF LEAVERS			
Within Cambridge area		)	)
University	)	)	)
Research Institute	)	)	)
Company	) 2017-19 aggregated	)	)
Other	)	)	)
		) Destination of staff who left	
Within UK but outside Cambridge area		BI	) Update annually
University	)	) during last two years	) for latest 2 yrs
Research Institute	)	)	)
Company	) 2017-19 aggregated	)	)

Other	)		)	)
Overseas	)		)	)
TRAINING				
Bioinformatics	)		)	)
Flow cytometry	)		)	)
Imaging	) 2015-16 to 2017-18 annual	Fig 6.8	) BI Overall Matrics	) Update annually
BSU (animal facility)	)		)	)
Total	)		)	)
PUBLIC ENGAGEMENT EVENTS				
Number of events	)		)	)
Number of researchers involved	) 2011-12 to 2018-19 annual		) BI Overall Matrics	) Update annually
Number of people engaged	)		)	)

5. OTHER KEC

No of contributions to policy	) 2015-16 to 2018-19 annual		)	)
No of policy visits hosted	) 2013-14 to 2018-19 annual		)	)
No of new TAG grant applications	) 2012-13 to 2018-19 annual		)	)
No of KEC prize applications	) 2015-16 to 2018-19 annual		) KEC Core Indicators	) Update annually
No of KEC grant applications	) 2013-14 to 2018-19 annual		)	)
No of KEC training events for BI staff/students	) 2017-18 to 2018-19 annual		)	)
No of attendees at internal KEC training events	) 2017-18 to 2018-19 annual		)	)