



Competitive Advantage

The Cambridge Cluster Report – 2008

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This report was published in December 2008.

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'Audit Team of the Year' 2008

'Tax Team of the Year' 2008

'Corporate Finance Deal of the Year' 2008

'Employer of the Year' 2007

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BDO Stoy Hayward Foreword

Unlike in previous years the cluster report this year is issued against an economic backdrop in which the major (if not the only) considerations are uncertainty and fear. Consideration has moved from does Cambridge do as well as its international competitors and does it provide enough innovation and success to keep its pace in the technological environment to one of simple survival. Much discussion has taken place recently and while a lot of this has been downbeat and perception can be a strong motivator in a downward spiral there are many ways in which Cambridge holds advantages over others.

There is the old joke about a group of people being chased by a polar bear. To survive each has only to outrun one other person and not the bear itself. This is one way of viewing the current economic situation. Essentially the idea is that the weakest fail first and Cambridge is a long way from being the weakest. Indeed on this basis Cambridge could actually come out of the current economic climate well. It is an established centre of excellence with a strong track record of success and a history of the type of technology that while complex is more physical and therefore understandable. It also has some significant institutional supporters and investors.

Established track record of 800 years

Clearly the Cambridge phenomenon is not 800 years old even if the University is but there is nonetheless an element of truth in the comment. Many people whether they be called entrepreneurs or not have come to Cambridge over the centuries for the knowledge they can gain here and it is out of this tradition that the phenomenon has grown. No business can ever afford to sit on its laurels. There must always be change and in lean times it is often the quality of the management and balance sheet that determines how it rides out bad times, rather than current trading. This report includes a small sub set of the milestones that have occurred over the last few years. Over the longer period Cambridge has developed a very strong balance sheet where relatively new centres of technological innovation might well find that they have insufficient resources to survive a tightening of the financial belt.

Investment

Those looking to invest often see economic downturn as a good time to get into the market and will be more disposed to look to proven centres as providing greater and safer opportunities. Also the Cambridge Cluster is an existing centre with much money already invested by those who know the market who may well decide to sit out the economic situation rather than cut their losses and retreat. Cambridge's position in the bio tech and environmental Cleantech markets together with the fact that it has a very significant research hospital on its doorstep means that it may have access to funding from sources not available to other clusters especially if the UK Government looks to increase spending in health and education sectors to boost the economy.

Technology

For some years now the emphasis in the money markets has been on development companies which has the advantage to investors of requiring less investment in equipment and consequently requires less cash from the outset. As economies tighten however, investors look to ensure that returns are more guaranteed with lower risk and it is possible this could lead to a swing back toward the Cambridge strengths. Cleantech has a lot of its basis in Hardtech and this is an area where Cambridge has an even better track record than most and is currently beginning to see a new crop of potential successes.

So there is potential for Cambridge to see some of its competitors fall by the wayside with the subsequent competitive advantage as the economy comes out of the recession.

On the other hand the world is not a simple place and the analogy with the polar bear story will not hold very far in a global recession if those within the Cambridge cluster do not supply the right innovation, businesses and management for investment. Those with the money to invest have only one goal in their professional life and that is profitable return. This goes hand in hand with what is often considered to be one of Cambridge's weaknesses, good managerial talent is hard to find. At the recent BDO Stoy Hayward debate on the future of Cambridge 86.9% (of those who didn't vote for funding) saw Managerial talent as the region's biggest limiting factor.

There is a strong possibility that Cleantech and Biotech can provide Cambridge with the life line that enables the phenomenon to continue but unless it is clear that the idea can be made into a business, funding will not be forthcoming. As such it is now more than ever that managerial and entrepreneurial talent will become the factor which will determine whether success will be achieved or not.

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Library House Research Services Foreword

This is the fifth Cambridge Cluster Report published by Library House. Over the course of the previous four reports, Library House has charted the shape and development of the Cambridge cluster. Now, as we present our fifth analysis, it is perhaps fitting to take a look back at the findings and impact of the previous cluster reports.

This first Cambridge Cluster Report was published by Library House in 2003. This report involved an initial effort to understand the structure of the Cambridge cluster by measuring the size of each sector. From a top-level perspective, this report revealed that the information technology sector was predominant, closely followed by the life sciences.

The second report, entitled "Flight to Quality", was published in 2004 and showed that the Cambridge cluster had successfully weathered the dot-com downturn, rebounding earlier and more strongly than the rest of the UK and Europe. In fact, average investment levels by round were between 57% and 100% higher in the Cambridge cluster than in the rest of the UK and in Europe.

In 2006, Library House published its third report, "The Supercluster Question." In this report, we identified how Cambridge formed part of a larger, disconnected innovation supercluster: "The Cambridge cluster forms part of a larger geographic region of innovation, incorporating London, Oxford and parts of the Thames Valley. This combined area receives over half of the total venture investment in the UK. Transport links between these areas are at maximum capacity and patchy at best, in addition, there appear to be no significant plans for upgrading them." The related presentation, given by Jens Lapinski at the launch event, is probably one of the best examples of how Library House staff were able to identify the key issues for the cluster's future. Lapinski highlighted the issues mentioned above, demanding actions and investments to avoid future problems. Following the presentation, Library House staff who attended various events around the country were repeatedly told by external colleagues that Cambridge did not have a problem with transport – "it's the English way of travelling." Now, two years later, most discussions on the Cambridge cluster result in urgent calls for action to improve the transport infrastructure.

The 2006 report was also the last time we published precise figures on the number of innovation and technology-based companies in the Cambridge cluster. Although this was an interesting exercise, one which revealed new and exciting companies and charted the progress of existing firms year on year, we felt it was time to move forward and focus on a much larger question: how does the Cambridge cluster perform in comparison with the 20 other leading European clusters?

Our fourth report, "Looking Inwards, Reaching Outwards", which was published in 2007, proceeded to answer this question by comparing the level of venture capital investment in the Cambridge cluster with 20 leading European clusters. This report revealed that Cambridge attracted the highest level of investment per capita in Europe and reaffirmed the region's standing as "one of Europe's leading technology clusters."

Now, in our fifth edition, "Competitive Advantage", Library House re-emphasises the Cambridge cluster's outstanding reputation as a world-leading cluster. For the first time, our analysis extends to quality of life and the universities are examined to a greater extent. We also asked stakeholders in the Cambridge cluster to contribute their thoughts to the report in order to show the variety of activity in the cluster. As a result this report provides more detailed insights into the cluster, and the opportunities it provides, than ever before.

But the future is not all bright. The UK is in the midst of a worldwide recession that will inevitably have an impact on the Cambridge cluster. Despite its undoubted strength, the Cambridge cluster will certainly suffer from the current economic climate with reduced growth rates and fewer investment opportunities. However, as we have seen in recent years, the Cambridge cluster has a great capacity to recover from such crises far quicker and more successfully than other regions. As one commentator put it, "Despite the difficult time, there is always something going on in Cambridge."

On behalf of the Library House group, we would like to thank BDO Stoy Hayward for their support over the past three years in helping us to develop the Cambridge Cluster Report. We are especially grateful to BDO Stoy Hayward for providing us with opportunities to hold roundtable discussions and to interact with stakeholders and other cluster participants in the wider Cambridge area. These external contributions have added immense value to this report and have enabled us to provide our readers with a more insightful and relevant analysis.

Finally, to our colleagues, associates, and readers, we would like to take this opportunity to wish you the very best of luck for the future. We hope that the 2008 Library House Cambridge Cluster Report contributes to the success of the Cambridge region in overcoming the challenges that lie ahead and that the coming year brings with it better economic times and increased opportunities for us all.

The Team of the 2008 Library House Cambridge Cluster Report

Executive Summary

The Cambridge cluster is widely recognised as one of the most innovative clusters in the world. The cluster is characterised by combined strengths in research and business, with universities and research organisations working alongside companies in healthcare and life sciences, hardtech (semiconductor and electronic components), and information and communications. The business landscape has an excellent blend of university and corporate spin-outs, small to medium sized companies, and public listed firms that are supported by technical consultancies and other business services providers. The two Cambridge-based universities, the University of Cambridge and Anglia Ruskin University, along with several other research organisations provide an immensely valuable pool of skills and knowledge that provides the Cambridge cluster with a competitive advantage.

The Cambridge cluster is a preferred region for venture capital and foreign direct investment from all over the world. The Cambridge technopole is one of the top regions in Europe in terms of total institutional investment per capita. The area also boasts one of the world's highest densities of research and development outlets, from national and international corporates to technology-based companies, from small start-ups to major public-listed companies.

The venture capital climate has benefited from opportunities to exit companies via trade sales or initial public offerings. In addition to several acquisitions of its biotechnology, ICT, and hardtech companies, a major acquisition has just taken place in the cluster after Sanofi Pasteur Holding acquired Acambis plc in a £285m deal. Other recent acquisitions include Thales' integration of nCipher in a £51m deal while Sumitomo Chemical acquired Cambridge Display Technology in a £142m deal. Private venture capital-backed companies have also been targeted by international corporations. For example, VASTox plc acquired DanioLabs Ltd. for almost £30m, GlaxoSmithKlein acquired Domantis Ltd. in a major £239m deal, and AstraZeneca bought Kudos Pharmaceuticals for £189m. This activity demonstrates that the Cambridge cluster is high on the radar of corporations and investors around the globe.

The local start-up scene, which benefits through the engagement of several associations, organisations, and individuals with young companies and entrepreneurs, has contributed to these successes. The cluster provides young start-ups with networking opportunities, coaching, training and advice as well as funding from business angels and from the three main players, NW Brown, Cambridge Capital Group and Cambridge Angels. The range of opportunities the cluster has to offer young start-ups has created a vibrant seed funding environment and contributed to the increased professionalism of a new generation of entrepreneurs.

Beyond the traditional sectors of life science, ICT, and hardtech, Cambridge should be well placed to develop vibrant industries in the areas of cleantech and creativity. Cleantech can benefit from Cambridge's traditional strength in hardtech where hard innovation is key. The creative industry can play an important role in putting Cambridge's ideas into the right design, but also as a source for mediatech companies which combine technology with creativity. Cambridge has the opportunity to emerge as an important region in the future.

The continuing challenge for the Cambridge cluster is how to attract entrepreneurs and businesses who can tell a compelling story to investors, to customers, and to the market. The competition among clusters has significantly increased over the past years and the world's leading business, science, and technology regions have to be prepared for fierce competition in attracting talent.

Cambridge retains a special advantage over other clusters however. In addition to its status as one of the world's leading regions in innovation, Cambridge is also a city that offers an excellent quality of life for those working and researching in the area. With a variety of cultural venues, sporting grounds, museums, and parks, Cambridge provides a wide number of opportunities for entertainment and relaxation. The public transport system, which already benefits from over 700 taxis, frequent coaches, and several park&ride facilities, is undergoing further developments and improvements. A beautiful city centre, a rich cultural heritage, excellent schools and nurseries, and good transport links to different airports and to London all contribute to Cambridge's image as a desirable place to live and work. As a world-class university city, Cambridge is used to housing individuals and families from all around the world and the city provides a welcoming environment for both UK and international visitors and migrants.

Although the current economic slowdown brings with it uncertain times, Cambridge is well positioned to cope with the challenges of the future and, with continued investment and effort, Cambridge can only build on its current position as one of the world's leading innovation clusters.

Key Facts

112 the current number of venture backed companies active in the Cambridge Cluster

£884m the amount of institutional capital currently committed into the cluster

49,000 students are enrolled in two Cambridge Universities

£612m annual spending of the University of Cambridge

45 the number of currently active university spin-out companies from the University of Cambridge

£642m was the biggest disclosed acquisition of a technology company in the Cambridge Cluster
(AstraZeneca acquired the public listed Cambridge Antibody Technology in 2006)

£285m the biggest disclosed acquisition in the cluster since 2007
(Sanofi Pasteur Holding SA acquired Acambis plc in 2008)

£4,555m market capitalisation of Cambridge Cluster companies in the LSE techMARK

£2,106m the biggest market capitalisation of a Cambridge Cluster company (Autonomy Corporation)

(All data as of October 2008)

Introduction into the Cambridge Cluster

The Cambridge Cluster is located in the East of England and is the second largest of the nine official regions of England. It encompasses the counties of Essex, Hertfordshire, Bedfordshire, Cambridgeshire, Norfolk and Suffolk. The East of England is directly to the north of London, and it has around 400 km (250 miles) of North Sea coastline, from The Wash in the north to the Thames estuary in the south.

The 2001 census counted a population of 5.4m, with an average growth of 0.5% p.a. since 1991 - almost twice the growth rate of the UK population, currently estimated to be 0.275 % p.a. Much of this growth is due to the strong levels of migration from London and the counties predominantly from the South East.

Impressive as this is for the East of England, growth in Cambridgeshire has averaged 1% p.a. over the same period, with most of this growth within Cambridge city itself.

The region claims to be host to over 1,000 tourist attractions, and received over 132m visits in year 2007 according to the UK Tourism Survey. BBC East has produced local television and radio programmes for the region since 1959.

Further information about the governmental structure and the regional development strategy can be found on the websites of Government Office for the East of England and East of England Regional Assembly.

Cambridge City is the administrative centre of the county of Cambridgeshire. According to the 2001 census the population was around 108,000 including over 22,000 students, but it is estimated nowadays to be somewhere in the range of 120,000 to 130,000.

Quality of life

Cambridge city and the surrounding area regularly scores high in Halifax national surveys of the 'best' places to live, which is scored on a wide range of criteria deemed important to the general populous. Although Cambridge and the surrounding regions are regarded by locals as an attractive place to live, 'quality of life' is an inherently difficult factor to quantify. However, there are certain factors that can be said to contribute to the well-being of residents, and these are outlined in this section of the report.

Cost of Living

Cambridge city is not an inexpensive place to live. The cost of bread is comparable to that of London – at least £1.30 for a known brand in the central supermarkets, although the average given below for comparison purposes is about £0.80p. The cost of a night out is also comparable to that of the capital, with a pint costing anything from £2.50 to £4.00 - regrettably, often at the higher end of that range and a cinema ticket costs around £7.00

Housing

In recent years, Cambridge has become an attractive area for people who want the financial rewards of working in London yet want an increasingly better quality of life. With a journey that in some instances can take as little as one hour door to door, Cambridge has become the perfect place for those seeking a balanced life. This, however, has led to housing prices in Cambridge higher than the UK housing price average, with central properties, particularly those near the station, selling for prices comparable to London.

Environmental Awareness

Cambridge is one of the UK's leading cities when it comes to furthering the cause of environmental issues, but it still falls behind the standards set by other European countries. All houses in the city are provided with kerb-side recycling services covering most recyclable wastes.

Transportation System

Cambridge has come under scrutiny in the past few years about its state of traffic and transportation. Although this is still very much an issue within the Cambridge region, there are a number of aspects of Cambridge which

Cambridge has a direct shuttle **train** connection to London's Liverpool Street and King Cross; with the latter having several connections to other UK cities and being directly attached to St.Pancras International with Eurostar connections to Brussels and Paris. One of the busiest train line in the UK are the morning and evening connections between Cambridge and London King's Cross.

Direct cross-country links are rare to find. One exception are the hourly trains to Birmingham. A feasibility study to reactivate the former "Varsity Line" between Oxford and Cambridge has been positive.

Cambridge can be easily accessed via different **roads**. The main south-north connection is the M11 motorway heading from the London's North Circular towards Cambridge with further east-west connections leading to the coast or English Midlands.

The regional **bus** service is run by Stagecoach while national route are being served by National Express. A high density of around 700 taxis and private hire ensure a good availability. Additionally there are several **park & ride** sites around Cambridge available.

Nevertheless the most popular and effective way of transporting in Cambridge is the **bike**. Several cycling paths have been set up to encourage cycling. However do not do not expect the cycling paths to be amongst the standards of some continental European countries.

The region's two main airports are Stansted Airport and Luton Airport, carrying 23.8m and 9.9m passengers respectively in 2007. Both airports are largely focussed on low-cost flights, RyanAir flying out of Stansted and EasyJet flying out of Luton. There are additional airports in Cambridge (private) and Norwich, carrying 2k and 700k passengers respectively in 2007.

The region's main sea ports are Harwich, Ipswich and Felixstowe. Felixstowe is the busiest container port in the UK, with 35% of container traffic passing through it.

Venues

Cambridge is a cultural cornucopia with a large number of live venues that allow it to thrive. The university and its colleges form a historic backdrop to the goings on in the city centre, and further out. Within the city district there are a number of museums, theatres, cinemas and live music venues, which despite popular belief are far from student hang-outs.

The biggest film venues are the beautiful Cambridge Arts Picture House and the several screen venues Cineworld and Vue Cinema.

Cambridge's biggest theatre venue is the Arts Theatre with over 600 seats located in the town centre at the St Edward's Passage.

The ADC Theatre is managed by the University of Cambridge, and has several shows a week during term time. The Anglia Ruskin University hosts the Mumford Theatre and shows by both student and non student groups. There are also a number of venues within the colleges.

The Junction and the Corn Exchange are two other major venues with regular performance of theatre groups, musicians and other artists.

Museums

Cambridge offers a variety of museums and galleries. Often these museums are run by the university or have close ties to a particular department. Some examples of the museums and their interest are:

- Cambridge & County Folk Museum — Local life
- Cambridge University Library — Events held in the Exhibition Centre.
- Fitzwilliam Museum — University of Cambridge art museum
- Kettle's Yard — Art gallery
- Museum of Technology — In the old Pumping Station; engines, print room and old machines
- Scott Polar Museum — Arctic and Antarctic exploration
- Sedgwick Museum — Fossil animals and plants; also a minerals display
- Whipple Museum of the History of Science — Scientific instruments from medieval times onwards
- Zoology Museum — Skeletons of animals and birds from around the world

Sport in Cambridge

Cambridge, although renowned for its scientific and political breakthroughs, has a little-known place in history as the birthplace of association football. In 1848, a group of students developed a definitive set of rules for the game, announcing them at Parker's Piece, which remains the place for lunchtime or

after work matches and kickabouts. From that day forth, these 'Cambridge Rules' were adopted and in 1863 on the formation of the Football Association these rules were the basis for the FA and the first game of the FA was played on Parker's Piece. It is rumoured that the width of a standard set of goal posts is exactly the same as two particular trees planted on the edge of the grass. Football is now the only truly global sport; 715million people watching the world cup final in 2006.

The probably two most well-known football clubs in the region are Cambridge United F.C. and Histon F.C. both current-day rivals as they are playing in the same Conference National League.

Cambridge plays a significant role in the history of competitive rowing. The Boat Race is an annual race of several miles between the crews of Oxford and Cambridge Universities. The race was first held in 1829, initially alternating between Henley and London courses, but now always on the Tideway of the river Thames in London.

There are a number of amateur rowing clubs in Cambridge, all eager to accept new rowers all year round. The famous Bumps races are held on the river Cam every July for town crews, and in February and June for crews from the colleges of the university.

Another major sport activity in Cambridge is rugby. The Cambridge Rugby Union Football Club "CRUFC", the eastern counties most successful club, plays in the National Division Two while the rugby league club "Cambridge Eagles" play in the National Conference League East. Also the university has its one rugby union team.

Education

There are a great many schools in the Cambridge area of all kinds. The region has largely moved away from the old system of primary schools and middle schools, although one or two are still running. The regulator Ofsted regularly publishes inspection reports on the standards of schools (http://www.ofsted.gov.uk/oxcare_providers/list)

A variety of language schools offer courses for students from all over the world.

Further education and training opportunities are provided by the Cambridge Regional College, The Institute of Continuing Education at Madingley Hall and The Learning Collaboration. Of course a large number of University courses are offered by Anglia Ruskin and University of Cambridge.

Touristic Aspects

In the UK several conservation charities are active to protect the heritage of the buildings and landscapes. The main trusts are the Woodland Trust, National Trust and English Heritage. These organisations are also not just protecting the most well-known places like Stonehenge and the Battle of Hastings Battlefield, but also many places around Cambridge like Anglesey Abbey, Audley End House, Hatfield Forest, Longthorpe Tower, Wicken Fen and Wimple Hall. (ATJ, StM)

Cambridge Events

Despite its international reputation, Cambridge is a relatively small city. However, it punches well above its weight in terms of cultural offerings, with a range of venues and events that would be the envy of many much larger cities.

An outsider might assume that the city boasts plenty of high art in keeping with its academic renown. Certainly, Cambridge provides a host of cultural events from opera and classical concerts to art exhibitions and pre-West End theatre shows. But Cambridge is also a major entertainment centre for the whole region, attracting audiences from across Eastern England to rock concerts, comedy shows, and touring musicals.

Nowhere is this diversity more evident than at the Cambridge Corn Exchange, the premier venue in the city and one of the largest in East Anglia. It can probably boast one of the most varied programmes to be found anywhere in the country – in any given week it might present a major international orchestra, a couple of top rock bands, a ballet company, and a large-scale children's show, quite possibly with a conference or trade show thrown in for good measure.

Across the road, the Cambridge Arts Theatre provides the very best in mid-scale theatre, featuring major stage names in top touring productions, many of which are destined for London runs. On a smaller scale, the Junction caters for more experimental tastes in contemporary theatre and dance, whilst also presenting a range of bands and a programme of club nights.

The city's major visual art venue is the remarkable Kettle's Yard, which has a notable permanent collection in its delightful house but also presents touring exhibitions of contemporary work in its gallery.

Cambridge could reasonably claim to be a city of museums, thanks in large part to the presence of Cambridge University. The Fitzwilliam Museum is an outstanding institution with collections of international significance. Behind the imposing columns of its facade, it houses paintings by artists of world renown from all eras – Titian, Rubens, Constable, Monet, Degas, and Picasso, to name just a few. And yet this only hints at its riches, which also include artefacts from ancient Egypt, Greece and Rome, pottery, coins, medals, manuscripts, furniture and armour.

But the Fitzwilliam Museum is only the beginning. Other university museums include the Museum of Archaeology and Anthropology, which houses everything from painted Peruvian pottery to a 14-metre high totem pole from Canada; the Museum of Zoology, complete with whale skeleton; the Whipple Museum of the History of Science; the Sedgewick Museum of Earth Sciences; the Scott Polar Research Institute; and the Museum of Classical Archaeology. In addition, the University Library, which houses one of the most important collections of books and manuscripts in the world, holds temporary exhibitions on a regular basis.

For a more local flavour there's the Cambridge and County Folk Museum, a fascinating social history collection housed in a timber-framed 16th century inn. And on the banks of the River Cam, the Cambridge Museum of Technology sits in an even more unusual setting – the city's original sewage pumping station, complete with the original equipment and other historic engines.

The influence of the city's two universities also extends to the performing arts. Anglia Ruskin University's Mumford Theatre presents a diverse programme of theatre and other events, while the University of Cambridge's ADC Theatre has played host to many undergraduate performers who have subsequently become household names.

And of course the University of Cambridge colleges play a highly visible role in the city's cultural life. King's College Chapel is perhaps the city's most iconic building but many other college buildings are also venues for concerts, plays, and other events open to the wider public.

Besides all this year-round activity, the city boasts a plethora of festivals and special events. The Cambridge Folk Festival is the oldest popular music festival in the UK and the leading event of its kind in Europe. It has an international reputation for its eclectic programme, encompassing everything from blues to bluegrass, country to celtic music. Musicians from across the world entertain some 14,000 people in a normally quiet local park at Cherry Hinton.

The Cambridge Film Festival can justifiably claim to be the third most important in the UK (behind Edinburgh and London), while Wordfest is an annual literature festival with a growing reputation for attracting major writers and thinkers.

The Cambridge Music Festival, staged every three years, will present a packed and imaginative programme for three weeks in November 2009, while the annual Cambridge Summer Music Festival is also a lively and varied event. In addition, the Heart of the World festival presents a range of world music activity from different cultures each May.

The Cambridge Children's Festival offers a wide-ranging programme for children, both in schools and in an outdoor family fun day. Other special outdoor events include the Big Weekend community festival on Parker's Piece in July, a couple of comedy festivals – one housed in a marquee on Jesus Green in August – and a programme of free Sunday afternoon jazz and brass band concerts in the city's parks.

The summer's outdoor offer also extends to the highly popular Cambridge Shakespeare Festival, with a programme of plays presented in attractive settings in university college grounds.

Once again the University of Cambridge is influential. Its Science Festival is already well established and is one of the most popular events of its kind. In 2008 it launched the Festival of Ideas and this looks set to become a regular addition to Cambridge's busy festival calendar.

Indeed, Cambridge never seems to be short of ideas – or cultural activity. (CCC)

The Geography of the Cambridge Cluster – A Researcher’s Perspective

“The enduring competitive advantages in a global economy lie increasingly in local things”

- Michael Porter, 1998

Despite a true definition for clusters existing, clusters dominate the economic and political map of the world today. But what actually is the Cambridge cluster and what effectively constitutes its boundaries? Answering these questions is essential to understanding what fuels the “Cambridge cluster” and how it can be sustained into the future.

Many different terms have been used to describe the close proximity of firms and institutions in the Cambridge region, with the Cambridge cluster being the predominant. Collectively, they adhere to two generic principles, agglomeration and interaction. Due to a lack of clarity on what ‘proximity’ means precisely, several different geographical boundaries have been identified as constituting the Cambridge cluster. For instance, the recent Cambridge Technopole Report takes a standard 25-mile radius around ‘The Greater Cambridge hinterland’ to be its standard measure whereas other authors discuss the cluster in general terms (for example, by number of firms and employees) without attributing any geographical measure to them (for example, Huggins, 2008). The argument is that that the Cambridge cluster should not be thought of as a spatial area or in the terms of a regional phenomenon that stretches as far and wide as Peterborough and into Essex, but it should however be seen as the dense agglomeration of firms and institutions. The area of concern for this more concentrated model is around the 17 Business Parks and Research Campuses of Cambridge and is embedded in a regional system that has received more explicit geographical boundaries, increasingly referred to as the South-East ‘super-cluster.’ It has to be said however that the ‘Cambridge effect’ does not terminate at the cluster boundary, but rather highlights the importance of close proximity in stimulating and sustaining innovation. It is important to understand the different scales, and the roles of each scale, in order for Cambridge to maintain its autonomy and evolution and to promote itself as a global force for cutting-edge research, incubator of new ventures, and headquarters of successful technology companies.

The cluster paradigm

A cluster is not necessarily bound by one industry or technology; it is an accumulation of related industries that interact together to raise the competitive advantage of the location collectively. Cambridge has evolved over the past 30 years from a highly specialised agglomeration of semi-conductor-based firms to a centre for high-tech businesses in software, electronics, nanotechnology, and biotechnology. Recent evidence suggests that cleantech is beginning to show a similar path trajectory. This convergence of different technologies has created one interrelated cluster, with the result that the Cambridge cluster is continually evolving and diversifying. It is this ability to support multiple technologies that has helped Cambridge to maintain its competitive advantage in a competitive global business environment.

Explicit in Michael Porter’s (1998) definition of a cluster was interaction, through local competition and rivalry but also through collaboration. Therefore, it is not just being in or around Cambridge that counts; it is what you do when you are in that location that really determines if you are adding to or benefiting from the cluster.

Clusters are important because they have consistently been shown to be conducive to higher innovation rates and productivity, which results in higher competitiveness. Michael Porter’s re-branding of cluster theory has championed the process of clustering for creating and sustaining competitive advantage. He theorises that the agglomeration of firms enables them to interact intensively, exploiting their privileged access to knowledge and experience, and, as a result, they are more productive and competitive. However, clusters have been criticised as being too elastic, encompassing every scale from local to trans-national, creating the confusion we see today. Some have assumed political boundaries, others a nominal distance value based on an assumption of a decay curve. It is therefore essential that we define the context and location of the Cambridge cluster.

Clusters are embedded within a hierarchical structure. At the firm level, companies are the source and sink of knowledge creation and innovation. At ever higher levels of hierarchy, the cluster expands to incorporate a growing number of networked companies in increasing complexity. As the level of hierarchy grows, so the geographical boundaries of the cluster also grow and in some instances interact with surrounding clusters. It is therefore clear that ‘clustering’ needs to be recognised within a larger framework which, in the case of Cambridge, may be a ‘super-cluster’. However, the exact shape of broader of frameworks is much contested, making an integrated framework all the more necessary.

The Cambridge Cluster

The Cambridge Cluster is a much more tightly defined region in Cambridge than has previously been recognized. This claim is based on the necessity for dense agglomeration of inter-related firms and the interactions that take place within this area. It is not the belief of the researcher that this occurs in a prescribed radius around Greater Cambridgeshire. The map below illustrates the extent of the area which is proposed, superimposed on the Biotechnology Cluster in Cambridge. The radius is approximately 7miles.

No one would expect this boundary to remain static in time, expansion at some point is inevitable, and integration with the ‘Golden Triangle’ of Oxford, London and Cambridge will, in theory, increase the area covered. Any future expansion will be built and focused around a Cambridge core and new firms will occupy these locations in the coming years, with those based on the business parks most able to take advantage of local networks, knowledge and expertise.

It is not just about being close - It is about exploiting the fact you are close Persistent competitive advantage occurs increasingly in local environments, but it is not just about being close to one another that matters. In today’s knowledge-based economy, the function and utility of social and

strategic networks, that allow firms to extract, learn and exploit knowledge for innovation, is the key competence in enhancing productivity. Relational proximity - how well we understand, trust, and interact with one another all play specific roles in reducing uncertainty and solving the problems of co-ordination - highlights the importance of interaction in clusters.

A word of warning remains; there are negative issues of proximity, cognitive lock-in, and organisational inflexibility. These are linked to firms not being able to access new and potentially valuable sources of knowledge. This occurs increasingly in specialised clusters that cannot diversify or enter other areas of technology. Such criticism could be placed on Cambridge's obsession with semi-conductor development. Although I do not advise we bite the hand that feeds us, I would suggest that we should concentrate on how to recombine our existing competitive advantage in this area to tackle new opportunities, such as clean technology. (IaE)

Sustaining Cambridge's Competitive Advantage

Clustering appears to be a central issue in sustaining Cambridge's competitive advantage in today's knowledge economy. The future of Cambridge cluster is therefore dependent on its ability to transfer leading knowledge into the businesses that surround it. This can only truly be successful by encouraging interaction, co-operation and competition at local level. When this happens, science, commerce, and the market can align, share visions for the future, and build on Cambridge's success.

To conclude, I suggest a pragmatic definition of the Cambridge Cluster, based on the firms that add and contribute to the Cambridge Cluster. This is essential for future awareness of where Cambridge fits into a broader matrix of regional policy and 'super-cluster' branding.

Cambridge Network

The Cambridge Network is a networking organization for business people and academics working in technology fields in the Cambridge area. The network was founded in 1998 by Nigel Brown, David Clevely, Fred Hallsworth, Hermann Hauser, Anthony Ross and Alec Broers. The current president of the Cambridge Network is Alison Richard, Vice-Chancellor of the University of Cambridge, and the chief executive is Peter Hewkin. Driven by the belief that "Cambridge Ideas Change the World" and funded solely by membership subscriptions and sponsorship, the organisation is answerable to its founder members and ordinary members who elect the board. www.cambridgenetwork.co.uk/aboutus

Cambridge Network's mission is "to link like-minded people from business and academia to each other and to global peers for the benefit of the Cambridge region". Now in its tenth year, it is a community made up of some 1300 organisations and a number of individuals from across the East of England. Benefiting from the principle of "Sharing for Success", members use its services to find:

- Talent
- Finance
- Partners

The Network helps members to "Raise Cambridge's Game" by providing a range of activities and services under the Cambridge brand, including:

- Networking opportunities with 40 events a year including founder dinners, open meetings, café networking, special interest groups (in areas as diverse as healthcare, intellectual property, finance, marketing, cleantech, IT, China, India and USA); partnering activities and specialist events to meet peers and partners and learn from as well as with them

- The region's most visited website for jobs, news, events and a comprehensive directory of company profiles: www.cambridgenetwork.co.uk
- A Cambridge Network LinkedIn group for referrals and discussions
- A training ecosystem, 'The Learning Collaboration' (TLC), where local organisations share their training to get better value www.thelearningcollaboration.com
- 'The Cambridge Corporate Gateway', a joint venture with the University of Cambridge, which attracts the world's best companies to find partners. This formula has delivered multi-million pound deals and also attracted global partners to set up research centres in Cambridge www.cambridgencorporategateway.com
- Access to discounts on selected products and services www.cambridgenetwork.co.uk/discounts
- Sister communities in Boston www.cambridgenetwork.us and Shanghai www.shanghai-network.com – each with their own LinkedIn group.

The Cambridge Network also delivers the electronics Knowledge Transfer Network in the East of England as well as the Cambridge University Local Industry Links programme. (CaN)

Research in the Cambridge Cluster

The two Cambridge-based universities, the University of Cambridge (www.cam.ac.uk) and Anglia Ruskin University (www.anglia.ac.uk), play an important role in the cluster. The 49,000 students¹ who receive their education in Cambridge and the significant sums of money spent annually on education and research by the University of Cambridge alone (£612m in 2006-07)² contribute significantly to the enormous pool of talented labour available to the Cambridge Cluster.

University of Cambridge

The University of Cambridge is one of the oldest universities in the world and the second-oldest, after Oxford (www.ox.ac.uk), in the English-speaking world. The University, which celebrates its 800th anniversary next year (See Box 5), was founded in 1209 by an association of scholars who left the University of Oxford after a dispute with the local townsfolk.

For those not familiar with the University of Cambridge, it can be difficult to understand how all the various schools, departments, colleges and other institutions are structured within one coherent body. In effect, the University is comprised of three sections: the University Schools and Governing Bodies; the Colleges, which all students and most academics are affiliated to and which provide living quarters, teaching facilities, and other support systems to their members; and the Associated Organisations (e.g. Cambridge University Press (<http://www.cambridge.org>), Cambridge Enterprise (<http://www.enterprise.cam.ac.uk>) and Cambridge Assessment (<http://www.cambridgeassessment.org.uk>)).

The University Schools and Governing Bodies

The administration of the University is carried out by a number of governing bodies, including the Regent House, the Senate, the Council, the General Board, and the Finance Committee.

The Regent House is the governing body of the University and has over 3,800 members. The process of making and amending the regulations which govern the University is carried out by the Regent House, although the General Board and the Senate have legislative powers in certain areas. The Regent House also has responsibility for electing members to the Council and the Board of Scrutiny and in making appointments to a number of University bodies.

The Senate, which was the governing body of the University until 1926, consists of all holders of the Cambridge Master of Arts or other higher degree and all current members of the Regent House. It is responsible for the election of the Chancellor, currently HRH the Duke of Edinburgh, and the High Steward and it enacts legislation to regulate these elections.

The Council is the principal executive and policy-making body of the University, and also deals with relations between the University and the Colleges. The Council consists of the Chancellor and Vice-Chancellor, plus 19 elected members drawn

from Heads of Colleges, Professors or Readers, members of the Regent House, and students. The Vice-Chancellor, currently Professor Alison Richard is the full-time resident head of the University and is the principal academic officer.

The General Board has responsibility for advising the University on educational policy and controlling the resources for the proper implementation of that policy.

The Finance Committee is accountable to the Council for all receipts and payments of the University, including its departments and subsidiaries, and for advising the Council on trends in University income and expenditure.

The core activities of the university, teaching and research, are organised into Schools, Faculties and Departments. The term 'School' refers to an administrative grouping of related subjects. There are six Schools at the University: Arts and Humanities, Biological Sciences, Clinical Medicine, Humanities and Social Sciences, Physical Sciences, and Technology. Within each School, a number of Faculties or Departments are responsible for different subject areas. Faculties and departments carry out research, teach undergraduate students in lectures and laboratories, and provide research and tuition facilities for postgraduate students.

In addition, there are a number of other collaborative bodies, such as the Medical Research Council (<http://www.mrc.ac.uk/index.htm>) or Cancer Research UK (<http://www.cancerresearchuk.org>), who have dedicated research institutes on the Addenbrooke's hospital site (e.g. the MRC Laboratory of Molecular Biology (<http://www2.mrc-lmb.cam.ac.uk>), the Hutchison/MRC Research Centre (<http://www.hutchison-mrc.cam.ac.uk>), the MRC Dunn Human Nutrition Unit (<http://www.mrc-dunn.cam.ac.uk>) and the Cancer Research UK Cambridge Research Institute (<http://www.cambridgecancer.org.uk>)).

The Colleges

The University of Cambridge has 31 Colleges (<http://www.cam.ac.uk/colleges/addresses.html>) which are independent institutions each with their own property and income. The colleges have two main roles, teaching undergraduates in small groups (known as supervisions) and providing accommodation, dining facilities, and a social network for students. In effect, the colleges provide a 'home away from home' for students by forming tight-knit communities of their members. Vice-Chancellor Professor Alison Richard described the role of the Colleges in her annual address at the opening of the academic year in 2005: 'At Cambridge, teachers and students meet in the Colleges, and the Colleges play a crucial formal role in education. But they also mix scholarship with fellowship and friendship, and academic studies with everything else. They are by no means the only communities within the University, but they are a unique and marvellous embodiment of the idea of academic community'.

Each College is governed by its own statutes and regulations. The governing body of a College consists of the Head of the College and some or all of its Fellows, the elected senior members of the College. Currently, College representatives have a seat in the

¹ 2008 HESA Survey

² 2007 Annual Report, University of Cambridge (<http://www.admin.cam.ac.uk/univ/annualreport/2007/statement.pdf>)

Council of the University. In the Council, the University and the College deal jointly with specific student matters. The Colleges, however, have the exclusive right to select the undergraduate entrants to the University of Cambridge.

The Associated Organisations

The third major component of the University is its external organisations. There are three major external organisations: Cambridge Assessment, Cambridge University Press (CUP) and Cambridge Enterprise.

Cambridge Assessment is the new identity of the University of Cambridge Local Examinations Syndicate (UCLES) which is a not-for-profit, non-teaching department of the University. Originally established in 1858 with the vision of 'promoting the public good by regulating and raising assessment standards', Cambridge Assessment is the largest assessment agency in Europe.

CUP is the oldest established press in the world. It has printed and published continuously since 1584 when the CUP book was printed. CUP is established as a trust by Statute of the University and has its own charitable status separate from the University.

Cambridge Enterprise, which is the technology commercialisation arm of the University, was founded in December 2006 as a wholly owned subsidiary of the University of Cambridge. Cambridge Enterprise is involved in three main areas, each with some degree of overlap with the other two areas. These are:

- Technology Transfer
- Consultancy
- Access to Venture Capital

The technology transfer services undertaken by Cambridge Enterprise include the management of new IP through the filing of patents and licensing of the IP, proof of concept funding, and bespoke marketing.

Through its consulting arm, Cambridge Enterprise provides support for the staff and research groups of the University that are undertaking consulting services with SMEs, large commercial companies, and public sector organisations. These consultancy services typically include the provision of expert advice or use of facilities. The main role of Cambridge Enterprise is to help negotiate the terms of the consultancy contract, to provide assistance with costing and pricing, and to help set up formal arrangements for the use of University facilities. The organisation also assists with invoicing, debt collection, and distribution of the income that arises from the consulting activities.

Cambridge Enterprise also provides new spin-outs with access to venture capital and expertise through its own Seed Funds or through the recently formed Cambridge Enterprise Venture Partners, a syndicate of 10 Venture Capital Firms and 2 business angel syndicates that meets three times a year and allows Cambridge companies to pitch to them for investment. Cambridge Enterprise also provides access to other local angel investors, as well as expert business planning, mentoring, surgeries, and other related programmes. Together, these initiatives help these new businesses to develop and hopefully one day become significant players in the cluster.

Anglia Ruskin University

Anglia Ruskin University (ARU) is the second university in the Cambridge region, and is celebrating its 150th anniversary this year. Awarded university status in 1992, ARU has a wide and varied history. ARU originated from the Cambridge School of Art, which was opened in 1858 by John Ruskin. This became the Cambridgeshire College of Arts and Technology (CCAT) in 1960, which then merged with the Essex Institute of Higher Education in 1989 to form the Anglia Higher Education College. In 1991, it became a polytechnic, changing its name to Anglia Polytechnic. Polytechnics primarily provide vocational-style training, equipping students with practical skills for employment, and are used to describe Institutes of Technology prior to 1992 (now referred to as New Universities).

Anglia Polytechnic was then awarded university status in 1992, changing its name to Anglia Polytechnic University (APU). APU continued in this form until September 2005 when, after consultation with staff, students, local residents, communities, and businesses, it changed its name to Anglia Ruskin University (ARU), adopting the surname of the original founder of the Cambridge School of Art as part of its title.

There are five faculties in the university:

- Ashcroft International Business School
- Faculty of Arts, Law and Social Sciences
- Faculty of Education
- Faculty of Health and Social Care
- Faculty of Science and Technology

These faculties are spread over two campuses, one in Cambridge and a secondary campus in Chelmsford which houses the Ashcroft International Business School. ARU also runs courses at its University Centres in King's Lynn and Peterborough which are based at the College of West Anglia and Peterborough College respectively. Each faculty, like those of the University of Cambridge, is also sub-divided into departments or divisions.

Contribution of Cambridge-based Universities to the Cluster

There are many avenues through which Cambridge-based universities can contribute to the cluster. These include the training of undergraduate and postgraduate students, providing a highly skilled labour pool that can feed into the companies in the Cambridge cluster, as well as providing a source of entrepreneurs who may end up forming companies of their own in the cluster. The income from universities can also be used towards the training of the aforementioned students, as well as towards academic research which helps to increase the knowledge-base of the cluster, and new technologies which can be commercialised through licensing or the creation of new companies. Through direct interactions with business, universities can transfer the knowledge gained from their academic research to the businesses in the cluster, aiding in their development. These different avenues will be discussed in more depth below.

University of Cambridge Family Tree

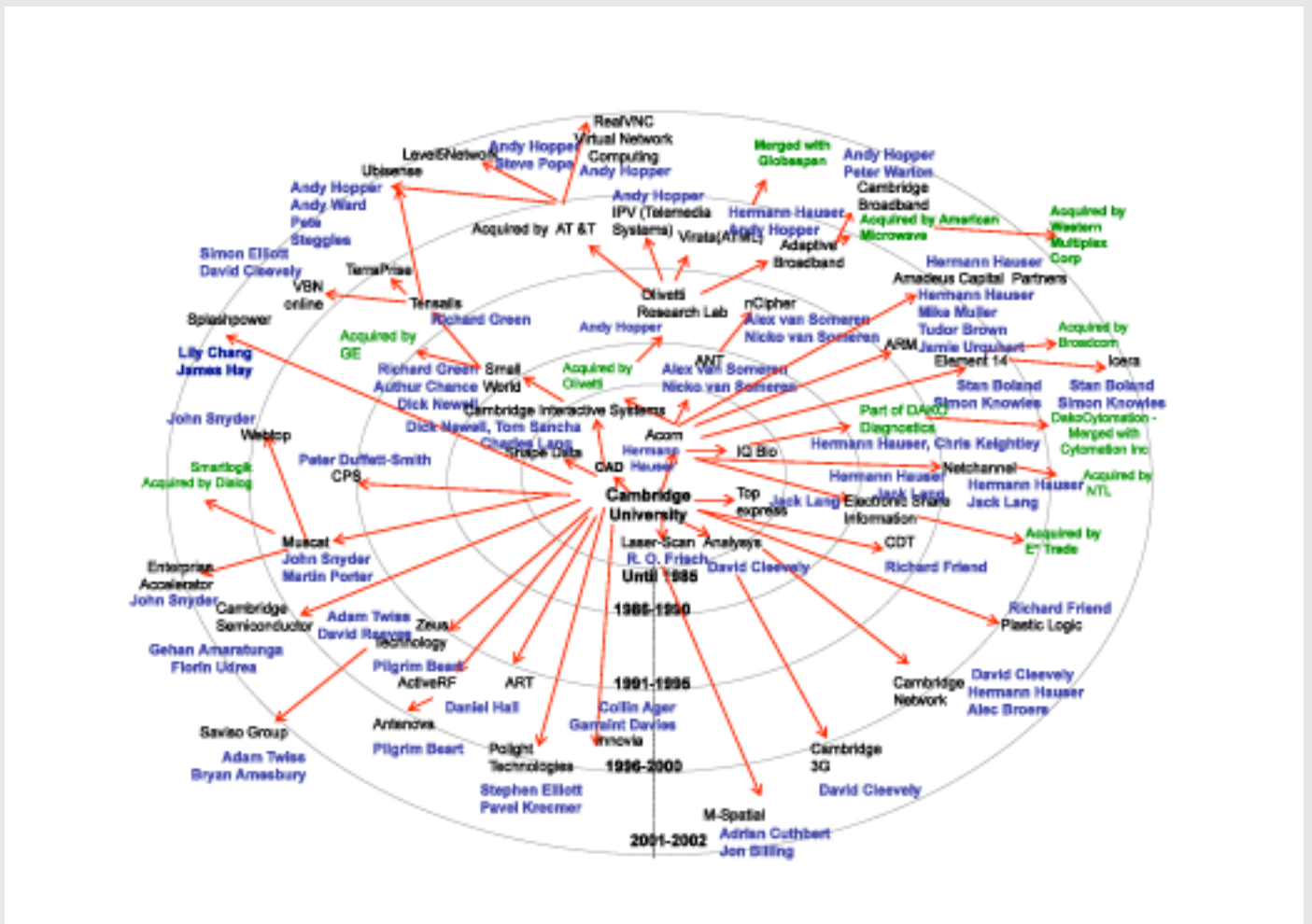


Figure 1 - The Hi-Tech Start-Ups associated with the Cambridge University
(Copyright: Y.M.Myint and Dr. Shailendra Vyakarnam, CfEL, Judge Business School)

Figure 1 traces the formation of the hi-tech cluster from the early stages when start-ups of the University such as the Computer Aided Design Centre (CAD) and companies such as Acorn Computers and Topexpress emerged in the late 1970s and 1980s. In this diagram, we see several names are repeatedly involved in founding different organisations over time. Most of these people can be traced back to the Computer Laboratory or the Department of Physics at the University of Cambridge. Andy Hopper, for example, who has worked with Hermann Hauser many times, appears frequently on the diagram and is currently the Head of the Computer Laboratory at the University of

Cambridge. These people developed the knowledge required for early entry into microprocessors and were involved in the very early days of designing computers and the associated electronics. Acorn, ARM, ANT, Virata (now Conexant Systems), the AT&T Labs, and UbiSense are some examples of firms that draw heavily on a core technology understanding of microelectronics. Some of the names on the diagram collaborate frequently in business ventures, but equally important is the fact that they are within a clearly identifiable social mini-cluster and there is much movement of tacit knowledge and opportunity creation based on the knowledge that radiates from the University. (CfEL)

Creating a Labour Pool of skilled Individuals in the Cluster

In the academic year 2006-07, the University of Cambridge received the most income of all UK universities, with a total income of around £958.2m (see Table 1 for data on Cambridge), £945m of which was spent³. In terms of total research income - the income that was specifically allocated for research - Cambridge was ranked 3rd in the UK, having received around £311.5m. Anglia Ruskin University received around £110.5m in total income, and £1.9m in total research income in 2006-07 (see Table 2 for data on ARU).

Both universities are heavily involved in teaching, resulting in a large potential pool of skilled individuals that could contribute to the cluster. The University of Cambridge had 28,776 students in 2006-07, 18,183 of which were undergraduates (see Table 1). ARU was also a significant contributor, teaching 20,299 students, 16,854 of which were undergraduates (see Table 2). In terms of total student numbers, the University of Cambridge was ranked 15th amongst all UK universities, while ARU was ranked 44th. The University of Cambridge is particularly outstanding in terms of postgraduate study with 10,593 postgraduate students in 2006-07 (ranked 4th in the UK), 6,635 of which were undertaking research degrees (e.g. PhD). The University of Cambridge thus had the highest number of research-only postgraduate students of all UK universities. ARU had 3,445 post-graduate students, 321 of which were research-only.

Together, the University of Cambridge and Anglia Ruskin University are significant providers of skilled individuals to the region; both universities provide a significant undergraduate resource, while the University of Cambridge is especially valuable in providing postgraduates.

University of Cambridge		
Total Income	Raw Value (£000s)	958,166
	UK Ranking	1st
Total Research Income	Raw Value (£000s)	311,464
	UK Ranking	3rd
Total Number of Students	Raw Number	28,776
	UK Ranking	15th
Number of Undergraduate Students	Raw Number	18,183
	UK Ranking	29th
Number of Post-Graduate Students	Raw Number	10,593
	UK Ranking	4th
Number of Research Only Post-Graduate Students (e.g. PhD Students)	Raw Number	6,635
	UK Ranking	1st

Table 1: Research, Undergraduate and Postgraduate Activity for the University of Cambridge in 2006-07 (Source: 2008 HESA Survey)

Anglia Ruskin University		
Total Income	Raw Value (£000s)	110,450
	UK Ranking	73rd
Total Research Income	Raw Value (£000s)	1,883
	UK Ranking	111th
Total Number of Students	Raw Number	20,299
	UK Ranking	44th
Number of Undergraduate Students	Raw Number	16,854
	UK Ranking	39th
Number of Post-Graduate Students	Raw Number	3,445
	UK Ranking	72nd
Number of Research Only Post-Graduate Students (e.g. PhD Students)	Raw Number	321
	UK Ranking	82nd

Table 2: Research, Undergraduate and Postgraduate Activity for Anglia Ruskin University in 2006-07 (Source: 2008 HESA Survey)

University-Business Interactions of the Cambridge-based Universities

Knowledge and technology transfer is the main channel for the exchange of knowledge and technologies between universities and businesses. Knowledge exchange has many benefits for universities (e.g. income), businesses (e.g. the receipt of new knowledge that can help the business to grow), and the economy and society in general (e.g. job creation, new products and services, higher living standards). Knowledge exchange between universities and business can take many forms:

- **Continuing Professional Development (CPD)**, where members of professions maintain, improve, and broaden the knowledge and skills required in their professional lives, usually through a range of short and long training programmes.
- **Consultancy** is the provision of expert advice and work that is dependent on a high degree of intellectual input from the university to the business. The main desired impact of consulting is not the creation of new knowledge, but the creation of new understanding.
- **Collaborative Research** is a structured research project that involves two or more partners in addition to the university. All parties work together toward a common goal by sharing knowledge, learning, and building consensus.
- **Contract Research** is research arising from collaborative interactions that specifically meets the research needs of the external partners (i.e. businesses).
- **Licensing of intellectual property (IP)**, which is a formal agreement that allows the transfer of technology between two parties where the owner of the technology (licensor) permits the other party (licensee) to share the rights to use the technology without fear of a claim of intellectual property infringement being brought by the licensor.

³ 2007 Annual Report, University of Cambridge (<http://www.admin.cam.ac.uk/univ/annualreport/2007/statement.pdf>)

- **Spin-Out Companies** have been set-up to exploit IP that has originated from within the university (university spin-outs) or from businesses (corporate spin-outs). Spin-outs can benefit society and the economy through the generation of new jobs and products and services.

To determine the extent to which Cambridge is involved in knowledge transfer with business, data on each of the knowledge transfer mechanisms outlined above was analysed for both the University of Cambridge, and Anglia Ruskin University.

Performance of Cambridge Universities at Knowledge Transfer with Business

The University of Cambridge is outstanding at many mechanisms of knowledge transfer, particularly in terms of collaborative research, licensing, and active spin-outs. For the academic year 2006-07, Cambridge was ranked 1st out of all UK universities in collaborative research income (£49.4m), licensing income (£3.5m), and in the estimated current employment levels of its active spin-outs, which generated 994 new jobs in the region (see Table 3)⁴. Cambridge was also ranked 4th for the number of new patents filed in 2006-07, having filed 112 patents, and this, coupled with its high activity in licensing, suggests that the University of Cambridge is strong in the generation, protection and licensing of its intellectual property.

The University of Cambridge is also active at contract research, ranked 8th in the UK for its contract research income (£25.1m). The University is equally prolific in spin-outs, ranked joint 9th for spin-out formation in 2006-07 (2 spin-outs) and 3rd for the number of active spin-outs (45 spin-outs; see Table 3).

Cambridge was also ranked 13th for income from CPD courses, having received £8.4m in CPD income, and ranked 30th for consulting income, having received £2.9m.

Taken together, this data indicates that the University of Cambridge is very active in knowledge transfer with business, as previously reported by Library House,⁵ and is particularly outstanding in terms of collaborative research, licensing, and spin-out activity. In addition to the economic benefits that these knowledge transfer activities provide to the region, they should also provide businesses in the cluster with significant support and expertise, helping their development. Furthermore, the high level of employment generated by the University spin-outs provides an additional economic and societal benefit to the cluster.

Anglia Ruskin University is also active in knowledge transfer with business, and its impact on the cluster should not be underestimated (see Table 4). For example, ARU generated £4.4m in CPD income, placing it 35th out of the 160 universities in the UK. ARU was also ranked joint 38th for the number of new patents filed, and it received £1.4m in consulting income, placing it 55th out of all UK universities. These figures, coupled with those from the University of Cambridge, suggest that the universities in Cambridge actively provide businesses and other non-commercial organisations with knowledge and technology transfer opportunities, which is an encouraging sign for the cluster.

University of Cambridge		
Continuing Professional Development (CPD) Income	Raw Value (£000s)	8,432
	UK Ranking	13th
Consulting Income	Raw Value (£000s)	2,900
	UK Ranking	30th
Collaborative Research Income	Raw Value (£000s)	49,381
	UK Ranking	1st
Contract Research Income	Raw Value (£000s)	25,078
	UK Ranking	8th
Number of New Patents Filed	Raw Number	112
	UK Ranking	4th
Licensing Income	Raw Value (£000s)	3,463
	UK Ranking	1st
Number of Spin-Outs Formed	Raw Number	2
	UK Ranking	Joint 9th
Number of Active Spin-Outs	Raw Number	45
	UK Ranking	3rd
Estimated Current Employment of Active Spin-Outs	Raw Number	994
	UK Ranking	1st

Table 3: Knowledge Transfer Activities for the University of Cambridge in 2006-07 (Source: 2008 HE-BCI Survey)

Anglia Ruskin University		
Continuing Professional Development (CPD) Income	Raw Value (£000s)	4,366
	UK Ranking	35th
Consulting Income	Raw Value (£000s)	1,363
	UK Ranking	55th
Collaborative Research Income	Raw Value (£000s)	1,103
	UK Ranking	77th
Contract Research Income	Raw Value (£000s)	65
	UK Ranking	122nd
Number of New Patents Filed	Raw Number	3
	UK Ranking	Joint 38th
Licensing Income	Raw Value (£000s)	18
	UK Ranking	Joint 71st
Number of Spin-Outs Formed	Raw Number	0
	UK Ranking	-
Number of Active Spin-Outs	Raw Number	0
	UK Ranking	-
Estimated Current Employment of Active Spin-Outs	Raw Number	0
	UK Ranking	-

Table 4: Knowledge Transfer Activities for Anglia Ruskin University in 2006-07 (Source: 2008 HE-BCI Survey)

⁴ 2008 Higher Education-Business and Community Interaction (HE-BCI) Survey - http://www.hefce.ac.uk/pubs/hefce/2008/08_22/

⁵ 2008 Library House and UNICO Report: Metrics for the Evaluation of Knowledge Transfer Activities at Universities, and 2007 Library House Report: An Analysis of UK University Technology and Knowledge Transfer Activities (<http://www.libraryhouse.net/publications/downloads/Gatsby-v8lowres.pdf>)

The Scale of the Cambridge Universities

Both universities in Cambridge play an important role both as a source of employment and education for students in the region. The University of Cambridge is the largest employer in the region with 8,357 direct employees⁶ in the 2006-07 academic year, not including staff employed by the 31 Colleges. Anglia Ruskin University contributes an additional 2,128 direct employees to the region. There were more than 18,500 full-time students studying at the University of Cambridge in 2006-07, of which 66% were undergraduates. Of the undergraduates, the number studying arts, humanities, and social sciences (6,159) is roughly equal to the number studying science and technology (6,142). Competition for an undergraduate place at the University is strong, with 14,300 applicants in 2007 but only 3,381 students being accepted (Source: UCAS).

Anglia Ruskin is also a strong contributor to the region in terms of full-time students, with 14,600 full-time students studying at the university in 2006-07, 87% of which were undergraduates. Around 42% of the undergraduates at Anglia Ruskin are studying arts, humanities, and social sciences (5,319), with 58% studying science and technology (7,235). Demand for places at Anglia Ruskin is also strong, with the university receiving 11,110 applicants in 2007, but only accepting 2,539 students.

The University of Cambridge also extends its learning opportunities to the community and has offered adult and continuing education since the 1860s. Its Institute for Continuing Education offers a wide range of life-long learning courses and attracts over 10,000 part-time students every year. Anglia Ruskin is particularly strong in catering for part-time students, with the university claiming to be the most important provider of part-time higher education in the country next to the Open University⁷.

Recent Developments at Addenbrooke's Hospital

The Cambridge Biomedical Campus at Addenbrooke's Hospital is set to become one of the leading centres for medical and biomedical research and development in Europe. The UK is already the largest bio-tech market in Europe, raising more money for research in this field than any other country in Europe, and, with the proposed expansion to the Cambridge Biomedical Campus, Cambridge is set to become the centre of the biomedical industry in the UK.

The expansion plans will incorporate existing facilities on the site, which include Cancer Research UK Centre, the Wolfson Brain Imaging Centre, the Cambridge Institute for Medical Research, the Wellcome Trust Clinical Research Facility, and the University of Cambridge's School of Clinical Medicine. The first phase of development will include NHS and University Genetics laboratories, University of Cambridge Metabolic Research laboratories, MRC Epidemiology Unit, and an Addenbrooke's Clinical Care Centre. These projects will double the size of the campus by 2020, with potential for around 4,500 new

primary research jobs (3,900 biomedical research park and 600 University) in addition to support jobs both on and off the site.

The basic science will be delivered by the MRC National Centres and Units and the University's research, especially in the fields of biochemistry, pathology, physics, and chemistry. This will be embedded into wider co-operations with organisations like the Sanger Institute, the Babraham Institute, major charities, and pharmaceutical companies. More applied research will take place in the University Clinical School, the Cambridge Institute for Medical Research, Cancer Research UK, and the Institute of Metabolic Science. The new campus will also host a Biomedical Research Centre – one of six in England.

This strong foundation will enable the Addenbrooke's Hospital to deliver better health care, with the Rosie Maternity Hospital, specialist units, and other clinics providing patients with improved treatments in the areas of cancer, transplants, neurosurgery, metabolic disorders, cardiovascular medicine, musculo-skeletal, women's and children's health, immunity and infection, and genetics.

In addition to the benefits the Cambridge Biomedical Campus will bring to the Cambridge Cluster, further plans are in place that will see the Cambridge University Hospitals NHS Foundation Trust, in cooperation with the Greater Cambridge Partnership and the East of England Development Agency, develop an enterprise hub to include incubator and start-up space. (RoW)

⁶ 2008 HESA survey

⁷ http://www.anglia.ac.uk/ruskin/en/home/your_university/about_anglia_ruskin.html

Technology and Knowledge Transfer from the University of Cambridge

Finding the right partners to commercialise discoveries arising from the world-class laboratories of the University of Cambridge is achieved through a number of routes, most commonly by licence to a new or existing company. Cambridge Enterprise facilitates commercialisation via the optimum route, and exists to help University of Cambridge inventors, innovators and entrepreneurs make their ideas and concepts more commercially successful for the benefit of society, the UK economy, the inventors and the University.

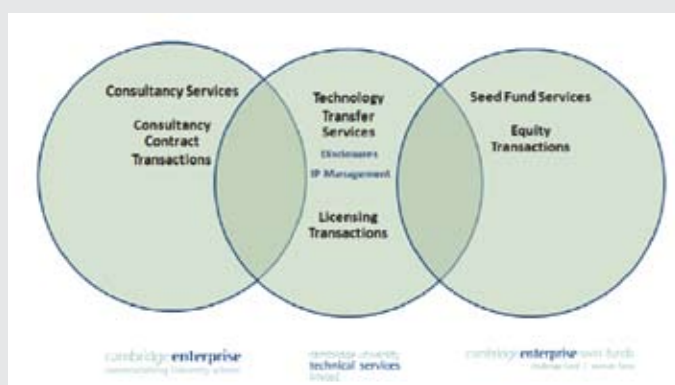
The goals of Cambridge Enterprise are to:

- build strong relationships with University academics
- be an attractive partner for industry and investors to take University ideas forward through commercial channels
- make significant, measurable progress towards financial sustainability.

Cambridge Enterprise's current investment portfolio contains 68 companies and over 400 active licence agreements. Additionally, Cambridge Enterprise provides consultancy services for University of Cambridge staff and research groups wishing to provide expert advice or facilities to public and private sector organisations worldwide, with more than 100 consultancy agreements signed each year.

During 2006/07 Cambridge Enterprise returned £5.3 million to University of Cambridge academics and Departments, representing 88% of income received. This returned income provides valuable additional funding for research in departments as well as a direct return to the inventor. The accounts for this year (2007/08) are likely to show significant improvement on the previous year's performance.

Cambridge Enterprise delivers its mandate by working in three overlapping areas:



The University of Cambridge has contributed to over 20% of all newly formed companies in the Cambridge Cluster between 2001 and 2006¹. In the same period, University spin-outs have attracted £140 million in venture capital², raised over £390 million in total, and employ over 1700 people.

The University is famous for creating breakthrough technologies which generally arise from long-term basic research. It can often take over a decade from the first patent filing before it is known whether or not the technology will be a commercial success.

One way to commercialise technology is to create a new company. This was the case with Plastic Logic www.plasticlogic.com where the founders licensed University technology to create a company around their innovation. Plastic Logic has developed the world's first electronic reader aimed specifically at business users. The technology originated from research undertaken at the Cavendish Laboratory under the direction of Professor Sir Richard Friend.

Licensing is another route for commercialising. An example of a commercial partnership involving a licence is the CASTEP technology, a software tool developed at the Cavendish Laboratories by Professor Mike Payne to help in the development of better materials. The research began in 1981 and it was not until 1994 that the commercial potential of this fundamental work was realised with the signing of a licence with Accelrys Limited www.accelrys.com. Today the software is widely used in industry to predict and investigate physical or chemical processes and through the results better predictions can be provided on how materials or surfaces perform.

The Cambridge Enterprise website www.enterprise.cam.ac.uk contains six sections which provide extensive information:

1. For Industry which contains invention licensing and investment opportunities.
2. University Community information for those working within the University.
3. Consultancy for University of Cambridge staff and research groups wishing to provide expert advice or facilities to public and private sector organisations worldwide.
4. Press and Events which is the main resource for Cambridge Enterprise news and information, including news, success stories, forthcoming events and publications.
5. Cambridge Enterprise Seed Funds with information on how Cambridge Enterprise uses its seed funds to encourage commercialisation of University inventions through investing at the earliest of stages to attract smart money and management into emerging companies.
6. About Us which contains information about Cambridge Enterprise's goals and principles, group performance, back copies of Annual Reviews, and company information. Cambridge Enterprise Limited became a wholly owned affiliate of the University of Cambridge in December 2006. Previously, Cambridge Enterprise operated as a department within the University. The origin of the technology transfer office is the Wolfson Industrial Liaison Office (WILO), which was founded in 1970 with an endowment from the Wolfson Foundation. In March 2000, WILO merged as a department within the then Research Grants and Contracts Office to form Research Services Division. One year later, WILO was renamed the Technology Transfer Office which then became part of Cambridge Enterprise, merging the commercial activities of the existing Cambridge Entrepreneurship Centre and University Challenge Fund.

¹ The Impact of the University of Cambridge on the UK economy and society. Library House 2006.

² The Cambridge Cluster Report 2007, Library House.

In late 2009, the office plans to relocate to the new Hauser Forum currently under construction on the University's West campus, following a generous multi-million pound donation by Dr Hermann Hauser and his wife Dr Pamela Raspe. Within the Hauser Forum will be an IdeaSpace for emerging companies and a seminar centre which will be used for events promoting Cambridge research to the business and investment community. A café and atrium meeting place will replace the existing West Café and service the whole West Cambridge site. Next door,

the Broers Building will provide commercial, research and development, and ancillary space which will be let to private organisations whose activities are relevant to entrepreneurship and knowledge transfer.

More information can be found at www.enterprise.cam.ac.uk. (CaE)

The Cambridge 800th Anniversary

From humble beginnings to its current standing as one of the world's leading research universities, the University of Cambridge celebrates 800 years as a seat of learning in 2009. Cambridge is one of the world's leading research universities. It has more than 80 Nobel Prizes to its credit, more than any other institution. Some of the most famous minds in history have studied, researched or taught here. This is the place of Newton and Darwin, Wordsworth and Milton, Babbage and Hawking. It is also the place where the first fully 3D computer game was written, where the precursor to the modern webcam was invented, and where some of today's best-known actors and comedians got their start.

The 800th Anniversary presents an opportunity to thank staff, alumni, benefactors, students and the local community for their part in making Cambridge what it is today. In marking the year, the aim is to strike a balance between academic achievement and celebration, respect the past, celebrate the present, and leave a legacy for the future. Many of the ideas and plans for the 800th Anniversary Year provide a springboard for the future - starting something fresh that will grow in years to come.

17th January 2009 marks the beginning of the University's 800th Anniversary Celebrations. Churches across central Cambridge, including the University Church of Great St Mary's, will ring their bells in celebration. A new work for bells has been especially composed for the occasion and will be performed by the bell-ringers at 7:15 p.m. Additionally, a number of Cambridge buildings will be specially lit on the evenings leading up to the 17th. Local churches, college chapels, and alumni groups worldwide are invited to participate.

In March 2009, the home of student drama in Cambridge, the ADC Theatre will present a very special event to mark the University's 800th Anniversary. For one night only, alumni and current students will gather to entertain, reminisce, and celebrate the incredible impact Cambridge graduates have had on the world of British theatre and entertainment.

Cambridge Cantat 800, a week-long celebration of the University's rich and diverse tradition of choral music will take place from April 11th-19th 2009. Participating groups include the world-famous choirs at King's, Clare, and Trinity College.

The Cambridge University Musical Society has commissioned Sir Peter Maxwell Davies, Master of the Queen's Music, in collaboration with Poet Laureate Andrew Motion, to write a new piece for a symphony orchestra and chorus which will be premiered in King's College Chapel on 13 June 2009.

Other planned events for 2009 include a concert in London and a series of lectures, exhibitions, and podcasts exploring 800 Years of Cambridge Ideas.

Cambridge's well-known Science Festival and Bridge the Gap Charity Walk will incorporate anniversary elements into their 2009 programming, as will the new Festival of Ideas and Open Cambridge.

Next year also sees a number of events marking the 200th anniversary of Charles Darwin's birth and the 150th anniversary of his publication *On the Origin of Species*.

Many other public events are planned throughout the year. Please see our website at www.cam.ac.uk/800 for more details. (UoC)



Company Landscape

The Cambridge cluster is well-known for its acceleration of small and medium sized companies (SMEs) across biotechnology, software, electronics, and the semiconductor industries. Over the years, a number of these companies, including Autonomy, ARM, and CSR, have already grown into large public listed companies with market caps of around £1bn. In addition, several companies, operating nationally and internationally, also have subsidiaries within the Cambridge cluster. The factor that all these companies have in common is that they are both technology and innovation-orientated. Calculations of the exact number of technology and innovation-orientated companies can vary widely depending on the definitions of both a company's business and the area of the cluster. According to the definitions employed by Library House, there are around 1,000 companies located in the Cambridge cluster. The following section describes the innovative capacity of the industry in more detail.

The Cambridge cluster is home to more than 221 companies, each reporting revenues of around £10m or more. According to sections 247 and 249 of the UK Companies Act 1985, medium-sized companies are defined as those with a turnover of more than £5.6m. These companies employ over 75,000 people and 89 of them are subsidiaries of international holding companies, which account for nearly £3bn of revenues and over 15,000 jobs. A more detailed look into the different types of medium and large companies in the Cambridge region shows the importance of the Cambridge cluster to the whole of the East of England.

The East of England is a powerful economic region counting for 155 public listed companies on the LSE with market capitalisation of £45,954m. Most of these companies (87) are listed on the AIM (Alternative Investment Market), with a market cap of (£1,617m). Another 68 companies are listed on the LSE Main Market worth £44,337m. The LSE has a special index, called the techMARK, to cover innovative technology and healthcare companies. Remarkably, the East of England accounts for 21 of the 94 techMARK companies, worth £5,118m. Autonomy Corporation and ARM Holdings jointly count for two-thirds of the market cap in the East of England with £3,328.94m.

But why are large companies important to the Cambridge cluster? Large companies offer considerable benefits to the region where their headquarters are based. For example, certain key skills are kept local and the region itself benefits from direct, as opposed to just portfolio, investments. Many entrepreneurs in the Cambridge cluster began their careers in corporate outlets located in the region. Additionally, the presence of large companies provides local suppliers with trading contracts, supporting the local economy.

Venture capital backed companies have been key to the growth of the Cambridge cluster. The level of investment has been much lower in recent times than a few years ago, the Cambridge cluster is still one of the most attractive areas for investment opportunities.

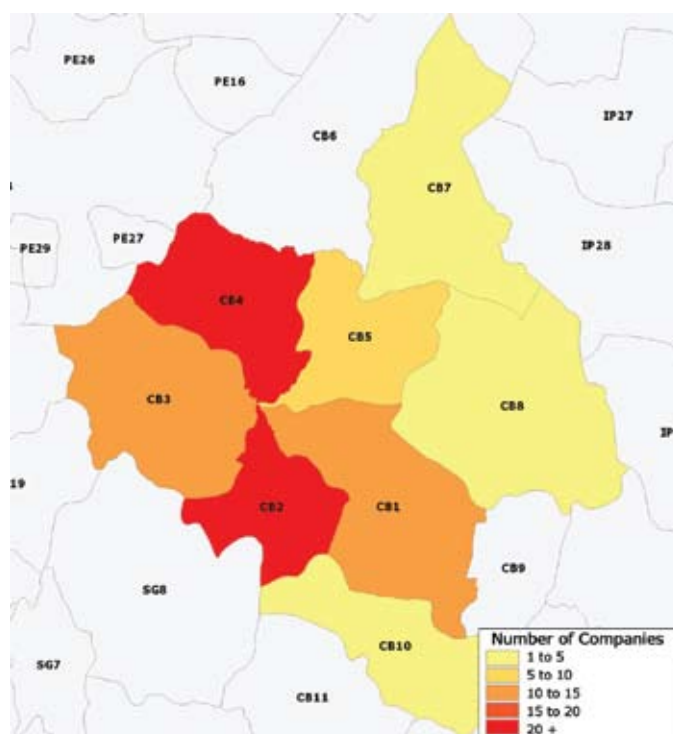
There are 164 venture capital backed companies in the East of England, of those 112 companies are active in the Cambridge Cluster and have received a disclosed amount of over €885m in venture capital investments.

The distribution of venture capital-backed companies by sector is similar to the overall structure. Most companies are in the information and communication technology sector and the healthcare and life sciences.

Sector	No.
Information Technology	30
Healthcare and Life Science	40
Communication Technology	19
Industrial Systems & Components	10
Services and Retail	8
Materials	3
Energy	2
Total	112

Table 5: Sectoral overview of Venture Capital-backed Companies in the Cambridge Cluster

University spin-out companies mainly emerged from the University of Cambridge which contributed 45 currently active spin-out companies. Equally active were the technical consultancies around Cambridge (including Cambridge Consultants, The Technology Partnership (TTP), PA Consulting, Sagentia, and TWI) with their ambitious plans to spin-out promising ideas into **corporate spin-out companies**.



• Map showing the distribution of venture capital backed companies by CB postal district

Industry Landscape

Science and Research Parks

The first science/research park that was set up was the **Cambridge Science Park** (<http://www.cambridge-science-park.com>), which was founded in 1970 by Trinity College. Based in the north of Cambridge, and around 4 miles from the city centre, the Cambridge Science Park was the first of its kind to be set up in the UK and is today home to over 100 companies. The Cambridge Science Park also features an Innovation Centre which caters for new start-ups by providing flexible lease structures, enabling the nascent start-ups to only pay for what they need and to expand easily as they grow. The juxtaposition of young start-ups and more established biotech firms should also enable these new companies to take advantage of the clustering effect, further helping their development.

The **St. John's Innovation Centre** (<http://www.stjohns.co.uk>) was founded in 1987 by St. John's College to specifically cater for innovative businesses. The Innovation Centre is also based in the north of Cambridge, next to the Cambridge Science Park, and the site is home to over 60 companies. The centre also hosts another 265 companies that have a rented address on the site and use of conference facilities, but no actual physical premises. This rent-address scheme, called the Star Service, is used by many early stage start-ups that want access to the other companies and services in the Innovation Centre, potentially aiding their development and providing an avenue towards proper tenancy on the site in the future.

The **Babraham Research Campus** (<http://www.babraham.ac.uk>), based next to Babraham, a village 6 miles south-east of the Cambridge city centre, was founded in 1996 as part of Babraham Bioscience Technologies (BBT), the private commercial development arm of the Babraham Institute, a biomedical research institute.

Granta Park (<http://www.mepc.com/grantapark/Home.aspx>) is also located in the south-east of Cambridge, only 8 miles from the city centre. The research park, which opened in 1998, is currently in an expansion phase, with two new developments scheduled to open at the end of 2008 and in 2009.

IQ Cambridge, formerly known as the Cambridge Research Park, (<http://www.iq-cambridge.com>), is located in Waterbeach, 5 miles north of the Cambridge city centre. The first stage of development has recently been completed and the site currently hosts 13 companies.

Healthcare and Life Science Sector in the Cambridge Cluster

The healthcare and life science sector covers a wide variety of companies that have the potential to significantly improve our quality of life through the development of new products (for example, drugs and diagnostic products) and services to combat diseases such as cancer or Alzheimer's. These companies have traditionally been, and still are, an integral part of the Cambridge

Cluster. As of November 2008, there were 30 venture-backed biotech companies in the cluster. This represents 34% of all the venture-backed companies in the cluster, making biotech the second largest sector in terms of company number after the information and communication technology sector.

As with all high-tech sectors, the healthcare and life science sector is heavily reliant upon entrepreneurs who are willing to start up a company to commercialise their ideas. Many biotech entrepreneurs developed their skills while working at the University of Cambridge, at research institutes funded by the MRC or Cancer Research UK on the Addenbrooke's site, or in existing healthcare and life science companies themselves. However, many other entrepreneurs move to the Cambridge region specifically to set up biotech companies. An example of this is the cluster-based biotech company MedCell, which uses stem cells to provide musculoskeletal regenerative therapeutics and was originally a University College London spin-out before relocating to the Cambridge cluster. Another example is Novathera, originally a spin-out from Imperial College⁹, which was acquired by MedCell in June 2008 and subsequently relocated to the Cambridge cluster.

There are many location-related factors as to why entrepreneurs can benefit from the cluster. These include access to a high quality labour pool, including highly skilled students, PhDs, and post-docs from around the world who are attracted to the region by the world-famous University of Cambridge. The presence of big pharmaceutical companies such as Amgen, Pfizer in Cambridge and GlaxoSmithKline in nearby Stevenage is also an important factor in terms of both attracting and retaining skilled individuals and companies to the region. In addition, large pharmaceutical companies are an important source of new entrepreneurs, often combining both research and commercial expertise.

Overview of Biotech Companies in the Cambridge Cluster

As mentioned in the previous section, the Cambridge cluster and the broader region is home to several international pharmaceutical and biotechnology companies, having R&D facilities such as Amgen (R&D and Marketing), Genzyme (the first dedicated R&D facility in Europe), Pfizer, and GSK (which houses the company's Pharmaceuticals R&D facility; its global headquarters are based in Middlesex) all based in the area.

Other established companies in the region are Abcam, an established manufacturer and sourcer of antibodies that originated from the University of Cambridge, and Alizyme, which develops products for the treatment and management of obesity and other related conditions, such as type 2 diabetes, and gastrointestinal disorders.

Growing into established companies requires access to finance, especially venture capital-style funding, which provides large enough amounts of funding to enable healthcare companies to progress with their research. Many Cambridge success stories have benefited in the past from the attractiveness of the region to both UK and international investors.

⁹ <http://www.pr-inside.com/medcell-and-novathera-merge-r650090.htm>

Female Entrepreneurs in Life Science

The Cambridge Cluster is well known for its strengths in healthcare and life science. Within this community there are several female entrepreneurs that are very active and involved in the business that directly contributes to the success of the sector. Below are the profiles of some of these successful and influential female entrepreneurs:

Gordana Apic

Gordana is the Chairman of the Board at Cambridge Call Network and is a co-founder of CCNet and was also the CEO at CCNet until 2005. She holds a PhD in Computational Biology from the University of Cambridge and a MSc in Molecular Biology from University of Heidelberg, Germany. Gordana is currently leading a research team at European Molecular Biology Laboratory (EMBL) in the field of bioactive peptides and predictive systems based on the network context. She is also co-founder of Novasterix Ltd. a drug development company based in Heidelberg and Cambridge.

Sabine Bahn

Sabine is co-founder of Psynova Neurotech and a leading research scientist in her field. A psychiatrist by training, she established the Cambridge Centre for Neuropsychiatric Research (CCNR), which has conducted the largest and most comprehensive functional genomics study on psychiatric disorders to date. For more than 12 years, Sabine has pursued parallel interests in medicine and molecular neurobiology, strongly believing in the strength of empirical, "bottom up" research as a way to understand the complex and intricate molecular mechanisms that are the basis of any given cognitive process.

Catherine Beech

Catherine is currently the Chief Executive of Babraham BioConcepts. Prior to this Catherine was a founder and Director of Life Sciences at the Cambridge Gateway Fund ("Gateway"), a venture capital fund investing in life sciences and technology companies. After Gateway's merger with Avlar, Catherine retains responsibility for the management of Gateway's life science portfolio. Catherine's previous experience included 13 years in multinational pharmaceutical companies. Catherine is a director of Avlar BioVentures Limited and DanioLabs Limited, and sits on the DTI's Technology Strategy Board.

Linda Cammish

Linda is founder and MD of Lindaction Ltd. After completing her B.Sc. in Chemistry from Bristol University Linda went on to do a Ph.D. at Cambridge University, working at the MRC, Cambridge. When she completed her Ph.D. she joined the commercial world and has held a variety of roles in multinational companies. She was recently Head of Commercial Development at Abcam Ltd. She has over 20 years experience in the life science industry involving products and services, including hardware, software, reagents and drug discovery services and technology access programmes. Linda also has an MBA from Henley Business College.

Rebecca Jones

Rebecca is a Director of Working in Tandem Ltd. With her co-director, she researches and writes reports for the biotechnology industry and international public health, specialising in vaccines and immunology. Rebecca has many years' experience editing,

writing and researching information for a broad range of audiences from scientific and health professionals to the general public. Previously she worked in science publishing as the editor of two review journals of molecular medicine. Rebecca has a PhD in immunology and three years' experience of postdoctoral research (molecular and cellular immunology) in the US biotechnology and UK university sectors.

Beatrice Leigh

After 24 years, Beatrice Leigh left GSK in 2004 to become Chief Executive Officer for Cresset-Biomolecular Discovery Ltd. She is a Non-Executive Director of BioPark Hertfordshire Ltd. and a non-voting member of the ERBI Board. She also runs a consultancy business. As a research biochemist, Beatrice worked at Harvard, Cambridge and the MRC before moving to Smith Kline & French in 1980. From 1984 to 1999 she was worldwide academic liaison officer until the GSK merger in 2000, after which she was appointed Director Operations for Technology Development mandated to build new platform technologies.

Fiona Marston

Fiona is co-founder and Chief Executive of Novacta Biosystems. With a track record of 25 years in the biotechnology industry, Fiona was previously Chief Executive of Metris Therapeutics. She worked in venture capital, founding and managing Healthcare Ventures Limited for the Rothschild Bioscience Unit and J&J Development Corporation and was Deputy Director of CRC Technology Limited. With a PhD in biochemistry, and a MBA from London Business School, Fiona's industrial career began at Celltech, during the company's formative years. She started her commercial career in Celltech's international business development group.

Cathy Prescott

Cathy has over 20 years experience within the life sciences sector. She spent over 6 years as a director for Avlar BioVentures Ltd, specialising in the investment and development of early-stage biotech companies. She has also held senior management positions in public and private healthcare companies. Cathy has accumulated experience in assessing technology, commercial and strategic corporate development, raising venture funds and private investment. She is currently the founder and director of Biolatrix Ltd., director and co-founder of Aclar Ltd, advisor to the Institute of Pharmaceutical Innovation and DRW Ltd and director for EESCN Ltd.

Madhuri Warren

Madhuri is company director of VSS Diagnostic Services Limited (trading as Pathology Diagnostics Limited). Madhuri has a sixteen year background in clinical/academic medicine, with a specialisation in medical histopathology, and a ten year background in basic science, including molecular biology, genetics and comparative pathology. She is a graduate of Clare College, University of Cambridge (1988), Fellow of the Royal College of Pathologists, and an active member of European and US comparative pathologist organisations. Madhuri is committed to the support of women in science and the development of mentoring networks.

Year of IPO	Life Science Companies	LSE Market	LSE Sub-Sector	Current IPO MarketCap (£m)/Acquisition Value
2006	Intercytex plc	AIM	Biotechnology	27.80
2005	Abcam plc	AIM	Biotechnology	156.31
1995	Acambis plc	Acquired	Pharmaceuticals	285.00

Table 6: LSE Public Listed Companies Healthcare and Life Science Companies (over £10m Market Cap)

Year of Acquisition	Target Companies	Acquirer	Acquisition Value (£m)
2008	Acambis plc	Sanofi Pasteur Holding SA	285
2007	DanioLabs Ltd	VASTox plc	15
2006	Cambridge Antibody Technology plc	AstraZeneca plc	642
2006	Domantis Ltd	GlaxoSmithKline plc	239
2006	KuDOS Pharmaceuticals Ltd	AstraZeneca plc	189
2005	Arakis Ltd	Sosei Groupation Corpo	107
2005	Cambridge Biotechnology Ltd	Biovitrum AB	30
2004	Meridica Ltd	Pfizer Inc	70

Table 7: Acquisitions of Healthcare and Biotech Companies based in the Cambridge Cluster

Several success stories from the cluster have proven that not only can venture capital be raised, but also that the necessary returns can be delivered in the field of biotech. The successful exit of companies in the cluster, such as Domantis, which was sold to GlaxoSmithKline for £230m in December 2006, and KuDos, which was sold to AstraZeneca for £121m in January 2006, is also an important factor in stimulating investment in the biotech and pharmaceutical markets.

Locations for Healthcare Companies

Once an entrepreneur has decided to set up a biotech company in the Cambridge cluster, there are many possible options as to where the company headquarters could be based. Most biotech companies in Cambridge are located in science parks, due to the presence of an established infrastructure and availability of lab space.

The Cambridge Science Park, based north of the city, houses big pharmaceutical companies such as Amgen, Genzyme, and Bayer; cluster success stories such as Domantis and KuDos; as well as newer companies such as Serentis.

The other main science parks in the region that house healthcare companies are the St. John's Innovation Centre, the Babraham Research Campus, Granta Park, IQ Cambridge, and the Chesterford Research Park.

The St. John's Innovation Centre, based next to the Science Park, is home to biotech companies such as Intercytex, which is developing regenerative medicine products to restore skin and hair, and Altacor, which is developing therapeutics to treat Glaucoma and retinal conditions such as age-related macular degeneration.

The Babraham Research Campus, located next to the Babraham Institute, south of Cambridge, specifically caters for biotech companies. A key component of the campus is the Babraham Bioincubator, which was established in 1998, and is specifically focused on providing business and technical mentoring for start-up and early-stage ventures. The Bioincubator is home to around 30 biotech start-ups, such as Amura, which is focused on discovering small molecule therapeutics to treat osteoporosis and chronic pain; Phico Therapeutics, which is developing anti-bacterial therapeutics against bacteria including the multi-drug resistant 'superbug' *Staphylococcus aureus*; and Senexis, which is building a pipe-line of drug candidates to combat degenerative disorders such as Alzheimer's and Parkinson's disease.

Located in the south of Cambridge near the Babraham Bioincubator, Granta Park is home to larger biotech/pharma companies such as MedImmune, which was acquired in June 2007 by AstraZeneca and integrated with Cambridge Antibody Technology; and Pfizer, which claims to be the world's largest research-based biomedical and pharmaceutical company. Granta Park is also home to the aforementioned Alizyme, which in September 2008 received a USD 3 million milestone payment from Takeda Pharmaceutical Company Limited after Takeda decided to commence Phase III clinical trials in Japan of cetilistat, a drug licensed by Alizyme in 2003 for the treatment of obesity.

IQ Cambridge, formerly the Cambridge Research Park, is based north of Cambridge and houses 13 companies on its premises. These include the University of Oxford biotech start-up Summit Plc, which gained the premises following its acquisition of Cambridge start-up DanioLabs in March 2007 and has a drug pipeline targeting neurological disorders and infectious diseases. New buildings, including ones that contain laboratory space, are

Hardtech Sector in the Cambridge Cluster - A Roundtable Discussion

Hardtech is a broad term encapsulating a range of technologies in IT hardware and electronics. For the purpose of this analysis, the FTSE sector definition for Technology Hardware & Equipment, which includes Computer Hardware, Electronic Office Equipment, Semiconductors, and Telecommunications Equipment, will be employed.

Hardtech and the Cambridge Cluster

Due to the nature and diversity of hardtech, it has relevance across several traditional sectors; some of the most prominent in the Cambridge cluster include the semiconductor, display, printing, and telecoms industries.

The cornerstone of many of the hardtech competences in the cluster originate from the relentless innovation taking place in the major consultancies, such as Cambridge Consultants, TTP, Sagentia, and the PA Consulting Group. These firms provide a breeding ground for entrepreneurship, where technology innovators are developing products from concept through to market success.

Issues in the Hardtech Sector

The issues affecting the hardtech sector vary amongst different groups. From an entrepreneur's perspective, one of the issues specific to hardtech is the need for investors to appreciate that the investment cycle is often different to other sectors. In particular, the timeline for a return on investment requires a longer-term perspective than other sectors might. It is also a commonly held view that hardtech is not a particularly fashionable sector, making it sometimes more difficult to attract investors.

A separate issue that many entrepreneurs in this field face is finding lab space at a reasonable cost within the Cambridge region as most available facilities are suited to a different type of business. However, in the north of England, science parks are actively seeking to lure in high-tech businesses with state of the art facilities and lower rental costs. This contributes to a feeling amongst some entrepreneurs that government policy tends to focus resources on less developed regions, with a danger of becoming complacent about maintaining and building on the success of established areas.

A concern sometimes expressed for the hardtech sector is a shortage of appropriately skilled labour. Because of the demand for experienced physicists and engineers, finding the right talent can be a significant challenge. However, this is not just a cluster-specific issue, but rather part of a much broader skills gap in traditional physical science disciplines. Although the University of Cambridge is a rich source of talent, it does not produce engineers with the appropriate industrial experience. This is compounded by the trend in recent years for many suitable candidates to be lured to London for highly paid jobs in finance. However, the backdrop of recent job losses due to failings in the financial sector has led to a certain optimism among recruiters that talented engineers will now actually use their talents in an engineering role.

Opportunity and Optimism for Hardtech

Overall, the outlook for the hardtech cluster is very positive, with the CEO from one of the cluster's major consultancies remarking that "Cambridge is a very special place [...] there is a magic mix which makes things happen." The ingredients for this 'magic mix' include opportunism, an entrepreneurial energy, and highly talented and ambitious people from around the world. It is clear that the Cambridge brand and reputation plays a large part in the success of the cluster, but this brand is increasingly about more than the University; it also encompasses the established reputation

Year of IPO	Hardtech Companies	Status: LSE Market / Acquired	LSE Sub-Sector	Current IPO MarketCap (£m) / Acquisition Value
2007	Sapura plc	Main Market	Telecommunications Equipment	99.54
2004	Cambridge Display Technology plc	Acquired	Information and Communication	142.00
2004	Cambridge Silicon Radio (CSR) plc	Main Market	Semiconductors	434.45
2004	Amino Technologies plc	AIM	Telecommunications Equipment	31.80
1998	ARM Holdings plc	Main Market	Semiconductors	1,424.60
1985	Domino Printing Sciences plc	Main Market	Electronic Equipment	325.25

Table 8: LSE Public Listed Hardtech Companies (over £10m Market Cap)

Year of Acquisition	Target Company	Acquirer	Acquisition Value (£m)
2008	nCipher plc	Thales plc	51
2007	Cambridge Display Technology plc	Sumitomo Chemical	142
2005	i2 Ltd	ChoicePoint Inc	53
2005	UbiNetics Ltd	CSR plc	27
2005	Apama Ltd	Progress Software Corporation	14

Table 9: Acquisitions of Hardtech Companies based in the Cambridge Cluster

Cambridge Consultants Family Tree

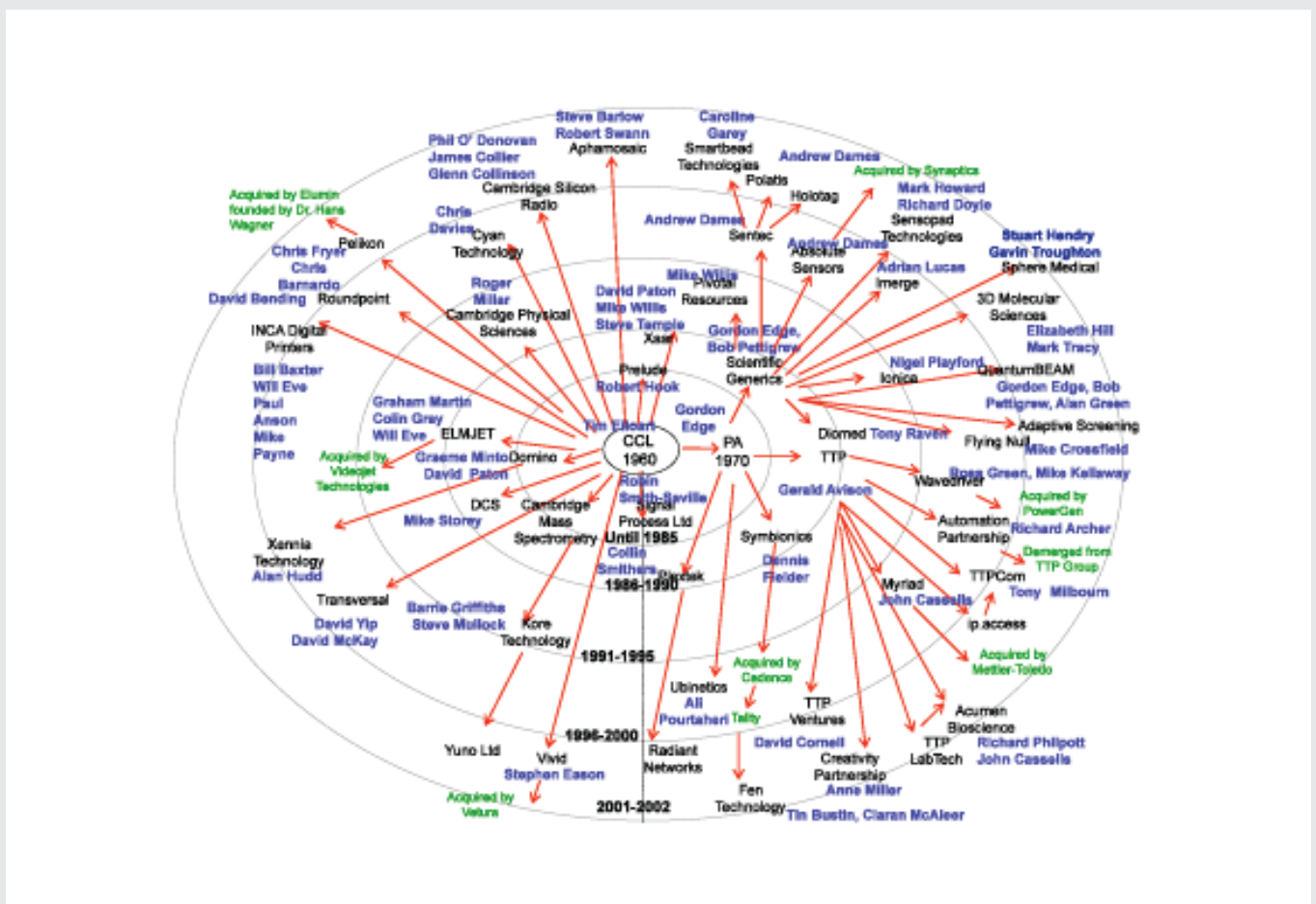


Figure 3: The Hi-Tech Start-Ups spawned from the Cambridge Consultants
(Copyright: Y.M.Myint and Dr. Shailendra Vyakarnam, CfEL, Judge Business School)

Figure 2 maps the formation of major technology consulting firms since Cambridge Consultants Ltd (CCL) was formed in 1960, subsequently spinning-out the Generics Group, PA Technology and the Technology Partnership. These consultancies represent a distinctive element of the cluster and have continued to prosper into more rounded technology houses. Figure 3 illustrates the growth of the bio-tech cluster. It maps the formation of University start-ups, including Cantab Pharmaceuticals and Cambridge Antibody Technology (CAT) in the late 1980s. It also shows Enzymatix, which was founded by Chris Evans and Alan Goodman. Neither of these entrepreneurs is related to the University of Cambridge but they are both active in the venture capital scene and have played crucial roles in developing new bio-tech ventures in the cluster.

Behind the formation of these companies there are complex personal networks created over a number of years. There is a perception in Cambridge that personal networks are the most important way to share information creatively and foster further ideas for business success. The family tree analysis has provided not only a means of identifying key individuals within the cluster, but also the links between entrepreneurs with prior associations. This has been very much in line with the claims by several of the Cambridge

entrepreneurs interviewed that a history of working for a common company is one of the most important factors leading to today's network of relationships. Many of the boards and management teams in Cambridge today were put together by entrepreneurs leveraging their relationships with former colleagues.

All three figures have illustrated the value of local entrepreneurial communities and how important it is for those involved in enterprise support and development to understand the local landscape. Over the years, many of these individuals have remained largely within the areas of their technical excellence. They have nurtured future talent by employing people, providing student projects at the University, supplying onward linkages to clients and other resources, forming connections between investors and entrepreneurs, and staffing new enterprises with experienced management teams. This indicates the importance of relational social capital in shaping the formation of the Cambridge hi-technology cluster, facilitating the flow of knowledge and innovation and increasing the rate of new company formation. One can also see that the temporal effects combined with multiple relationships and directorships lead to a "bottom-up" view of clusters and how they develop. (CfEL)

for high-tech innovation in industry. This branding, be it 'Silicon Fen' or the Cambridge name itself, helps companies to access markets internationally. Consultancies take a large chunk of their business from the US, and successful start-ups can establish good links to facilitate international expansion. However, this brand is not as internationally recognised as it could be, and so building upon it is seen as a key way to help continue the success of the past, in what are increasingly globalised markets.

It has been noted by some commentators that while jobs and some wealth creation is passed on to the local economy from activities within this high-tech sector, much of the business done by Cambridge companies is in international markets. In this sense, there was some consensus that there is an opportunity for the local economy to take more of a role in adopting new technologies and hardtech business. Just because a cluster develops world-leading technologies, it does not always follow that the region is forthcoming in adopting them.

Some regional commentators have suggested that Cambridge entrepreneurs in hardtech need to pay more attention to marketing skills and become better at selling themselves and their businesses. This is something that does not come naturally to the archetypal 'techie'. Views on this opinion are mixed, with some suggesting that the British understated approach is one of the reasons British companies are trusted internationally. "People like the way we do business, and that's why they continue to deal with us", was one view.

Broader Issues

During discussion with roundtable participants, many issues raised had broader implications for the cluster beyond the hardtech sector. The contentious issue of poor transport infrastructure, which is often mentioned in connection with the Cambridge cluster, was again raised as a factor that seriously inhibits further economic development of the cluster. Combined with this was the view that, like Silicon Valley, Cambridge needs to be viewed in a broader regional context, joining forces with other centres of excellence to make a region with real international clout. This so-called 'super cluster question' has been debated before, but the requirements of coordinating such an undertaking seems to have been beyond the capabilities or ambitions of any one agency, at least in the short term. The principle remains, however, that to gain an international reputation on the scale of Silicon Valley Cambridge cannot go it alone. As one commentator put it, "Cambridge is essentially a big village", and there was a view that, given its size, the per-capita output of spin-outs and successful innovation was nothing short of phenomenal. While fears were often bounded around about the growth of the cluster slowing, there was an overall optimism that the fundamental ingredients that make the cluster what it is are still there in abundance. (RiW)

Embracing the Future – Cleantech in Cambridge

Cleantech is a broad term used to describe a number of niche technologies that improve productivity and efficiency, whilst reducing energy consumption and pollution. The Library House definition of cleantech focuses on clean energy, by far the most significant component of the cleantech sector, and covers the clean energy supply chain. This includes the discovery and generation of useful

energy, energy infrastructure, including storage and distribution, and technologies for improving consumption and efficiency. Well known examples of cleantech are generation technologies such as solar and wind power. Some less easily identifiable examples of cleantech might include a company developing advanced materials for incorporation into next generation batteries.

As a sector, cleantech has become more and more prominent in recent years as rising oil prices, climate change legislation, and energy security have pushed it to the top of political and business agendas.

Cleantech in the Cambridge Cluster

Because clean-tech marries combines many of the competences characteristic of the cluster, Cambridge is extremely well placed to take advantage of what is likely to be one of the most important sectors of the global economy this century. Some of the well known hardtech companies in Cambridge cross over into cleantech, for example Camsemi, whose power management circuitry lowers the power consumption of devices that operate on standby, such as televisions and chargers. Nujira, another established hardtech company, has technology which enables power consumption in telecommunications networks to be reduced by up to 50%, giving it cleantech credentials. The other dominant sector in the Cambridge cluster, biotech, also has a potentially significant role to play in cleantech, with sustainable next generation biofuels and biological carbon sequestration technologies both relying on cutting edge developments in biotechnology.

One archetypal example of a Cambridge cleantech company is AIM listed CMR Fuel Cells, based in Harston in the vicinity of the technology consultancy Sagentia. It is headed up by John Halfpenny, a Cambridge-educated engineer and serial entrepreneur, who has a record of successfully exiting companies in the hardtech sector and is now using these skills to build a cleantech company.

Cambridge activity in cleantech has been steadily increasing in recent years and perhaps one of the most encouraging signs for cleantech in the cluster is the clear and conscious move by Cambridge consultancies to stake a claim in this emerging field. TTP, Cambridge Consultants, Sagentia, and PA Consulting have all taken steps in recent years to institute some sort of cleantech agenda within their organisations. As these consultancies are together associated with a large proportion of successful Cambridge spin-outs, this trend bodes well for a growing cleantech cluster in the future. This also highlights the overlap with many of the consultancies' existing core markets in the hardtech and energy sectors where cleantech innovation has been going on for a number of years, just under a different banner.

As one might expect, many of the issues relating to cleantech in the Cambridge cluster are similar to those faced by the constituent sectors like hardtech. For example, attracting funding to businesses that are capital intensive and may take several years to generate revenues requires patient and committed investors. The appetite for such risks is not common and entrepreneurs often have to look further afield than Cambridge for investment funding. But a new wave of investment in this sector is occurring, going against all the trends for the current economic downturn, with strong policy incentives and issues of energy security and unstable oil prices a constant driver. Investors in this sector are deal hungry and funding is available for the right opportunity.

Looking to the wider region, Peterborough is experiencing a hive of activity in the environmental technology sector, a close relative of cleantech. The myriad of interrelated initiatives and organisations in Peterborough include The Centre for Sustainable Engineering, UK CEED, Envirocluster, and the Eco Innovation Centre. Nevertheless, Peterborough has begun to put itself on the map in this arena, and a similarly concerted effort in Cambridge could pay significant dividends.

Identifying the nature and focus of the cleantech sector within Cambridge is fundamental to the consideration of its future growth. There is a clear distinction between companies that install solar farms or lay insulation in houses, and the high-tech companies that manipulate nano-materials to develop the next generation of solar cells or the next generation of insulating materials. The core strength of the Cambridge cluster lies within the latter, as leading cutting-edge research and innovation will continue to be the hallmark of the Cambridge brand.

The University and Cleantech

The University has embraced the ethos of cleantech for several years now with numerous programmes that focus on climate change and environmental technology in place. The Cambridge Environmental Initiative was launched four years ago to facilitate and support interdisciplinary environmental research within the University. More recent examples include an MBA class offered by the Judge Business School on climate change leadership, and a recent event in September 2008, 'Entrepreneurship for a Zero Carbon Society', which was hosted jointly by the University of Cambridge and the Judge Business School and attracted influential players to discuss climate change policy. Much of the world class research behind climate change has come from the British Antarctic Survey which is also based in Cambridge and is strongly affiliated to the University. There are also discussion forums and university societies that have been set up to address climate change and energy-related issues.

Embracing the Future

There is a strongly held view among many of those involved in Cambridge cleantech that a big opportunity lies ahead. As a sector, cleantech has begun to reach the consciousness of decision-makers, and the initial ripples of investment are giving way to a huge wave of innovation, venturing, growth, and opportunity. No one doubts Cambridge has the potential to be at the forefront of this exciting new industry and all the ingredients are there. However, there is also an emerging view a concerted effort is required in order to capitalize on all the strengths that Cambridge has to offer.

To date, much of the cleantech activity in Cambridge has largely been organic, with limited central leadership, strategy or direction. Although this is a valid and natural way for clusters to evolve, some take the view that it is now time to institute a more formal and coordinated effort to direct future activity. Gathering this critical mass, awareness and branding in cleantech can serve to both stimulate further activity within the cluster, as well as attracting investment from outside.

To give just one example of what increased emphasis on cleantech might mean, take a materials science department within the University that is developing tough lightweight composites. Industry funding for this research might naturally have come from a sports car manufacturer. However, with a shifted emphasis

towards cleantech, this same technology and research can be used to develop a lightweight low carbon vehicle or perhaps a more robust wind turbine blade. This demonstrates that cleantech is not simply defined by the technology; it is equally, if not more importantly, about understanding the market.

Cambridge ideas, innovation, and entrepreneurship have proven to be forces to change the world. If the city can begin to build national and international recognition as a force in cleantech, then a positive spiral of innovation and investment can follow. Continuing to develop this industry is not just important for the local economy, but it can also continue the legacy of Cambridge in helping to both lead and change the world. (RiW)

The Prevalence of Soft Technology in Cambridge

As in previous years, there exists a disparity between the number of Cambridge companies involved in hard technology and soft technology. Soft technology is an umbrella term that includes technologies in mediatech and digital media as well as the traditional software produced by companies such as Microsoft and Autonomy.

Library House defines mediatech as technologies, services, and products that facilitate the creation or dissemination of media, be it digital or otherwise. Mediatech companies are split into two primary sectors: 'Enablers' and 'Content and Supply Providers'. Enablers include advertising (enabling media through monetisation), Digital Rights Management (DRM), creative tools, and other devices. Although device manufacturers are included in this definition, developers of individual components are not, even if those components were solely for use in media devices. Content and service providers are classified according to the kind of content they provide, be it video, audio, text/photo, games, or other (including gambling). A further sub-division is made based on the communication channel by which the media is delivered.

The mediatech sector in Cambridge today is at a similar stage to where the cluster's biotechnology companies were when they first got started in the early 1990s. However, while biotechnology quickly emerged as a vital part of the Cambridge cluster, the general consensus is that mediatech is unlikely to have the same impact on the region. The reason for this is that the Cambridge cluster does not provide the same advantages to mediatech that it does biotech and other sectors. For example, Biotechnology companies rely heavily upon a steady stream of top-tier graduates and skilled researchers for their success. The Cambridge cluster, containing two universities, thus provides biotech firms with easy access to a highly-educated workforce. Mediatech companies, on the other hand, almost by definition, are not dependent upon a specific geographical location. A good mediatech firm thrives on a global outlook, both in terms of potential markets and employees. In fact, contrary to the received norm that companies in the Cambridge cluster rely on the University of Cambridge as a source of bright, educated employees, recent evidence has shown that mediatech firms draw the majority of their workforce in Cambridge from the city's second university, Anglia Ruskin.

Although networking is a vital aspect of mediatech business development mediatech companies do not rely upon the networking framework that business clusters offer. Although mediatech businesses often need to establish some sort of end-to-end connection before being able to offer a product (for

Year of IPO	Software and Internet Companies	LSE Market Segment	LSE Sub-Sector	Current IPO MarketCap (£m)
2005	Bango plc	AIM	Internet	13.15
2004	Brady plc	AIM	Software	10.22
2000	Autonomy Corporation plc	Main Market	Software	2,448.70
1996	Aveva Groupplc	Main Market	Software	992.61

Table 10: LSE Public Listed Software and Internet Companies

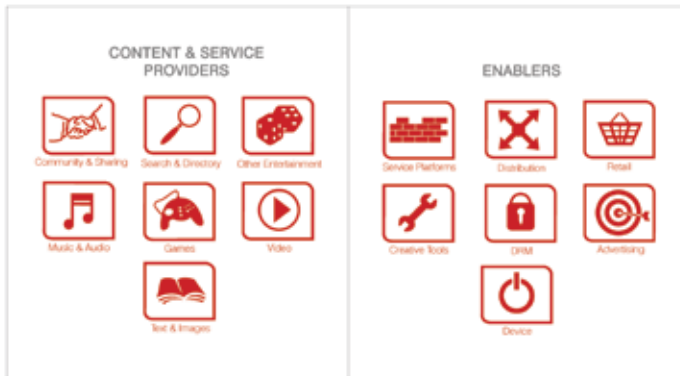


Figure 4: Overview of Library House Mediatech Landscape

example, a link from content producers to content distributors to media owners to the final customer), two entrepreneurs working within mediatech have told Library House that the opportunities for networking offered by the Cambridge cluster are not an important factor in the decision to move there. Although these entrepreneurs were both based in Cambridge for some time, they told Library House that they only met each other when both were attending a conference in Barcelona. This seems to be a common experience of mediatech workers, as they are much more likely to network through large conferences and mediatech events rather than through local networking systems. Freedom of information exchange through networking or the “buzz” factor is accepted as a vital constituent of any clustering activity and so this evidence raises the question whether Cambridge has a mediatech cluster at all?

Despite the fact that, on the whole, Cambridge is not renowned as “the place” for mediatech, the Cambridge cluster has been the spawning ground for many of the most innovative and publicised mediatech companies in recent times. These companies include the likes of Rumble, True Knowledge, Plastic Logics, Jagex, and FoneStarz Media. An important factor in the success of a cluster is the ready availability of funding. Mediatech businesses, however, are more readily bootstrapped without VC intervention. Library House research has shown that of the venture-funded companies that were exited in 2007, mediatech firms required an average 27% less funding than companies within other sectors. Although institutional venture capital may not be a significant factor in encouraging the mediatech cluster, Cambridge’s highly active business angel network provides more of an attraction, with interviewees claiming that there are “10 to 12 highly influential people” working within the mediatech industry in Cambridge.

Within traditional software, the Cambridge cluster has strong links with a number of international corporations, including

Microsoft. Roger Needham, the former head of the Cambridge University Computer Science Laboratory, set up the Microsoft Research Cambridge laboratory in 1997, while Bill Gates has forged strong ties with the University of Cambridge through his \$210m sponsorship of the Gates Cambridge Scholarships. Although the University of Cambridge is home to Microsoft’s only research laboratory in Europe, the benefits of this facility extend beyond the University to the local business cluster and current research into MAVIS, Amalgam, Pex, and VEXE’DD will prove valuable to all levels of companies and researchers in the region. For example, Wayve, a consumer communications medium that aims to keep families and friends in touch with each other, has developed a device that provides a messaging service that is delivered over WiFi. The device’s dimensions are approximately 200x120x50mm and it has a seven inch diagonal touch screen with an in-built camera. As of September 2008, the Wayve device offers functionality for SMS, MMS, notes, and pictures. The product allows users to write handwritten notes and take photos, and send them to other Wayve devices, mobile phones, or to an email address.

Autonomy is one of the UK’s largest software companies, appearing on the FTSE 100 and winner of numerous accolades including the Truffle ‘Best Performing Software Company in Europe’ award. Autonomy was founded by Dr Michael Lynch and Richard Gaunt in 1996 as a spinout from the University of Cambridge. The company is considered to be an enterprise software company, which means that its sole task is to solve problems in an enterprise through a suite of programs. Autonomy tackles the specific enterprise issues of search and knowledge management by their products unique ability to use adaptive pattern recognition techniques. At this point in time, Autonomy also has over 300 OEM partners and more than 400 Value-added resellers and integrators, numbering among them are leading companies such as Citrix, EDS, Novell and Symantec. Autonomy is just one example of the many Cambridge software companies that has retained its main base in Cambridge, despite its enormous growth around the globe.

Developing the Creative Cluster in Greater Cambridge

The Greater Cambridge Partnership (GCP) is the Sub-Regional Economic Partnership (SREP) covering a 25-mile radius around Cambridge. The sub-region includes Huntingdon, Ely, Newmarket, Bury St Edmunds, Haverhill, Royston and Stansted. It has a population of 750,000 people, 27,500 businesses and an annual economy worth over £12 billion.

Prompted by reports that the area was falling behind rival European cities, such as Berlin, in developing softer technologies, the GCP formed a creative industries sub-group. The group was comprised of partner members from the East of England Development Agency, the Arts Council England – East, University of Cambridge, Anglia Ruskin University, Screen East and BT.

The group commissioned the creative industries consultants nmp to:

- i. Map the creative industries sector in the area, with an emphasis on the technology-based creative industries. Highlight existing and potential linkages to the hi-tech sectors and identify the future needs of the creative industries sector.
- ii. Map the existing support infrastructure for the creative industries including both physical infrastructure, such as workspace provision, and in terms of softer support, such as networks and business support.
- iii. Identify future customer trends, including growth area demographic change which may lead to new or changed demands for the products from the creative industries.
- iv. Create an Action Plan for the development of the creative industries in Greater Cambridge incorporating clear recommendations to make the most of the fusion between the hi-tech and creative industries sectors.

(NB: creative industries are described by the DCMS as "Those industries which have their origin in individual creativity, skill and talent which have the potential for wealth and job creation through the generation and exploitation of intellectual property".)

The Action Plan was launched at the GCP Annual Conference in May 2009 and a series of themed recommendations were proposed, along with specific project ideas. The creative industries sub-group has remained in operation to co-ordinate the implementation of projects in the Action Plan and examples, related to each of the themes, include:

Theme 1 – Commitment & positioning

The GCP has led the creation of a new Cultural Leaders Group in Greater Cambridge, which has now begun to meet and which is comprised of the most senior decision makers from local authorities and cultural and economic agencies in the area. Early discussions have focused on the content/technology lab and a potential convention centre for the area. The Group will provide leadership for the cultural sector which the report claimed has, hitherto, been lacking in the area.

Theme 2 – The creative environment

Huntingdonshire District Council has developed new workspace for the creative industries at Longsands Technical College in St Neots. The architecturally exciting centre provides incubation space for new businesses, break-out areas, and display space for artists. The centre helps meet the need identified in the Action Plan for a ladder of workspace to be made available for the creative industries.



Theme 3 – An international centre for the development of technology solutions for digital content delivery

The Arts Council England – East, and other partners, are leading on a proposal for the creation of a creative industries hatchery to aid the development and deployment of technology applications for content distribution. The project is a unique selling point for Greater Cambridge, fusing the creative industries sector with the technology companies in the area. The Pervasive Media Studio in Bristol provides an existing example.

Theme 4 - Supporting business growth

"Creative Cambridgeshire" is a new website being developed by Anglia Ruskin University to act as a vehicle through which like-minded individuals can share knowledge and information across the creative industries sectors. It will also help join together existing creative industries networks.

Theme 5 - Skills development & talent retention

Arts & Business East are developing their work through the Knowledge Exchange where arts/creative-based companies work with hi-tech companies to generate ideas for each other. Arts & Business have brokered meetings between the Hoipolloi theatre company and Kodak in Cambridge. Another example is linking the Britten Sinfonia with Cambridge University Press. (GCP)

Access to Finance in the Cambridge Cluster

Access to finance at all investment stages is critical to the successful development of a cluster. This includes access to venture capital specialist resources and financing, public and private research and development funding, business angels, and investor networks. Proximity to financial intermediaries such as banks, venture capital firms, trading houses, and other funding institutions is therefore of clear benefit to a cluster. Of all European provincial centres of high-technology, the Cambridge cluster is perhaps the best served in terms of financial services, with a high number of Business Angels, Enterprise Capital Funds, and Venture Capital Investors to take advantage of.

Business Angels in the Cambridge Cluster

The Cambridge Cluster is in the advantageous position of having three main angel groups to finance early stage companies: Cambridge Capital Group, Cambridge Angels, and NW Brown, which founded a business angel network under the title Great Eastern Investment Forum (GEIF). These groups, alongside other early stage investors like Create Partners, Amadeus & Angels Seed Fund, and IQ Capital have contributed to the development of an extremely vibrant seed-funding environment in the cluster. Here we profile some of the key players in the Cambridge angel investment scene.

Deal Year	Name	Amount Invested (£k)	Investor Names	Sectors
2007	AlertMe	5,000	Business Angel(s) Tudor Investment Corporation	ICT
2007	Arecor	600	Oxford Technology Management (Oxford Technology VCTs)	Health Care & Life Science
2007	Horizon Discovery	Undisclosed	Cambridge Enterprise	Health Care & Life Science
2007	Imense	Undisclosed	Cambridge Angels	ICT
2007	Syrris	42	GEIF Ventures Great Eastern Investment Forum	Industrial Systems & Components
2007	True Knowledge	600	Octopus Ventures	ICT
2008	Cambridge Temperature Concepts	Undisclosed	Cambridge Angels	Health Care & Life Science
2008	CRFS	Undisclosed	Cambridge Angels	ICT
2008	Green Energy Options	800	Private investor(s); Bank of Scotland Corporate Finance; Oxfordshire Investment Opportunity Network	ICT
2008	Optisynx	100	Cambridge Enterprise	ICT
2008	Phonetic Arts	Undisclosed	David Braben IQ Capital Partners	ICT
2008	Zogix	Undisclosed	CREATE Partners	ICT

Table 11: Selected first Round Investments into the Cambridge Cluster 2007/2008

GEIF/GEIF Ventures

NW Brown, a Cambridge-based financial services company, runs the GEIF and manages the GEIF Ventures Early Growth Fund, a £5m co-investment fund that invests in promising early growth businesses. Since it was founded in 2003, GEIF Ventures has invested in 22 companies, mostly within the healthcare & life sciences and information technology sectors. GEIF Ventures invest an average of £70,000 per funding round. GEIF Ventures has invested in Altacor, an early stage pharmaceutical company that focuses on the area of therapeutic ophthalmology. The group also participated in follow on rounds with Short Fuze, a company developing software products in the emerging field of machinima, and CamrivoX, a VOIP provider targeted at the small business and home market.

Cambridge Capital Group

The Cambridge Capital Group (CCG) provides technology companies that are primarily based in Cambridge with early stage finance. Although based in Cambridge, the group aims to attract angel investors from outside the area to invest in promising Cambridge technology companies.

To date, the Cambridge Capital Group has made more than 25 investments in a wide range of technology sectors. Like GEIF Ventures, the Cambridge Capital Group has largely invested in companies within the healthcare & life sciences and information technology sectors. In fact, the majority of the Cambridge Capital Group's investments have been in companies working on hard innovation, namely those involved in medical technologies, communications hardware, and biotech.

Indicating the importance of the University of Cambridge to the supply of technology currently being commercialized in the cluster, many of the Cambridge Capital Group's investments have been in University of Cambridge spin-outs. For example, the Cambridge Capital Group has invested in Ubisense Ltd., a high precision, real-time location tracking of high value assets; Inotec AMD, which develops wound-healing technologies; Addplus Systems Ltd., a producer of non-toxic additives for the plastics industry; and Scarlet Spot Ltd., a web 2.0 niche media business for the Polish community.

Cambridge Angels

Since its inception in 2001, the Cambridge Angels have invested over £11.5m in 33 start-up companies, primarily in the hi-tech and biotech sectors. While most of these portfolio companies are based in and around the Cambridge area, the Cambridge Angels have also invested in firms outside Cambridge, including several companies in London. One such firm is Ionscope, which develops systems for 'scanning ion conductance microscopy' (SICM), enabling the creation of images of living cell membranes at a resolution fifty times greater than conventional optical microscopes. Their most recent investments were in CFRS, Cambridge Temperature Concepts, and Imense.

Enterprise Capital Funds (ECFs) in Cambridge

ECFs were set up to provide early stage funding for SMEs affected by the government defined 'equity gap'. Of the five ECFs launched after the first round of bidding in 2005, two are run by Cambridge-based firms. These are the IQ Capital Fund, run by NW Brown, and the Amadeus & Angels Seed Fund, run by Amadeus Capital.

The IQ Capital Fund is a £25m early stage fund that launched in December 2006. The Fund typically invests between £0.25 million to £1.5 million in the first round of investment and follow on funding can bring the total invested to £2.5 million. The IQ Capital Fund has made investments into six companies to date: Dezine Force, Im-sense, OnRelay, Phonetic Arts, Short Fuze, and Spikes Cavell.

The Amadeus & Angels Seed Fund has £10 million under management and up to £10 million for co-investment from Amadeus III. The Amadeus and Angels Seed Fund (AASF) focuses on seed-stage technology companies in the UK. The fund is financed by Amadeus, the UK Department for Business Enterprise and Regulatory Reform, business angels, and private investors.

Venture Capital Investors in the Cambridge Cluster

Amadeus Capital and DJF Esprit are Cambridge-based investors that focus on the complete range of venture capital investments. Both investment firms have offices in both London and Cambridge.

DJF Esprit has \$500m of capital under management and invests in technology, media, telecoms, medtech, and cleantech. DJF Esprit manages a portfolio of 35 companies and their track record includes a number of successful and high profile exits such as KVS (sold to Veritas for \$225m), Alphamosaic (sold to Broadcom for \$123m), Fillfactory (sold to Cypress Semi for \$100m), DRI (sold to Invitrogen for \$60m), Blackspider (sold to Surfcontrol for \$40m), CPS (sold to CSR for \$35m), NetEconomy (sold to Fiserv), and Buy.at (sold to AOL for \$125m).

Amadeus Capital Partners invests across the technology spectrum in industries that include communications and networking, media, e-commerce, computer hardware and software, medtech, and cleantech. Amadeus, which was started in 1997, manages £460m in a portfolio of around 40 companies. Amadeus was an investor in Cambridge Silicon Radio, one of Cambridge cluster's biggest success stories, and the firm is currently invested in Plastic Logic, Artimi, and Velocix.

Cambridge Discoveries

Cambridge is renowned as the birthplace of a vast number of original ideas and ground-breaking discoveries. Behind this brilliant innovation have been a multitude of great scientists, inventors, and thinkers, just some of whom are detailed here.

One of the most famous and influential of Cambridge's scientists is Sir Isaac Newton, former student of Trinity College and Lucasian Professor of Mathematics. Newton is perhaps best known for his 1687 work, *Philosophiæ Naturalis Principia Mathematica*, considered by many to be one of the most important studies in the history of science. In it, Newton puts forward his law of universal gravitation - linking the gravitational attraction of bodies with their mass - and Newton's three laws of motion, which form the basis of classical mechanics. Newton is also considered one of the key developers of differential and integral calculus and he made significant contributions to the field of optics, inventing a refracting telescope and a theory of colour based on prism observations.

Another famous physicist to work and study at Cambridge was Ernest Rutherford, commonly known as the father of nuclear physics. Rutherford achieved fame for his model of atoms, the Rutherford model, consisting of a positively charged nucleus orbited by electrons, and he was the first person to transmute one element into another, converting nitrogen into oxygen. He came to Cambridge to carry out postgraduate work at the Cavendish Laboratory and returned later in his career to oversee work carried out by James Chadwick on the discovery of the neutron – based on Rutherford's theory of its existence and work by Cockcroft and Walton on the splitting of the atom.

Following in Newton's footsteps as Lucasian Professor of Mathematics in Cambridge is Stephen Hawking. Hawking has played a key role in recent developments in the fields of cosmology and quantum gravity. Hawking's research focused on black holes and the theory that they emit thermal radiation due to quantum effects. He has received a larger public profile following the publication of his popular science books, including *A Brief History of Time* which sold more than nine million copies.

Cambridge has also made huge contributions to other fields of science. In 1951, James Watson moved to Cambridge where he shared an office in the Cavendish Laboratory with Francis Crick. Building off X-ray crystallography work by Rosalind Franklin, the Crick and Watson discovered the helical structure of the DNA molecule for which they won the 1962 Nobel Prize for Physiology or Medicine.

Continuing the work on DNA, Dr Frederick Sanger won two Nobel Prizes for his work; the only person to win two such prizes in chemistry. Sanger first won the Nobel Prize in 1958 for his work in determining the complete amino acid sequence of insulin. He won the prize a second time for his work in developing a method of DNA sequencing called the chain termination, or Sanger method, which he used to sequence the genome of the Phage ϕ -X174, the first fully sequenced DNA-based genome.

Cambridge was also home to Charles Darwin, the father of evolutionary biology. Darwin enrolled at Christ's College in 1827, with his father intending him to become a clergyman. However, it was pursuits such as riding, shooting, and collecting natural

history specimens, especially beetles, which occupied most of the young Darwin's time. In 1831 he joined the HMS Beagle on its surveying expedition to South America as a gentleman naturalist, and it was research carried out on this five year voyage that led him to write *On the Origin of Species*, probably the most important and pivotal work in evolutionary biology.

During the Second World War, many University of Cambridge mathematicians were sent to Bletchley Park to aid in the cryptanalysis of enemy communications. Two of these, Alan Turing of King's College and Gordon Welchman, a Fellow of Sidney Sussex College, were instrumental in the continued efficient cracking of the German military cipher, Enigma. Building on work carried out by the Polish Cipher Bureau before the war, Turing and Welchman created a bombe, a special-purpose machine for breaking the cipher. This was a great success with over 200 machines in use by the end of the war. For his work on this, and on early computers after the war, Turing is commonly held to be the father of modern computer science.

Another military innovation of the same period was the jet engine, with Frank Whittle, a Cambridge engineering graduate, one of its key developers. Whittle joined the RAF as an aircraft apprentice in 1923, rising to the officer ranks when his abilities were recognised. In his graduation thesis at the officer training course at the Royal Air Force College Cranwell, he postulated an early design for a motor jet and subsequently went on to discover and patent a design for the jet engine.

Finally, returning to more recent innovations emerging out of Cambridge, Plastic Logic a spin-out from the Cavendish Laboratory, is commercialising plastic electronic technology research by Henning Sirringhaus and Richard Friend for use in hand-held devices. Its first product, to be launched in early 2009, will be a digital reader for business documents and information which will be thinner than a pad of paper, lighter than many business periodicals, and offer a higher-quality reading experience than paper or other electronic readers. The company, which recently relocated its headquarters to the US, has raised over USD 200m in venture capital funding to date. (SaS)

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Acknowledgements

We would like to thank everybody that contributed to this report, particularly BDO Stoy Hayward for their sponsorship.

The following individuals who contributed to this year's edition of the Cambridge Cluster Report:

- Sarah Collins (UoC), University of Cambridge
- Nigel Cutting (CCC), Cambridge City Council
- Martin Garratt (GCP), Greater Cambridge Partnership
- Peter Hewkin (CaN), Cambridge Network
- Iain Evans (IaE), Department for Geography, University of Cambridge
- Shirley M. Jamieson (CaE), Cambridge Enterprise Ltd.
- Shai Vyakarnam and Yupar Myint (CfEL), Centre for Entrepreneurial Learning, Judge Business School, University of Cambridge

The following individuals participated in the breakfast roundtable briefings, supplied data and provided insight in one-on-one interviews for use in this report:

- Simon Anderson, COO, Green Energy Options
- Max Bautin, Managing Partner, IQ Capital Partners
- James Beal, Managing Director, Renewables East
- Jody Chatterjee, Co-founder, Polysolar
- Hermione Crease, Head of Marketing, Sentech
- Clennell Collingwood, Investment Manager, TTP Ventures
- Simon Cooke, CEO, DFJ Esprit
- Phil O'Donovan, Co-Founder, Cambridge Silicon Radio
- Henry Fairpo, CFO, FoneStarz Media
- Julian Gilbert, CEO, Acacia Pharma
- Daniel Hall, Founder, Inkski
- John Halfpenny, CEO, CMR Fuel Cells
- Laurence John, Chief Executive of the Amadeus Mobile Seed Fund
- Maher Khaled, Technology Manager, Cambridge Enterprise
- Roland Kozlowski, CEO, Lectus Therapeutics
- Dermot Leonard, Technology Associate, Cambridge Enterprise
- Greg MacGarrell, CEO, MedCell
- Allan MacLean, CEO, Amdeo
- Dominic Mikulin, Co-Founder, Optisynx
- Damyn Musgrave, Co-founder, Gendrive
- Brian Moon, CEO, Cambridge Consultants
- Chris Newton, SVP, BioFocus DPI
- David Parry-Smith, Director, ChiBio Informatics
- Daniel Roach, Executive Director, Amura Therapeutics
- Robert Sansom, Chairman, Cambridge Angels
- Rend Shakir, Founder, Cambridge Matrix
- Peter Taylor, CEO, TTP Group
- Neil Wilson, Founder and CEO, Camfridge

We would also like to thank everyone who helped produce the report:

- Siobhán Ní Chonaill, Editorial Assistant
- James Moore, Head of Business Development
- Sam Snelson, Head of Data Team (SaS)
- Malgosia Rozycka, Designer
- Along with the whole Library House data team and finally...

The management of all the companies that provide Library House with the data contained within our reports, ensuring that they are both timely and correct.

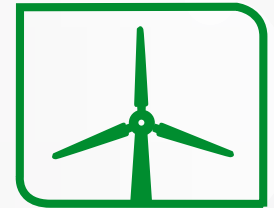
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