

cambridge

technopole report

an overview of the UK's leading high-technology business cluster
www.cambridgetechnopole.org.uk



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Cambridge Technopole Report

This report aims to provide a brief overview of the history, selected key organisations and their activities, and the challenges and opportunities facing the UK's leading high technology business cluster. This report is targeted at those wanting an introduction to how the Cambridge 'ecosystem' for innovation operates and provides links to sources of further information.

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This report and related resources can be accessed via:

www.cambridgetechnopole.org.uk

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Part I: Overview

Introduction

The 'Cambridge Technopole' (also known as 'Silicon Fen', 'Cambridge Cluster' and the 'Cambridge Phenomenon') is a geographic area of intense high-technology innovation activity encompassing the City of Cambridge at its heart and the sub-regional Greater Cambridge hinterland of approximately 25 miles radius. It sits in the wider region of the East of England, one of the fastest growing and most innovative regions in the UK. Much of this growth has been fuelled by the dynamism of the Cambridge Technopole area.

Working population	Approximately 365,000	
Geographic area	25 mile radius centred on Cambridge	
High tech firms	1,525 firms, employing over 53,000 people, with combined revenues of UK£12bn and market capitalisation of UK£50bn	
Number of universities	3 (University of Cambridge, Anglia Ruskin University, The Open University)	
Key technology sectors	Information technology (hardware and software), mobile telecommunications, biotechnology, electronics (inc. plastic electronics), instrumentation, nanotechnology, inkjet printing, technology consultancy.	

Source: Cambridgeshire County Council Research Group (www.cambridgeshire.gov.uk/business/research) and Cambridge Cluster Map (www.camclustermap.com) and Silicon Valley Comes to the UK (www.svc2uk.com).

Evolution

The modern 'Technopole' is now considered to be just over 50 years old. However, commercial innovation has been a feature of Cambridge over many centuries, as illustrated by the formation of Cambridge University Press in 1534 to exploit commercially the innovation of moveable-type printing technologies¹. The birth of the modern Technopole can be linked to several milestones including the formation of Cambridge Consultants in 1960 and the establishment of the Cambridge Science Park by Trinity College in 1970. By 1978 there were around 20 high-tech companies in the area and several of these became key players in the then emergent micro-computer² and industrial inkjet printing³ industries.

By 1985 the number of high-technology companies had increased to around 360 when the significance of developments in Cambridge was highlighted by the publication of the much-

¹ http://www.cambridge.org/home/page/item6451893/?site_locale=en_US

² Famous examples include Acorn Computers (<http://tinyurl.com/25rpjg>) and Sinclair Research (<http://tinyurl.com/punpje>).

³ <http://www.ifm.eng.cam.ac.uk/pp/inkjet/community.html>

cited 'Cambridge Phenomenon' report⁴. This report gave an overview of the evolution of the high-technology industry in Cambridge.

By 2000, the Cambridge Technopole had grown significantly and was home to over 1,300 technology-based firms employing around 38,000 people. The private, public and academic organisations within the Technopole were linked together by new networks that sought to ensure that Cambridge became more than just the sum of the activities of individual firms. Such networks included the Cambridge Network (focusing on the technology sector) and One Nucleus (focusing on the life sciences). This period also coincided with the increasing levels of support for knowledge-based enterprise and innovation from the national and regional public agencies.

Though the majority of firms within the Technopole were small, within this population were global success stories such as Acambis, ARM, Autonomy, CSR and Domino Printing Sciences. In addition, the Technopole has been able to attract R&D activities of multinational corporations – such as Toshiba, Rolls-Royce, Microsoft and Unilever – through the establishment of laboratories embedded within, or located near University departments, or renting space in local science parks.

The success of Cambridge Consultants underpinned the development of a vibrant international technology consultancy cluster within the Technopole. This consultancy cluster has played a major role in the growth of new industry sectors such as industrial inkjet printing, and a range of applications of wireless information and communication technologies (ICT).

In addition to the strengthening of core sectors within the Technopole (including ICT, biotechnology, and industrial inkjet printing), recent years have also seen strong developments in newer sectors such as computer gaming, regenerative medicine, plastic electronics and broadly defined 'cleantech'. These newer sectors build upon the deep roots placed by the longer-standing sectors. For example, plastic electronics draws upon – and merges strengths in – semiconductor and inkjet technologies.

⁴ Segal, Quince & Partners (1985), The Cambridge Phenomenon: The Growth of High Technology Industry in a University Town, www.sqw.co.uk.

Measures of performance

There are now 1,525 technology-based companies in the Technopole region, employing over 53,000 people, with combined revenues of just under £12bn, that have generated a total market capitalisation of £50bn. Unemployment is 2.1%, compared to UK average of 7.8%, and the Gross Valued Added (GVA) to the UK economy per job in the Technopole is £45k, compared to London's £34.2k⁵.

In addition to these core measures of performance, various other indicators have been used to highlight key features of the Cambridge Technopole in relation to other national and international high tech clusters. These include:

- University of Cambridge people and technology have been at the heart of over 300 new high-tech ventures in the past 20 years⁶, many of which now lead their industry sectors.
- Spin-outs from the University of Cambridge (i.e., new ventures in which the University holds an equity stake) have received more venture capital investment than any other UK university⁷.
- Numerous significant scientific discoveries and inventions have been made at the University of Cambridge. This is reflected in the fact that the University has more Nobel Laureates than any other university in the world – 89 in total⁸ – and is consistently ranked as one of the top four universities world-wide.
- Cambridge is one of a handful of regions in Europe to be ranked by the European Commission as 'excellent for its support of innovative start-ups'⁹, and highlighted by analysts as one of the top three innovation ecosystems globally¹⁰.
- 12 Technopole companies have been valued at over US\$1bn in the past 15 years: Abcam, ARM, Autonomy, AVEVA, CAT, Chiroscience, CSR, Domino, Ionica, Marshall, Solexa, Virata. ARM was first of these to reach a US\$20bn valuation in 2013.
- Cambridge has proved to be an attractive location for R&D activities of numerous multinational corporations seeking to both engage with the University of Cambridge and be connected with the commercial innovation activities within the Technopole. Examples of such include Microsoft, Rolls-Royce, Philips, Unilever and BP. One of the most significant recent examples has been that of AstraZeneca, which announced in mid-2013 its intention to move its global R&D headquarters to the Cambridge Biomedical Campus.

⁵ SVC2UK (2012). Startups that scale: Why it matters and how to do it: Lessons from Silicon Valley Comes to the UK 2012, http://www.svc2uk.com/docs/SV_report.pdf

⁶ Information on University of Cambridge spin-outs can be found at www.enterprise.cam.ac.uk.

⁷ Sainsbury, D. (2007). The Race to the Top: A Review of Government's Science and Innovation Policies. <http://bit.ly/aU3URQ>.

⁸ "List of Nobel laureates by university affiliation" <http://bit.ly/QfcjCi>

⁹ <http://cordis.europa.eu/paxis/src/cambridge.htm>

¹⁰ Graham, R. (2013). Technology Innovation Ecosystem Benchmarking Study <http://bit.ly/14UqaZ6>

Challenges and opportunities

Role of the public sector

Though the growth of the Technopole has often been said to be driven by a 'bottom-up' approach, the direct and indirect role of the public sector has been significant. The policies of the current national coalition government have led to cuts in direct support for innovation, and to changes in the structure of delivery of such support. Both the uncertainty surrounding these changes and the absolute reduction in support present challenges to entrepreneurs and those that support them. One area of clarity was the decision to abolish the Regional Development Agencies (RDAs)¹¹ and to devolve some of the activities of the former RDAs to new, smaller Local Economic Partnerships (LEPs). The Cambridge Technopole is now part of the Greater Cambridge Greater Peterborough Enterprise Partnership¹², which was formed in 2010.

Cuts in public funding and the closure of the East of England Development Agency have changed the availability of support for innovation and enterprise in the Technopole. Public funding schemes to support innovation (such as the SMART awards for market and technical feasibility studies¹³) are now administered via the Swindon-based Technology Strategy Board. Support for enterprise is now either delivered through on-line resources (such as Business Link¹⁴) or through national programmes with regional delivery agents (such as Growth Accelerator¹⁵).

Finance for innovation

The decline in venture investing nationally since 2009 has been mirrored in the region. Figure 2 shows VC (including seed, start-up, early- and later-stage VC) activity. Though government-backed schemes went some way to meeting the gap created by a decline in private-sector activity, the East of England has the fewest government-financed equity funds of any English region. Private venture funds in Cambridge – with some notable exceptions – are in many instances either managing out portfolios or reserving funds for follow-on rounds only.

The funding environment continues to change. While the activities of existing VC funds seem to be slowing in terms of number of deals but increasing in terms of amounts invested (as shown in Figure 2), new sources of funding continue to appear. One of the most potentially influential of these is Invoke Capital, the new fund established by Mike Lynch, former CEO of Autonomy plc (sold in 2011 to HP for £7bn). This reflects an important feature of the Technopole: the recycling of both talent and money to drive innovation.

¹¹ Announced in a joint letter in June 2010 from Business Secretary Vince Cable and Communities Secretary Eric Pickles to local councils and business leaders. <http://bit.ly/bmjV9i>

¹² The goal of this LEP is: "[...] to create an economy with 100,000 major businesses and create 160,000 new jobs by 2025, in an internationally significant low-carbon, knowledge-based economy balanced wherever possible with advanced manufacturing and services.". Further background on the Greater Cambridge Greater Peterborough LEP can be found at www.yourlocalenterprisepartnership.co.uk.

¹³ E.g. SMART awards: <http://www.innovateuk.org/deliveringinnovation/smart.ashx>

¹⁴ <http://www.businesslink.gov.uk/>

¹⁵ <http://www.growthaccelerator.com/>

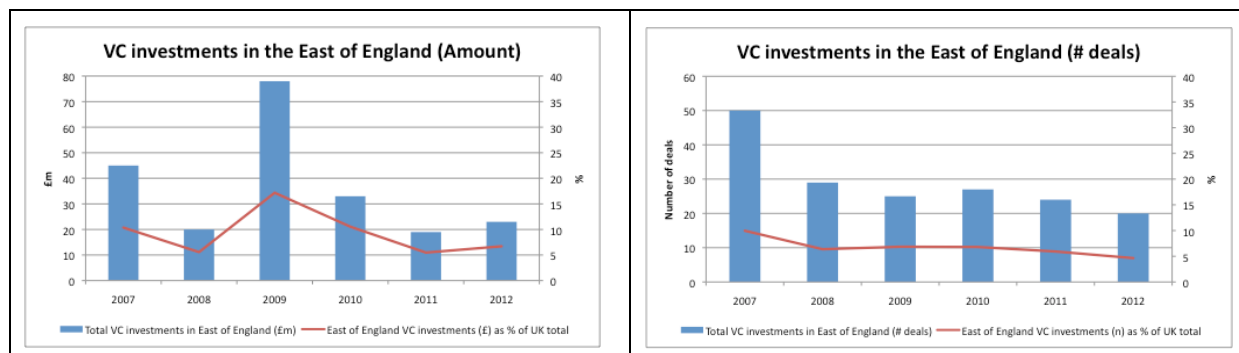


Figure 2

Source: BVCA Investment Activity Reports for 2008, 2009, 2010, 2011, 2012 (www.bvca.co.uk)

Open innovation

Few of the technologies developed in the Technopole are brought to market by firms operating alone. This is in part due to the complex nature of many modern technologies, but also a lack of sufficient investment to allow firms to implement vertically integrated business models. As a result, the Technopole has developed an infrastructure that seems well suited to support the implementation of 'open innovation'¹⁶. Such infrastructure includes the availability of specific IP-licensing skills, investors with experience of partnership-based approaches to innovation, a university that supports collaborative projects with industry, and the presence locally of a range of multinational firms willing and able to work with early-stage technology firms.

Beyond the Technopole

Some commentators believe that the Technopole may have reached a critical mass in terms of number of firms and employment levels. This raises the question of whether the Technopole should stand alone or now be considered both strategically and operationally as part of a Greater South East 'supercluster' involving London and Oxford¹⁷. This would allow Cambridge to be recognised for what it is – predominantly a 'hotbed' of start up activity involving businesses that are commercially exploiting scientific knowledge – but with much stronger links to the substantial financial, marketing and manufacturing capabilities from across the South East. The merger of ERBI and the London Biotechnology Network to form One Nucleus, and the merger in 2006 of Cambridge-based SQW with Oxford Innovation are illustrative examples of such broadening activities. In addition, the high profile of the software and social media start-up and inward investment activity in East London Tech City¹⁸ presents an opportunity for the Cambridge software cluster to form mutually beneficial ties.

¹⁶ www.ifm.eng.cam.ac.uk/ctm/teg/openinnovation.html

¹⁷ The benefits of such a 'supercluster' were presented in: EEDA/LDA/SEEDA (2007). The UK's engine for growth and prosperity: A case for targeted investment in the Greater South East. <http://bit.ly/dfLabt>.

¹⁸ <http://www.techcityuk.com/>

Part II: Organisations and activities

The Cambridge Technopole is an innovation ecosystem with particular cultural characteristics:

- **Community** – in Cambridge, people often comment that there is a sense of being part of a unique environment that brings together a diverse range of people, resources and activities to underpin invention, discovery and innovation. The Cambridge Network's strap line of '*Cambridge ideas change the world*' perhaps best sums this up.
- **Collaboration** – because of the sense of community, organisations and individuals are typically willing to help each other. This is reflected, for example, in the high levels of engagement from the business community in the broad range of enterprise education activities offered throughout Cambridge.
- **Constructive chaos** – there is no one group that 'organises' Cambridge. New initiatives are continuously springing up; some succeed, some fail. This can lead to confusion, overlapping activities and dilution of resources, but does result in a highly entrepreneurial environment.

In the following sections, examples of some of the key initiatives and organisations that reflect the character of the Cambridge Technopole are presented.

Universities

There are three universities with significant activities within the Cambridge Technopole area.

<p>University of Cambridge</p>	<p>One of the world's oldest universities and leading academic centres. Cambridge comprises 31 Colleges and over 150 departments, faculties, schools and other institutions. It has around 18,000 fulltime students.</p>	<p>www.cam.ac.uk</p>
<p>Anglia Ruskin University</p>	<p>ARU has some 28,000 students who are currently studying at ARU's two main campuses in Chelmsford or Cambridge or at one of the colleges that form ARU's Regional University Partnership.</p>	<p>www.anglia.ac.uk</p>
<p>Open University (OU)</p>	<p>The Open University is a world leader in modern distance learning, and is the largest provider of undergraduate part-time education in the East of England supporting over 17,000 students.</p>	<p>www.open.ac.uk</p>

Conferences

Cambridge hosts numerous international entrepreneurship and innovation-related conferences that bring together the private, public and educational sectors. Some examples of these are given below.

Cambridge Corporate Gateway	Provides companies from around the globe with the opportunity to access both high-technology cluster and University research.	www.cambridgenetwork.co.uk
High Value Manufacture Conferences	Forums for discussion of issues relating to high value manufacturing.	www.cambridgeinvestmentresearch.com
Nerve Summit	3 day event aimed at "showcasing the world's most disruptive technologies"	www.itsnerve.com
OneNucleus Annual Conference	Europe's largest life science and healthcare gathering	www.onenucleus.com
Silicon Valley Comes to Cambridge	A not-for profit series of industry supported events designed to improve the ecosystem for entrepreneurship in the UK, Europe and beyond.	www.svc2uk.com
Technology Ventures Conference	Provides platforms for entrepreneurs, venture capitalists and technologists to interact.	http://cutec.org
TEDx	TED conferences bring together the world's leading thinkers and doers to share ideas. TEDx is a programme of local, self-organized TED-like events.	www.tedxgranta.com , www.tedxoxbridge.com

In addition to large-scale conferences, there is a diverse programme of talks, workshops and seminars running throughout the year, on a wide range of innovation and enterprise-related topics. Information on such events can be found via sites including: www.cambridgenetwork.co.uk/events, www.onenucleus.com/events, www.talks.cam.ac.uk, and events.stjohns.co.uk.

Networks and communication

Numerous networks have developed in Cambridge to bring together a wide range of technological and commercial interests. They vary in scale, focus and activities, but their proliferation and sometimes overlapping agenda can present challenges for those seeking to work out who does what in the Cambridge ecosystem. Examples of the diversity of innovation-related networks in Cambridge are given in the following table.

Business Leaders' Network (BLN)	The BLN runs events to promote interaction, investment & discussion between the individuals behind the UK's most active investors, businesses & innovation clusters.	thebln.com
Cambridge Elevator	CambridgeElevator.com brings together the global startup community to share experiences and best practice and fast-track commercialisation of bright ideas.	www.cambridgeelevator.com
Cambridge High-tech Association of Small Enterprises (CHASE)	Founded in 1987 by a group of technology enthusiasts, CHASE is an association of technology start-ups & small enterprises in the Cambridge area.	www.chase.org.uk
Cambridge Network (CN)	Established in 1998, the Cambridge Network links business and academia to each other and to the global high technology community. It has 1000 paying members, with over 16,700 individuals registered.	www.cambridgenetwork.co.uk
Cambridge Tech Meetup	A networking group focused on celebrating the technologies being developed in Cambridge.	www.meetup.com/Cambridge-Tech-Meetup
Cambridge University Institute for Manufacturing (IfM)	IfM provides a unique environment for the creation of new ideas and approaches to modern industrial practice. IfM links education, research and practice at the technology, management and policy levels.	www.ifm.eng.cam.ac.uk
CamCreative	CamCreative is a network for a diverse group of interests including graphic & web design, media of all kinds, literature and publishing, visual arts, multimedia, performing arts and general culture.	www.meetup.com/camcreative
CamTechNet	Aims to be "one place where information relevant to Cambridge technology professionals is brought together"	www.camtechnet.info
Cambridge Cleantech	A membership-based network organisation supporting the growth of environmental goods and services or "cleantech" companies in the Greater Cambridge area.	www.cambridgecleantech.org.uk
Connected Cambridge	Connected Cambridge is one of 10 connected clusters around the world with a common purpose to create a top tier of interconnected entrepreneurial communities which benefit from each others' insight, connections and brands	www.connectedcambridge.com
MakeSpace	This group is for members and visitors to Makespace, a community inventing shed in Cambridge, UK. The meetups are organised by community members both in the space and elsewhere in Cambridge.	www.meetup.com/makespace
One Nucleus	Established in 1997 (as ERBI), One Nucleus is a membership organisation for life science and healthcare companies, based in Cambridge and London, the heart of Europe's largest life science & healthcare cluster.	www.onenucleus.com

An important role in the development of the Technopole has been that provided news and media organisations focused on supporting communication within and beyond the Technopole.

Business Weekly	Business Weekly is an independently owned newspaper founded in May 1990 to fill a void in the B2B media marketplace.	www.businessweekly.co.uk
CaBuMe	Reports on the business and technology communities with a range of interviews, news, reports and analysis.	www.cabume.co.uk
Cambridge News	Local newspaper with roots back to 1888 with dedicated business section that has been reporting key events through growth of Technopole.	www.cambridge-news.co.uk/Business
Cambridge Cluster Map	Cambridge Cluster Map is a free-to-access online service brought into being by Cambridge University and leading figures from the area's technology community.	www.camclustermapping.com

Science parks and incubators

The Cambridge Technopole is home to a range of specialist accommodation for knowledge-intensive and early stage ventures. This breadth of provision is illustrated through the following examples.

Babraham Bioincubator	Started in 1998 - combined office and laboratory space for start-up and early stage ventures.	www.babraham.co.uk
Cambridge Biomedical Campus	Now undergoing major expansion, the Biomedical Campus will provide research and commercial facilities co-located with Addenbrookes Hospital	cambridge-biomedical.com
Cambridge Science Park	Started in 1970 - Premises for over 100 science-based firms from small start-ups and spin-outs to subsidiaries of multinational corporations.	www.cambridgesciencepark.co.uk
Chesterford Research Park	250-acre low-density scheme to provide accommodation for science and technology based companies of all sizes.	www.chesterfordresearchpark.com
Colworth Science Park	Office and laboratory space close to Bedford providing accommodation for a range of company sizes supported by specialist scientific services.	www.colworthpark.com
Granta Park	Research & development park providing 600,000 sq ft of laboratory and office space, situated 7 miles south east of Cambridge.	www.grantapark.co.uk
ideaSpace Enterprise Accelerator	Based at the Hauser Forum at the West Cambridge site, ideaSpace seeks to accelerate the early stage growth of new ventures	www.ideaspace.cam.ac.uk
Melbourn Science Park	200,000 sq ft of R&D and office space located 9 miles south of Cambridge. Owned by The Technology Partnership Group.	www.melbournsciencepark.com
St. John's Innovation Centre	Started in 1987 - Provides business support and accommodation for around 60 early stage knowledge based companies.	www.stjohns.co.uk

Venture capital funds and business angel networks

Examples of actively investing Cambridge-related funds focusing on high-tech and biotech include the following.

Fund	Investment areas	URL
Amadeus Capital Partners	Communications, networking & computing hardware & software, media, e-commerce, medical, clean energy technologies.	www.amadeuscapital.com
Avlar BioVentures	Biotechnology, Life Sciences, Medical/health related.	www.avlar.com
Cambridge Angels	A business angel group set up in 2001 to accelerate early-stage investments in Cambridge start-ups.	www.cambridgeangels.net
Cambridge Capital Group	Private equity syndicate of angel investors offering funding for early stage technology based companies.	www.cambridgecapitalgroup.co.uk
Cambridge Enterprise Seed Funds	Seed funds to encourage the commercialisation of University of Cambridge inventions.	www.enterprise.cam.ac.uk/university-community/seed-funds/
Cambridge Innovation Capital	Combines strong relationship with University of Cambridge and deep industry links; invests in high-growth technology companies.	www.cambridgeinnovationcapital.com
DFJ Esprit	High growth potential ventures in technology, media, telecoms and healthcare	www.dfjesprit.com
Invoke Capital	Focused on growth of early-stage companies in areas including genomics, security, pattern recognition, signal processing and big data.	www.invokecapital.com
IQ Capital	Seed, early stage and expansion funding for technology ventures.	www.iqcapital.co.uk
TTP Venture Managers	Early stage science and technology companies.	www.ttpventures.com

Support for university-based entrepreneurship

Organisations within the University of Cambridge and Anglia Ruskin University have also developed activities to support start-up, growing and mature ventures. Anglia Ruskin University has developed strong links with the local business community, and offers a number of routes by which businesses can access support (business.anglia.ac.uk).

Within the University of Cambridge, the University Enterprise Network (www.enterprisenetwork.group.cam.ac.uk) has been established to improve the flow of information on resources available to support innovation and entrepreneurship within and

outside the University. Details on a sample of members of the Enterprise Network are given in the following table.

Cambridge Enterprise (CE)	Cambridge Enterprise exists to help University of Cambridge inventors, innovators and entrepreneurs make their ideas and concepts more commercially successful for the benefit of society, UK economy, the inventors and the University.	www.enterprise.cam.ac.uk
Cambridge University Entrepreneurs (CUE)	CUE organises the most successful student run business planning and creation competitions in Europe. Since 1999, CUE has had over 450 entries and has awarded over £320,000 in grants to 41 business ideas. These companies have raised more than £28m further funding and are currently valued at more than £42m.	www.cue.org.uk
Cambridge University Technology and Enterprise Club (CUTEC)	CUTEC organises a series of events and activities that are designed to enhance entrepreneurship amongst members of the University. These allow the sharing of experiences from technology investment and entrepreneurship with both the university and business communities.	www.cutec.org
Centre for Entrepreneurial Learning (CfEL)	CfEL delivers a range of educational activities on the practise of entrepreneurship, to inspire and build skills and 'spread the spirit of enterprise' within the University of Cambridge and beyond. Key programmes include Enterprise Tuesday and the Ignite Programme.	www.entrepreneurs.jbs.cam.ac.uk
Institute for Manufacturing (IfM)	IfM works closely with companies in the areas of strategy and performance, technology management, international manufacturing and supply networks through research, education and direct support.	www.ifm.eng.cam.ac.uk
i-teams	i-Teams allows entrepreneurial post-graduate students to work with real inventions to determine the best route for their commercialization, and present the results at CUTEC's annual Tech Ventures Conference.	www.iteamsonline.org
IdeaSpace Enterprise Accelerator	IdeaSpace is an experiment designed to connect innovators to the resources they need in order to make a significant impact on the world around them.	www.ideaspace.cam.ac.uk
Judge Business School (JBS)	Through its Cambridge Venture Projects, Global Consulting Projects and MOTI projects, JBS encourages MBAs, graduates and undergraduates to collaborate with local companies on specific projects. JBS has also established 'Accelerate Cambridge' with the aim of "nurturing venture creation out of the University of Cambridge".	www.jbs.cam.ac.uk www.accelerate.jbs.cam.ac.uk

Professional service providers

Entrepreneurs in Cambridge have access to a full range of support from small, medium and large professional service providers, many with strong international operations.

The following table shows some of the major legal, banking and accountancy organisations that have offices in Cambridge. Some of these professional service providers have developed charging mechanisms appropriate for the needs of early stage technology ventures (e.g., deferred payments, reduced payments) and recruited specialist staff to deal with the

particular needs of technology businesses (e.g., banks with specialist technology business managers).

Eversheds	Full range of legal services for businesses	www.eversheds.com
Hewitsons		www.hewitsons.com
Mills & Reeve		www.mills-reeve.com
Taylor Vinters		www.taylorvinters.co.uk
Taylor Wessing		www.taylorwessing.com
BDO	Full range of accountancy services for businesses	www.bdo.co.uk
Deloitte		www.deloitte.co.uk
Ernst & Young		www.ey.com/uk
Grant Thornton		www.grant-thornton.co.uk
KPMG		www.kpmg.co.uk
PWC		www.pwc.co.uk
Barclays	Full range of banking services for business	www.barclays.co.uk
Cambridge and Counties Bank		www.ccbank.co.uk
HSBC		www.business.hsbc.co.uk
LloydsTSB		www.lloydstsbbusiness.com
NatWest / RBS		www.natwest.com/business.ashx

Support is also available from a range of specialist private sector organisations providing services including investment readiness, PR, technical and market due diligence, IPR and mentoring, reflecting the growing sophistication of needs of new and growing ventures in the Cambridge area. Information on these and other support service providers can be found at **www.cambridgenetwork.co.uk**.

Specialist financial service providers also reflect the evolution of needs within the Technopole. For example, NW Brown Group (providing a range of financial services to private and corporate clients) has been in Cambridge since 1974; Coutts & Co. (the specialist private banking arm of the Royal Bank of Scotland Group) opened offices in Cambridge in 2001; Kleinwort Benson Private Bank set up in Cambridge in 2008; in 2012 a new bank for smaller businesses (Cambridge and Counties Bank) was formed in Cambridge; and in the same year Silicon Valley Bank set up its first overseas branch in London with a reported 'strong interest' in supporting Cambridge firms.

There is also extensive provision of advice and support on intellectual property matters available in Cambridge – see www.cipa.org.uk and search for 'Cambridge'.

Technology providers

A critical role has been played in the growth of the Cambridge Technopole by those organisations whose function can be viewed as 'technology provider'. These can be divided into three groups: technology consultants; higher education research institutions (including embedded laboratories); and corporate R&D organisations (both Cambridge start-ups and 'incomers'). These organisations typically do much more than just their 'core' research function. For example, the technology consultants now actively exploit the competence they have developed through their consulting work through the formation of new business ventures (e.g., Cambridge Consultants have spun out a series of very successful ventures – such as Domino Printing Sciences – built around their expertise in industrial inkjet printing technologies). Corporate R&D labs also spin-out new ventures (e.g., Teraview from Toshiba Research (Europe)). It is also interesting to note the emergence of new large-scale academic-business collaborative initiatives within the Technopole. One example is the Cambridge Service Alliance (www.cambridgeservicealliance.org) that brings together BAESystems and IBM, with the University's Engineering Department and Judge Business School to address the challenges of complex product-service systems.

Examples of Technology Consultants		
TTP Group	Technology consulting, product development and new venture incubation.	www.ttp.com
Cambridge Consultants		www.cambridgeconsultants.com
Sagentia		www.sagentia.com
PA Technology		www.paconsulting.com
Examples of higher education research institutions and embedded laboratories		
University of Cambridge	The science and technology departments of the University carry out research across all major disciplines.	www.cam.ac.uk
Microsoft Research	Operates in partnership with the University of Cambridge Computer Laboratory. Focuses on security, information retrieval, OS & networking.	www.research.microsoft.com/aboutmsr/labs/cambridge
Unilever Centre for Molecular Informatics	Inter-disciplinary research integrating chemical, biological & materials sciences through molecular informatics.	www-ucc.ch.cam.ac.uk
Examples of corporate R&D organisations (Cambridge start-ups and incomers)		
ARM	Involved in joint research and development programs with universities, companies and other organizations.	www.arm.com
Nokia Research Centre (NRC)	A collaboration with the Nanoscience Centre and Electrical Division of the Engineering Department on projects that are centred on nanotechnology.	research.nokia.com/openinnovation
Toshiba Research (Europe)	Undertakes basic research into quantum semiconductor physics and related topics.	www.toshiba-europe.com/research

Appendix: Selected milestones in the evolution of the Cambridge Technopole

1209: Scholars leave Oxford to seek refuge in Cambridge – leads to formation of University of Cambridge.

1534: Cambridge University Press established.

1881: Horace Darwin establishes 'Cambridge Instruments' (now part of Leica).

1960: Cambridge Consultants formed "to put the brains of Cambridge University at the disposal of the problems of British industry".

1969: Mott Report published with recommendation for an expansion of 'science-based industry' in Cambridge.

1970: Inspired by Mott Report, Trinity College establishes Cambridge Science Park. University sets up Wolfson Cambridge Industrial Liaison Unit to support technology transfer.

1970s: Acorn Computers and Sinclair established in Cambridge.

1978: Barclays Bank begins actively supporting new technology ventures.

1985: 'Cambridge Phenomenon' report published by SQW which highlights growth of high-technology business activities in Cambridge.

1987: St. John's Innovation Centre established. University publishes its first IP policy for research council funded research.

1990: University of Cambridge Judge Institute of Management Studies established.

1997: Ionica plc becomes first Cambridge company to have a valuation of over US\$1bn. Eastern Region Biotechnology Initiative established. 1st Cambridge Enterprise Conference held.

1998: University of Cambridge Institute for Manufacturing established. Cambridge Network formed to provide a voice for the high-technology business community. Greater Cambridge Partnership established.

1999: University of Cambridge Entrepreneurship Centre, University Challenge Fund and Cambridge University Entrepreneurs established; University Technology Transfer Office activities enhanced. East of England Development Agency established. Public Cambridge companies, including ARM, Autonomy and Virata, reached multiple billion US\$ valuations.

2000: Bursting of dot com bubble leads to slow-down in Cambridge economy. Cambridge MIT Institute established in Cambridge with £65m of Government funds to promote entrepreneurship, productivity and competitiveness. Cambridge recognised by European Commission as excellent for support of innovative start-ups. Life science sector continues to grow.

2001: University revises its IP policy for externally funded research. 'Cambridge Angels' group formed.

2004 - 2005: IPOs of CSR, CDT, Bango and Amino Communications boosts investor confidence. M&A activity grows. East of England Science and Industry Council (SIC) established. Library House reports Technopole companies secured more than 25 per cent of the UK's venture capital investments and more than 8 per cent of the European total by value.

2005: Comprehensive new IP policy adopted by University. East of England Innovation Relay Centre ranked #1 in Europe.

2006: GCP establishes International Relations Manager to support international links. Library House reports Technopole growth has 'stalled'. Cambridge Enterprise Limited formed as a wholly owned subsidiary of the University of Cambridge to commercialise technology arising from the University's departments

2007: Plastic Logic receives largest single venture capital investment into a European technology-based start-up. 8th Cambridge Enterprise Conference held. St John's Innovation Centre celebrates 20th anniversary.

2010: Cambridge Consultants Ltd reaches its 50th anniversary; Cambridge Science Park reaches its 40th. Opening of Hauser Forum on West Cambridge site.

2011: Autonomy plc sold to Hewlett Packard for over UK£7bn. Plastic Logic receives new investment totalling US\$700m.

2012: Twelve Technopole companies have reached billion-dollar capitalisation since the mid-1990s, including one US\$10bn (Autonomy) and one US\$20bn (ARM). The combined market capitalisation of the Technopole companies reaches US\$50bn.

2013: AstraZeneca announce their decision to relocate their global R&D headquarters to the Cambridge Biomedical Campus, investing £330m to provide facilities for 2,000 staff.