

History of the Cambridge Cluster Role of the University of Cambridge

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Monday 19th October 2009

The Cambridge Cluster Today

Working population:	360,000 ¹	
Geographic area:	25 mile radius centred on Cambridge	
Number of high-tech firms:	Approximately 1,400 ²	
Employment in high-tech firms:	Approximately 43,000	
Number of universities:	3	
Key technology sectors include:	Information technology (hardware and software), mobile telecommunications, biotechnology, electronics (inc. plastronics), instrumentation, nanotechnology, inkjet printing.	

Cambridge Technopole - Evolution

- Headline facts and figures:
 - *The Cambridge Phenomenon, SQW (1985):*
 - 350 high-tech firms, emerging cluster
 - *The Cambridge Phenomenon Revisited (2002):*
 - 2001: 3,500 high-tech firms employing 50,000 – GCP area
 - *Cambridge Technopole Report:*
 - 2006: Number of high-tech firms: 1,500, employing 45,000
 - 2008: Number of high-tech firms: 1,400, employment: 43,000
- BUT: no comprehensive, reliable statistical annual survey of investment, growth, longitudinal trends
- Cambs County Council database is employment only
 - Even years. Survey based

2009: (Near) Anniversaries

- 1859: Charles Darwin, *Origin of the Species*
 - Diversity, selection, amplification
- 1970: Cambridge Science Park
 - Beginnings of physical cluster infrastructure
- 1985: SQW, *The Cambridge Phenomenon*
 - Cluster self-awareness, slippery marketing slope
- 2008: Worst financial crisis since 1929
 - Opportunity to rethink financial markets
 - ... and shoot some sacred cows

Science at Cambridge – to 1900

- **1847:** Election of Prince Albert as Chancellor
 - Import of German ideas on teaching of science
 - Move away from dominance of law, theology – and mathematics
- **1848 - 51:** Start of Natural Sciences Tripos
- **1868:** Committee on Teaching Experimental Physics
- **1869:** Cavendish Laboratory paid by Duke of Devonshire
 - Separation of theoretical (maths) and experimental physics
 - Maxwell, Rayleigh, Thomson, Rutherford, Friend...
 - Discoveries: electrons, isotopes, DNA
 - 29 Nobel Prizes (not all in Physics)
- **1904:** New Science Site opened by Edward VII
- **(1974:** Move to West Cambridge Site)

The First Spin-outs – from 1878

- **1878:** Cavendish Laboratory sets up workshop manufacturing apparatus
- Robert Fulcher, mechanic employed by Cavendish workshop, left to set up firm supplying scientific equipment to University
- Horace Darwin (son of Charles) assists Fulcher with design
- **1881:** Darwin purchases Cambridge Scientific Instrument Company from Fulcher
- **1896:** PYE Ltd spin-out from Cavendish workshop
 - William George Pye apprenticed at Cambridge Scientific Instrument Co
- **1966:** 60% of PYE sold to Philips Electronic Industries
 - CSIC also sold to Philips, intellectual property passes to Leica
- **Beginnings of repeat patterns:**
 - Inter-related spin-outs, indirect role of University
 - Capital realisation often through overseas trade sale

Technopole – Early 20th Century

- **1909: Foundation of Marshalls**
 - Was single garage, diversified, still in private hands
 - “involvement in aviation dates back to 1912 when its mechanics helped repair the engine of a British Army airship, the Beta II, which had made an emergency landing in Jesus Grove”
 - 2007: T/O £700M, PAT £18M, 1750 employees
 - Exception that proves the rule?
- **1934: Aero Research set up by N A de Bruyne**
 - Spin-out from Cavendish, making synthetic resins
 - Acquired by Ciba Geigy (CH)
- **1939: Pest Control Ltd for agrochemicals**
 - Acquired by Fisons, then Schering Group (D)

Cambridge Phenomenon - Origins

- Cambridge Phenomenon recognised role of Mott Report
 - Published by CU Senate 1969, long consultation
 - Response to refusal to house IBM Europe lab in Cambridge
 - Reversal of 20+ years of planning (Lewis Silkin; Holford principles 1950)
 - Led to creation of Science Park (1970), SJIC (1987)
 - New, not smoke-stack industries; University's permissive approach
- Not imposing central planning but:
 - BOTH removing central planning restrictions
 - AND providing a sense of vision and direction
- Cambridge then was small enough for '1000 flowers to bloom'

Synopsis of Key Dates – to 1985

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

Synopsis of Key Dates - 2

- **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 US\$bn valuation. 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. Ionica goes bankrupt.
- **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. Publicly quoted Cambridge companies, including ARM, Autonomy and Virata, reached multiple billion US\$ valuations.

Synopsis of Key Dates - 3

- **2000:** Bursting of dot.com bubble leads to slow down in Cambridge economy. Cambridge MIT Institute established with £65m of Government funds. Cambridge recognised by the EC as being a “region of excellence for the support of innovative start-ups”.
- **2001:** University revises IP policy for externally-funded research. ‘Cambridge Angels’ group formed.
- **2004-05:** IPOs of CSR, CDT, Bango and Amino Communications. Library House reports Technopole companies secured more than 25% of the UK’s venture capital investments and more than 8% 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 overseas links. Library House reports Technopole growth has ‘stalled’. Cambridge Enterprise Limited formed 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.
- **2008:** Library House goes bust. Funding withdrawn for GCP International Relations Manager.
- **2009:** MMI plc, Alizyme plc, York Pharma plc and private company, Cambridge Biostability – all East of England Life Sciences companies – file for bankruptcy

Reasons to be Cheerful

- Autonomy Corporation plc, founded 1996:
 - Unstructured information search
 - Market cap \$4bn, 2nd largest pure software company in Europe, offices worldwide
- ARM Holdings plc, founded 1990:
 - world's leading semiconductor intellectual property (IP) supplier
 - £299M revenues, £44M net income, 1700 employees, market cap £1.9bn
- Next generation, unquoted companies:
 - RedGate: developers of software tools for database administrators and developers (1999)
 - Jagex: developers and publishers of online computer games, including RuneScape and FunOrb (2001)
 - Owlstone: developers of button-sized programmable chemical sensor (2004)
 - Cambridge Temperature Concepts: non-invasive, easy-to-use female fertility monitor (2006)

World University Rankings - 2008

World Rank	Institution*	Region	Regional Rank	Country	National Rank	Total Score
1	Harvard Univ	Americas	1	USA	1	100
2	Stanford Univ	Americas	2	USA	2	73.7
3	Univ California - Berkeley	Americas	3	USA	3	71.4
4	Univ Cambridge	Europe	1	UK	1	70.4
5	Massachusetts Inst Tech (MIT)	Americas	4	USA	4	69.6
6	California Inst Tech	Americas	5	USA	5	65.4
7	Columbia Univ	Americas	6	USA	6	62.5
8	Princeton Univ	Americas	7	USA	7	58.9
9	Univ Chicago	Americas	8	USA	8	57.1
10	Univ Oxford	Europe	2	UK	2	56.8

Institute of Higher Education, Shanghai Jiao Tong University

<http://www.arwu.org/rank2008/en2008.htm>

University of Lisbon = 478

Cambridge Enterprise Ltd – 2007/08

- **116** new invention/innovation disclosures received
- **83** patent applications filed
- **80** IP transactions signed: 47 for commercial purposes and 33 research licences
459 active IP and licence agreements under management including 130 research licences
- **15** proof of concept projects supported: 12 projects awarded funds totalling £430k
- **124** consultancy disclosures received
- **89** consultancy agreements signed
- **5** companies invested in representing £373k seed investment
- **68** companies in which Cambridge Enterprise holds equity
- **£1.7 million** received from equity realisations in 5 companies, comprising £841k received from seed investments and £809k from licensing transactions
- **£8.8 million** income received from consultancy fees, licensing fees and royalties, excluding licensing equity realisations, of which 82% was returned to academics and University departments and a further 7% invested in patent assets

Cambridge Science Park

- Founded 1970, response to Mott Report
- Owned and funded by Trinity College,
 - NO public funding
- 61.5 Hectares; 145,540 sq m R&D space
- 4km from City Centre, opposite SJIC
 - Mainly one-way traffic of growth firms
- 100 companies, 5000 people
- Early-stage start units also
- Limited social facilities (restaurant, gym, ATM)

Some Consultancies ...

- Cambridge Consultants 1960: spin-outs
 - Domino, Xaar, Prelude Trust, CSR, Vivid (IPOs)
 - Alphamosaic, Inca (trade sales)
- Scientific Generics, formed 1986 by Gordon Edge
 - Spun-out Chord Capital, venture investment arm
- TTP Group set-up 1988
 - Includes TTP Ventures
- ALSO: PA Consulting (1943)

Diversity....

“Most of all, though, I think the challenge for Cambridge is that there are **so many events going on** - you list a tiny fraction - that one simply **cannot attend even a substantial fraction** of them, regardless of interest. And for those **actually doing innovation (rather than just talking about it), long hours and great commitment are the norm, and one doesn't go to non-essential evening events** when one is flat out building tomorrow - one picks and chooses very carefully indeed.”

*Dr Laura James
Cambridge Technopole Blog
14 September 2009*

Selection...

- Cambridge's Pharaonic seven fat years:
 - Duplication of student organisations
 - Duplication of breakfast clubs
 - Duplication of umbrella organisations
 - Incomprehensible to the outside world
 - Mission creep of public sector goals
 - Exacerbated by solipsism of *most* social media
- Sweet are (some of) the uses of adversity:
 - Dissipation of energy and focus for the busy
 - Recession is a time for consolidation and focus!

Amplification....

Two elephants in the Cambridge room for years

1. Funding: despite hype, little VC. But angels.
2. Foreign competitors are investing heavily
 - From Paris to Peking
 - Joined up thinking on infrastructure
 - Resources put into risk capital
 - Massive push on education
 - Our lessons have been studied on countless tours

Not all will succeed. But some will...

Darwin, Mott & Lehman Bros

- Competent and realistic data centre:
 - Continental Chamber of Commerce Model?
 - Company formation, investment, growth
- New generation Mott Report
 - Real business plan: milestones, responsibilities
 - Both top down and bottom up: ‘that vision thing’
- New working relationship with government
 - Funding market failure, but government can’t pick winners
 - Amplify angels (active) rather than VC (inactive)
 - Must be high trust: no mission creep or mixed messages
 - Need the data!
- Cut down on activity, focus on action (results)

Finally: Adam Smith

“Despite all **Smith did to explain and defend the constructive role of the market**, he was deeply concerned about the incidence of poverty, illiteracy and relative deprivation that might remain despite a well-functioning market economy ... he argued, in general, for **institutional choices to fit the problems that arise** rather than anchoring institutions to some fixed formula, such as leaving things to the market.”

Amartya Sen

FT, 10 March 2009

Questions?



What Makes Clusters & Technology Transfer Work Effectively?

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Outline

1. General considerations on clusters and innovation
2. SJIC's experience vs international expectations
3. Cambridge cluster vs EU cluster policy
4. Current 'serendipity' approach based on
 1. Frequent personal contacts
 2. Loose institutional frameworks
5. Room for improvement – Hauser Forum
6. But no grand unifying theory

Elements of Successful Clusters

Professor James F Gibbons, Stanford University:

1. Universities and centres of academic excellence
2. Entrepreneurs with marketable ideas and products
3. Business angels and established seed funds
4. Sources of early stage venture capital
5. Core of successful large companies
6. Quality management teams and talent
7. Supportive infrastructure
8. Affordable space for growing businesses
9. Access to capital markets
10. Attractive living environment and accommodation

Invention Alone is Not Enough

“Among the many **Chinese technological contributions**, one can list paper, movable type, the water wheel, sophisticated clocks and, of course, gunpowder [...]

“But in China, as in Rome, these **inventions strikingly failed to serve as the basis for the growth and spread of industry.**

“[...] most notable [explanation] was **the propensity of government to expropriate and exploit** for its own purposes any inventions that the bureaucracy had not succeeded in suppressing [...] confiscation of the property of wealthy subjects was considered appropriate [...] led **those with resources to avoid investing in any visible capital stocks** [...] substantial impediment to economic expansion.”

William Baumol, *The Free-Market Innovation Machine* (2002), pp 254-5

Invention ≠ Innovation

“What sets Silicon Valley apart are **not the technologies discovered** there, but the companies created in the region that **develop, market, and exploit** these technologies. In other words, the Silicon Valley story is predominantly one of the *development* of technology and its market applications by firms - especially by start-ups.”

Lee et al, The Silicon Valley Edge (2000), p 3

“When Ralph Waldo Emerson reputedly and memorably said that the world would beat a path to the door of a person who made a better mousetrap [...] at least he realised that **the mousetrap had to be made and that it would not be sufficient merely to have an idea**, or even a patent, for a better mousetrap [...] the energy and effort called for to **take the idea of our better mousetrap successfully through to the sales floor** is immense.”

Lord Broers, The Triumph of Technology (2005), pp 43-52

Innovation Needs Entrepreneurs

1. **Co-ordination** of commodity producers and consumers - bringing goods to market
 - *Jean-Baptiste Say (1767-1832)*
2. **Risk-bearing**, committing to buy crops from farmers at given price *without* knowing what customers will pay
 - *Richard Cantillon (1680-1734)*
3. **Uncertainty-bearing**, which unlike risk cannot be insured as a recurring event
 - *Frank Knight (1885-1972) - Chicago School*
4. **Innovator**, not risk-bearer: “Risk always falls on owners, never on entrepreneurs”. Innovators create new industries.
 - *Joseph Schumpeter (1883-1950) - Austrian School*
5. **Arbitrageur**, moving markets to equilibrium, impossible in centralized economies
 - *Friedrich Hayek (1899-1932), Israel Kirzner (b.1930)*

Amar Bhide *The Origin and Evolution of New Businesses* (2000) chapter 1

Entrepreneurs especially important in taking new technology to market

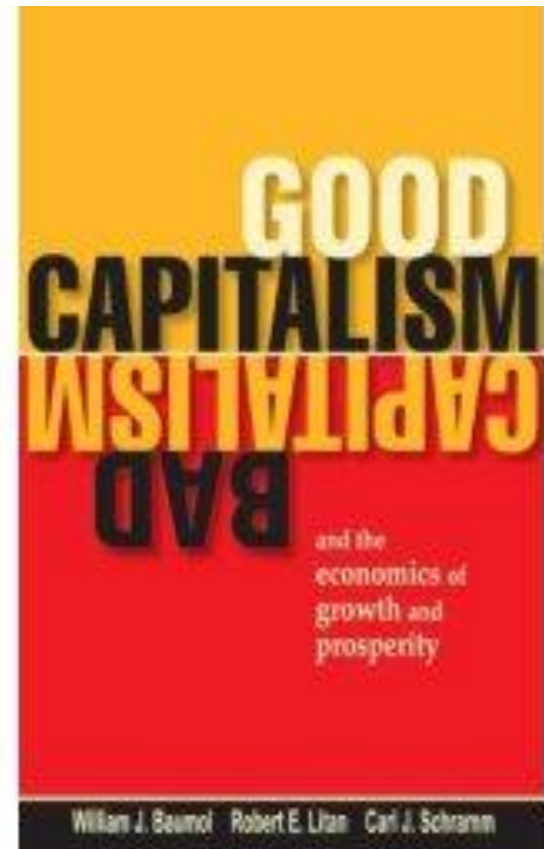
Entrepreneurship & Credit Crunch

Fall of the Berlin Wall 1989:

- Four types of market/capitalism
- 1. **State-guided capitalism:** government supports industries expected to be winners
- 2. **Oligarchic capitalism:** wealth concentrated in small group
- 3. **Big-firm capitalism:** main economic activity carried out by major corporations
- 4. **Entrepreneurial capitalism:** major role for innovative firms

Most economies combine 2 types (and change over time), successful ones combine 3 + 4

Entrepreneurial capitalism has recently been increasingly divorced from capital markets



St John's Innovation Centre – Case Study



Revealing FAQs

- SJIC visited every week by overseas delegations
- Issues raised always the same:
 - Do you only accept University spin-outs?
 - Are all your tenants from St John's College?
 - How many firms do you start up each year?
 - How much equity do you invest?
 - How soon do you send tenants to the Science Park?
 - How do I join the cluster?
- Cambridge model bottom-up, largely unplanned

History & Purpose



Established by St John's College in 1987 to provide flexible accommodation and business support services to early-stage, knowledge-based companies.

St John's Innovation Centre Site



St John's Innovation Park Offers:

1. “Virtual incubator” services
2. Unit-based accommodation for small businesses, on flexible terms
3. Larger-scale accommodation
4. Business support

**A commercial business, with income
paid over to St John's College, University of Cambridge**

Virtual Incubator Services

Star Tenant (Rent-address) service

- Low-cost access to business address, facilities and services with optional telephone number
- Cheap to offer, 'pipeline' of new prospective tenants
- Around 270 virtual 'tenants'
- Meeting/conference rooms at reduced rates



Innovation Centre Accommodation

- 53,000 sq ft of lettable space (= 4,924 m²)
- Units range from 100-3,500 sq ft in size (= 9.3 – 325 m²)
- Tenants can grow by taking on more units
 - or moving to larger ones
- Renewable leases (typically 3 years)
 - with only 1 month's notice of termination for small units,
 - 3 months' notice for large ones
- Rates are negotiated individually
- 'Easy in, easy out' leases

The flexibility of the accommodation is one of the main success factors of the centre

Building Facilities

- 6 small meeting rooms
- 4 conference rooms
- Restaurant
- Catering service for meetings
- Shared reception, postal handling, faxing
- Common room: newspapers, TV
- Telephone system, broadband internet
- Wireless hotspot for visitors
- Hotdesk facilities - new
- Car parking



Hot-desking – New for October 2009



Hot Desk Room: desk, WiFi, printer, coffee

- **Pay by the hour, day or week**




Typical Tenants

- Early-stage companies - researching and developing products
- Older knowledge-based companies - bring some maturity and steady income and may produce spin-out companies
- Service companies - provide support (training, marketing, networking, public relations) 15%
- Average size: 5-10 people
- Around 60 tenants at any time

Programmes for SMEs



Enterprise Advice Services

<p>Achieve More Partnership (European Union Scheme)</p>	
<p>Understanding Finance for Business (EEDA regional programme)</p>	
<p>High-growth Starts Programme (Public-private partnership)</p>	

These are publicly-funded programmes

Achieve More & EIX

- The ultimate aims of the **ACHIEVE MORE** project are:
 - to improve the success rate and accelerate the growth of knowledge-intensive ICT start-ups (KIS-ICT)
- The partnership will realize these goals through:
 - leading-edge incubators
 - using a unique and innovative business support platform the **ENTREPRENEURSHIP & INNOVATION EXCHANGE**, or EIX

AMP - Expected Results

- 400 ICT SMEs assisted to get to global markets and/or acquire the right finance for growth
- 50 Business incubators fast-tracking better practice sharing
- 15 ICT Clusters exploring evolving development models, outreach and cross regional working
- Development of new experimental financing models for early stage KIS
- Regular major policy recommendations for the development of ICT KIS sector

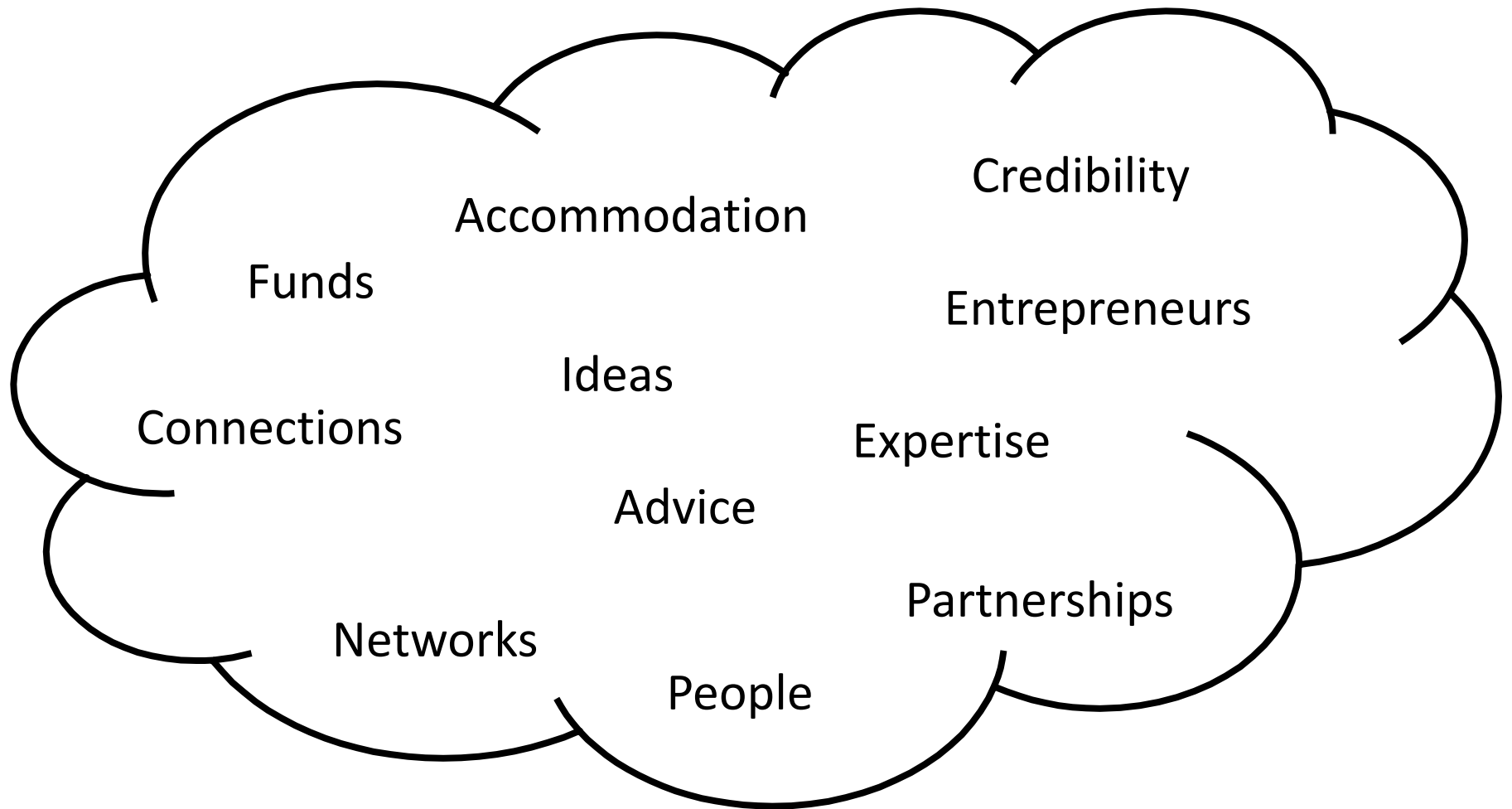
Understanding Finance for Business

- Three-year programme, EEDA-sponsored
- Workshop 1, half-day general overview across Eastern region
 - 500 companies each year
 - Diagnostic B at end of day: were all your questions answered?
 - If not: specialist full-day workshops available later
- Workshop 2: full day on grants or equity or operational finance
 - Need to prepare starter business plan (not grants)
 - 250 companies per year
- Stage 3: Mentoring/coaching for 75 firms per year
- Help also available from Business Link advisers and local partners
- Help firms prepare to raise finance, not to raise it for them

High-Growth Programme

- Free support to high-growth Cambridge companies
 - Can the business develop beyond the owner-managers?
 - Is it likely to need and justify external funding?
 - 0.5 to 1.0 days per company
- Help writing or reviewing a business plan
- Strategy development
- Intellectual property issues
- General business advice
- 175 companies per year
- 75 job creation/preservation targets

The Elements of Incubation at SJIC



Lessons from SJIC & Cambridge



Orthodoxy?

“Constructive chaos – there is no one group that ‘organises’ Cambridge. New initiatives are continuously springing up – some succeed and some fail. This may be perceived as inefficient, but does result in a highly entrepreneurial environment.”

Cambridge Technopole Report (2008), p5

- This message is dispensed every week to visiting Ministries of Science/Education (China, Brazil, France, Denmark, India)
- But what if the Continental model is better, as with the trains?
- Top down *versus* bottom up is a false dichotomy

The Basic Problem

“It is incumbent on Massachusetts [...] to do a much better job of technology auditing and forecasting. We need to collaborate more effectively and develop a technology road map that looks five or ten years down the line [...] **we run the risk of turning into Cambridge, England: we’ll have isolated clusters of the very best university research and a small number of R&D firms but not downstream production, service and support jobs that make a vibrant economy.** We’ll create all the new ideas - but others will get too much of the benefit.”

Prof Michael Best, UMass Lowell Center for Industrial Competitiveness (2004)

Example: European Cluster Policy

- SJIC engaged in EU incubator/cluster project
 - Difficulty in identifying ‘cluster manager’
 - No formal joining up of institutions, universities
- 2008 EU Cluster Survey:
 - East of England is education (healthcare) cluster
 - Data based on Ipswich, no Cambridge cluster?
- **To much of the outside world, we do not exist**

“The Cluster Mapping database is built in the intersection of regions and sectors in Europe. By combining the two dimensions of geography and industry we can statistically trace regional agglomerations of employment, defined as statistical regional clusters, across Europe.”

www.clusterobservatory.eu/index.php?id=44&nid=

Working Hypothesis for Status Quo

- Many University-Business interactions ‘unplanned’:
 - do not follow neat sequential patterns
- But serendipity is helped by:
 - frequent personal contacts at influencer level
 - loose institutional frameworks
- Proximity is as important as policy
- Room for improvement:
 - Too many competing ‘co-ordination’ organisations
 - Activity not action, outputs not outcomes
 - No ‘front door’, dealing with universities *insider game*

Meeting the Challenge: Hauser Forum



DATE: 10.07.2015
PROJECT: UNIVERSITY OF CAMBRIDGE EAST FORUM
SCALE: 1:500
DRAWN BY: J. WILKINSON
CHECKED BY: J. WILKINSON

STAGE: 02
VIEW: NORTH PERSPECTIVE VIEW
The information contained in this drawing is for informational purposes only and is not intended to be used for construction. It is subject to change without notice. The information contained in this drawing is for informational purposes only and is not intended to be used for construction. It is subject to change without notice.

UNIVERSITY OF CAMBRIDGE
East Forum
10.07.2015
NORTH PERSPECTIVE VIEW
WikinsonEyre Architects
10.07.2015
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Hauser Forum: Basic Facts

- £8m donation from Dr Hermann Hauser CBE
- £2m grant from EEDA, capital revenue swap
- Based on West Cambridge site
 - Gates Computer Lab, Cavendish, IfM...
- HQ for Cambridge Enterprise, pre-incubator
- Major seminar and lecture spaces; open café
- Co-location with commercial Broers Building
- Vision of 'open innovation' leading player
- Doors open January 2010, 5 year funding

Emergence of the Hauser Forum

Unmet needs caused by lack of:

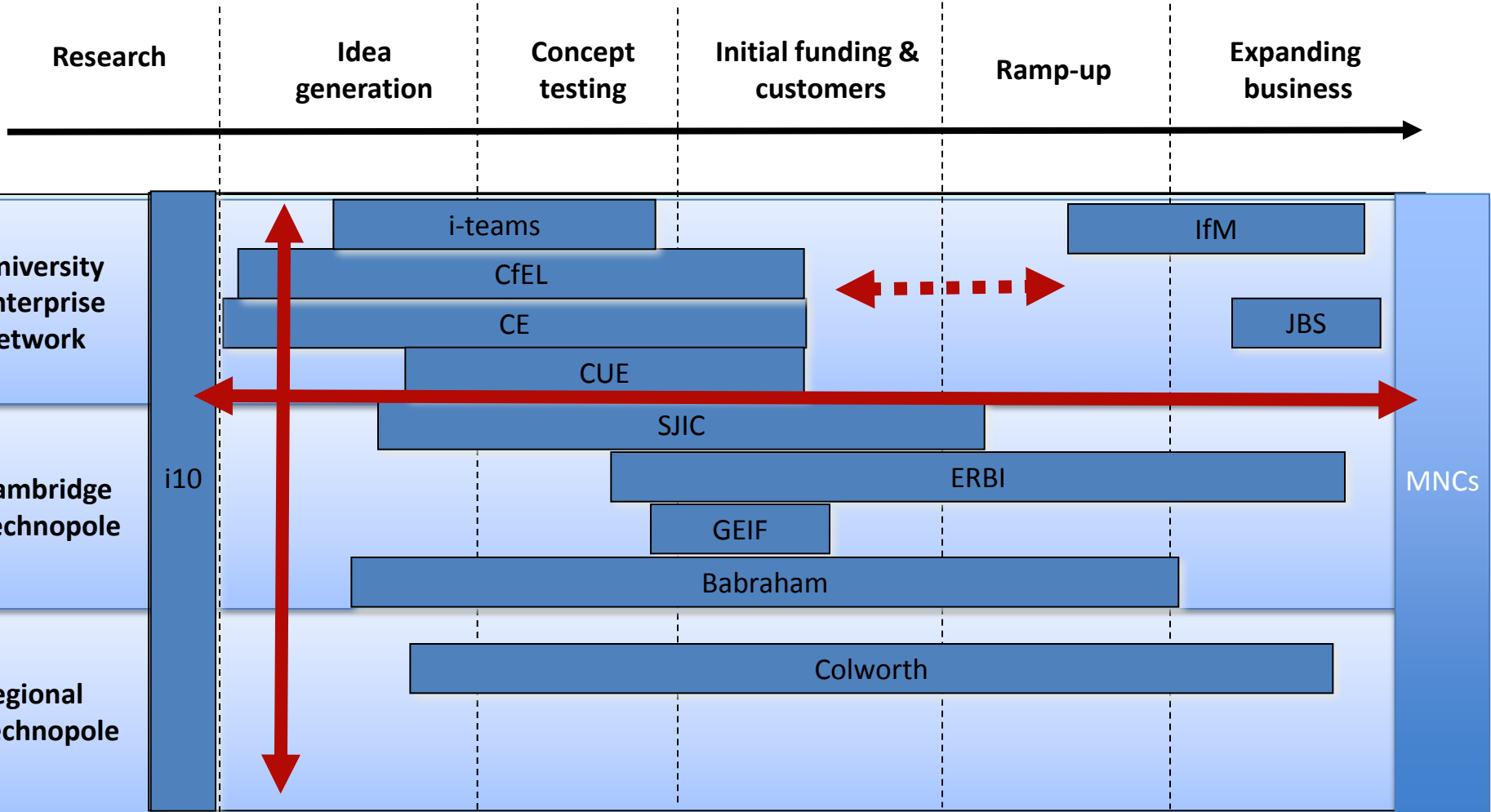
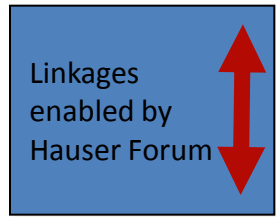
1. **Integration of activities** to support technology-based innovation and entrepreneurship within Technopole
2. **Systematised access** to University resources
3. **Early stage, at cost space** for University-related start-ups and spin-outs
4. **Facilities supporting interaction** between small and large firms

Hauser Forum and Current Gaps

- Building as **'town hall'** for entrepreneurship & innovation
 - Open access to many areas and events by general public
 - 'The Street' for both planned and spontaneous activity
 - Move *from* people as main connection (insider game, 'who you know') ...
 - *To* location, procedures and processes (inclusivity, open access)
 - Opportunity for spontaneous networking as well as organised programs
- Coordinate **'traffic'** into and out of Technopole
 - For non-university entities seeking to access CU scientific, technical, managerial and entrepreneurial expertise
 - For CU institutions promoting business opportunities
 - For all in CU seeking signposting to Cambridge-based entrepreneurship and innovation activities

Integration

- University Enterprise Network
- Cambridge Technopole Group
- Regional Technopole Group



Illustrative examples only

Functionality vs Elegance

“There is not, and never will be, an economic theory of everything. Physics may, or may not, be different. But the knowledge we can hope to have in economics is piecemeal and provisional, and different theories will illuminate different but particular situations.

“We should observe empirical regularities and – as in other applied subjects such as medicine and engineering – we will often find pragmatic solutions that work even though our understanding of why they work is incomplete.”

John Kay - FINANCIAL TIMES 22/04/09

Questions



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