# Innovation Benchmarking Survey: New Findings on University Industry Relations and a UK Cambridge Policy Perspective

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## UK Innovation: Causes for Concern

- Low and declining Business R&D by international standards
- Alleged absence of an entrepreneurial culture in universities
- Overemphasis on links with large as opposed to small firms
- Major regional disparity in innovation inputs and high tech activity




## Solutions?

- Emphasise Developments in 'High Tech' Producing Sectors
- Emphasise Importance of Entrepreneurial Spin Outs from University Science Base
- Emphasise regional initiatives and integration of universities into regional innovation strategies
- Based on 'lessons' from the USA

# Key Questions

- What weight should be placed on high-tech *producing* sectors compared with high tech *users* e.g. retail or financial services?
- What weight should be placed on spin outs and university commercialization and small firm R&D compared to innovation and productivity performance in existing firms?
- Small Firms, Large Firms, or Systems as the targets of policy?
- Can we identify good models for regional cluster policies based around university industry links?




# Complementary Approach to LIS Industry-Case Based Research

- Analysis of Key Sectors for Productivity Growth using experience of USA
- Analyse Significance of Start Ups versus peformance change in Existing Firms for productivity growth
- Analyse Diversity of University Industry Links using Unique Large Scale Firm Survey Data for UK and USA

# US Productivity Growth

- Analyses by Nobel Laureate Robert Solow of MIT and McKinsey
- US growth of real GDP per hour
  - 1947-1972 2.9%
  - 1972-1995 1.4%
  - 1995-2000 2.5%
  - 2000-2003 2.6%
- A return to trend?
- Turn round concentrated in 8 year period?

*(www.cmi.cam.ac.uk/ncn/summit-2001-videos/solow/text.html, Farrell Baily and Rennes 'US Productivity after the Dot Com Bust' McKinsey and Company December 2005)*




# 1995-2000

- 1995-2000 v.1987-1995
  - 6 of 59 industries account for ALL of the acceleration in productivity growth
  - Net contribution of other 56 was zero
  - Top three
  - *wholesaling*
  - *retailing*
  - *security and commodity broking*

# The Second Three

- Electronic and electric equipment (semi-conductors)
- Industrial machinery and equipment (computers)
- Telecomms
- Total contribution was one third of top three




# 2000-2003

- 7 sectors account for 85% of ALL of the productivity growth 2000-2003
- Top Four
  - *Retailing*
  - *Finance and Insurance*
  - *Computer and electronic products*
  - *Wholesaling*
- Next 3
  - Admin and Support Services, Real Estate, Miscellaneous Professional and Scientific Services

## Services productivity growth and the performance differential

- Difference in *services* productivity growth accounts for most of the difference in national productivity performance between the USA the UK and Europe in the past decade
- Massive impact of investment in IT in *using* sectors
- Creation of new business models of service delivery




## Policy Implications for Local Innovation Systems

- Focus on High Tech Producing Sectors too restricted
- 'Catching up' in services complex, requires major organisational change at firm level, closer links between services high tech producing sectors and the science base

## Entrepreneurship, New Entry and Productivity Growth

- Productivity Growth
  - Productivity growth within firms
  - Reallocation of output between high and low productivity firms and impact of entry and exit
- Components vary across countries and industries




## Labour Productivity Growth Components in EU and OECD

- The dominant component in lab prod. growth is within-firms growth (e.g. >55-95% in eighties/nineties)
- Net effect of entry and exit accounts for 20%-40% of lab prod. growth
- Net effect is dominated by exit of low labour productivity firms
- Only 30-50% new entrants survive for 5 years
- US new entry component is large and *negative* and survival rate is lower *BUT survivors grow faster*

Source OECD *The Sources of Economic Growth in the OECD* Paris 2003

## New Entry 'entrepreneurial' Effects

- Entry effects bigger
  - Longer time periods (learning and output growth)
  - Information and communication technology sectors (rapid technical change and opportunities)
- It is not new entry per se but subsequent survival and growth that matters
- Very small proportion grow substantially




## Local Innovation System Policy Implications

- Sector specific policies to allow for different competitive dynamics
- Address barriers to growth not just start up
- Look at small and large firms as part of a system that must be integrated to work effectively
- Design policies to make the 'system' work

# Using New Survey Data on multi-faceted role of universities

**Educating People**
- Training skilled undergraduates, graduates & postdocs

**Increasing the stock of 'codified' useful knowledge**
- Publications
- Patents
- Prototypes

**Providing public space**
- Forming/accessing networks and stimulating social interaction
- Influencing the direction of search processes among users and suppliers of technology and fundamental researchers
  - Meetings and conferences
  - Hosting standard-setting forums
  - Entrepreneurship centers
  - Alumni networks
  - Personnel exchanges (internships, faculty exchanges, etc.)
  - Visiting committees
  - Curriculum development committees

**Problem-solving**
- Contract research
- Cooperative research with industry
- Technology licensing
- Faculty consulting
- Providing access to specialized instrumentation and equipment
- Incubation services




# CBR/IPC Target Sample Sizes

- 4000 companies drawn equally from UK and USA
- 60% from manufacturing and 40% from business services
- 75% companies with 10-499 employees and 25% large companies
- 25% from hi-tech sectors and 75% from conventional
- Have very recently achieved a sample of 3500 companies, 2000 from the UK and 1500 from USA
- Preliminary findings at this stage.

# CBR/IPC Survey Questions

- General Characteristics
  - When and how formed, who is running the company and with what business objectives.
- Innovation and New Technology
  - Innovation input and output measures, sources of knowledge, collaboration, innovation expenditures, barriers to innovation, the role of universities.
- Principal Products and Competition
  - Competition and competitive advantage, business constraints, customer base, geographic orientation.
- Finance and Capital Expenditure
  - Accounting information, capex and funding sources.




# Matched Sample of SMEs

- Matched pairs of companies drawn equally from UK and USA samples – 1900 companies in total each with fewer than 500 employees
- Matched by size and sector and by age of the business
- Focus today is on the answers to the questions relating to business-university links.

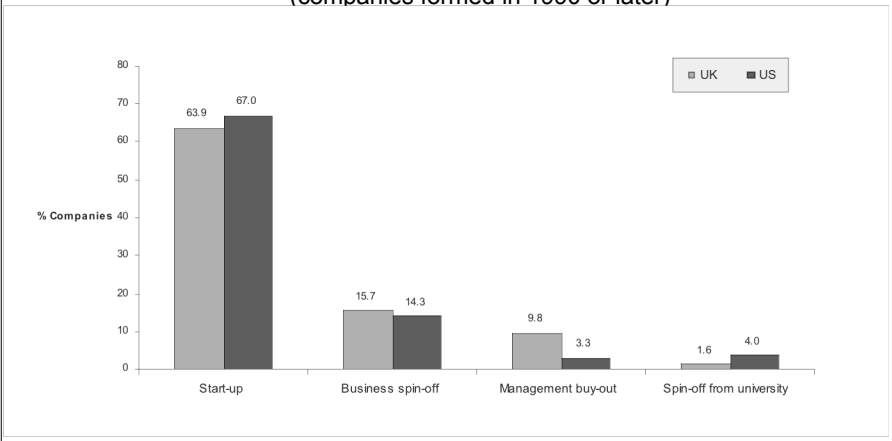
# Business Formation

- Over time wholly new business start-ups becoming proportionately less significant in both UK and US as new types of business formation develop.
- Wholly new start-ups still represent about two-thirds of new business formation in each country.
- Management buy-outs are more common in the UK.
- Business spin-offs do not differ in their relative importance between the two countries.
- University spin-offs are more than twice as frequent in the US, but still represent a small fraction of business births.




# Method of Business Formation

(companies formed in 1990 or later)



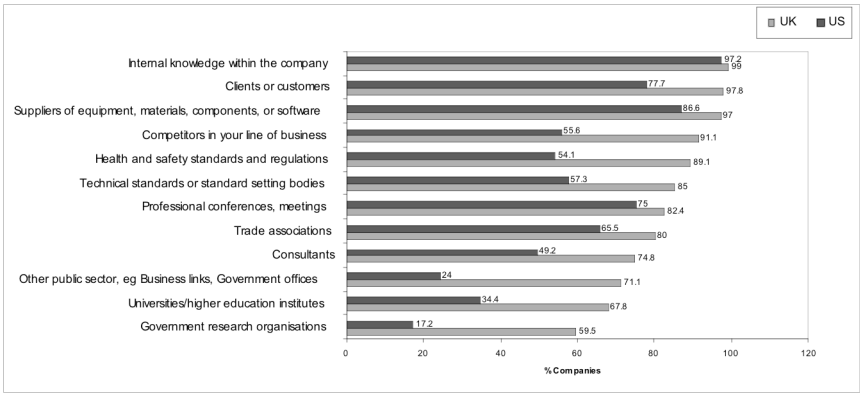
# Sources of Knowledge

- Companies who had introduced any form of innovation within the previous 3 years were asked about their sources of knowledge or information.
- A higher proportion of UK companies claimed to have used all sources than did the US companies.
- In particular about two-thirds of UK companies, but only one-third of US companies used universities/HEIs.
- On the other hand US users of information regarded the information as more important in most cases, especially the public sector sources.
- About 10% of companies in both countries regarded universities/HEIs as important sources.



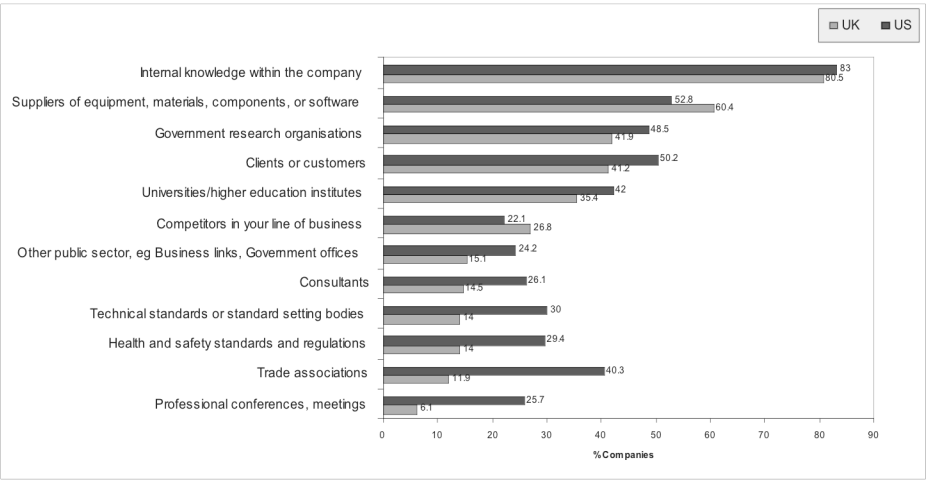

# Use of Sources of Knowledge

(% of companies)



# High Importance of Sources of Knowledge

(% of users of that source)



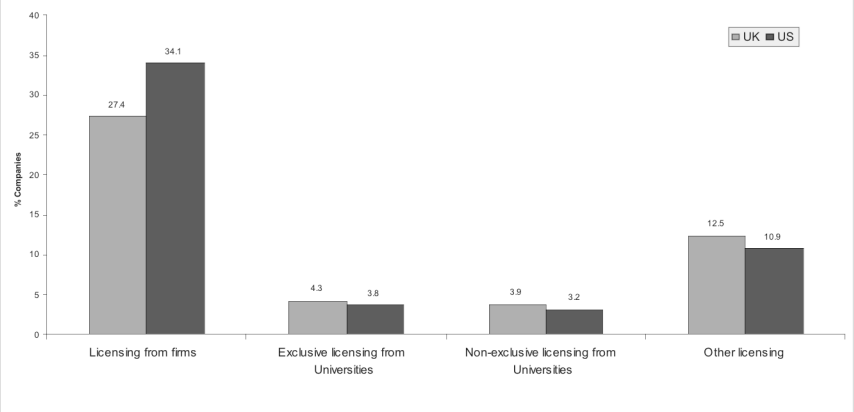




# Technology Acquisition

- Licensing from other firms is more prevalent amongst the US companies, but other licensing activity does not differ much.
- About 6% of companies in each country engage in licensing activities with universities, with the number of licences held ranging from one to sixty.
- UK companies appear to be more likely to use university based consultants to help them acquire new technologies than is the case in the US sample.
- No evidence from this preliminary analysis of a lack of engagement by the UK university sector.

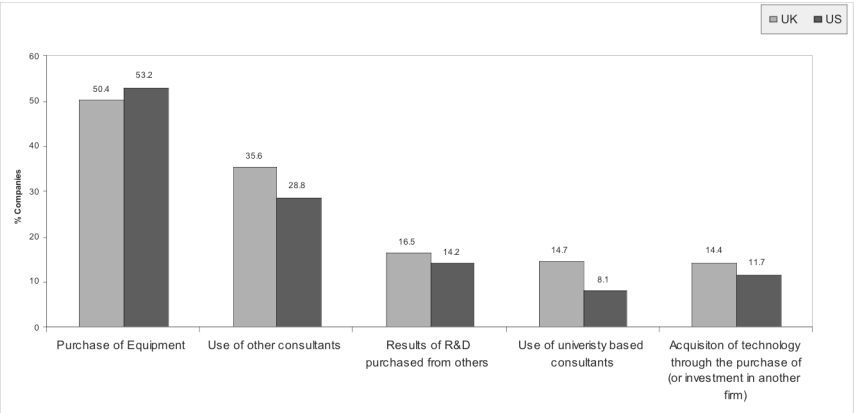
# Licensing and Technology Acquisition
(% of companies)







# Forms of Technology Acquisition
(% of companies)



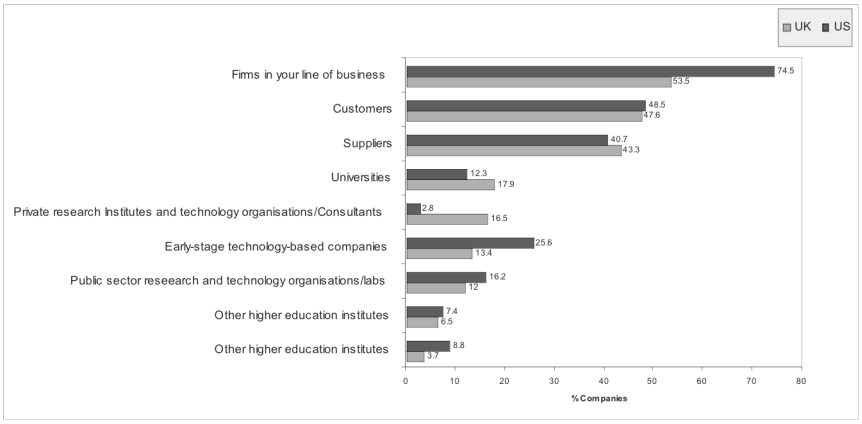
# Collaborative Activity

- Companies in each country are equally likely to collaborate with another firm or organisation.
- A significantly higher proportion of the UK sample collaborate with universities.
- US companies more likely to collaborate with early-stage technology-based companies and with private research institutes and consultants.
- About half of our sample companies in each country collaborate with customers and with suppliers.




# Collaborative Activity

(% companies)



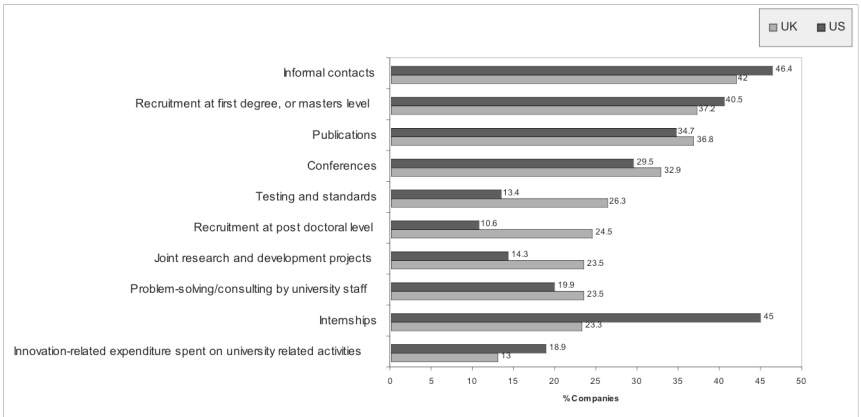
# The Contribution of Universities

- Companies are involved with universities across a range of activities.
- Recruitment of staff at post-doctoral level is more prevalent amongst the UK sample.
- A higher proportion of US companies make more use of internships.
- A higher proportion of US companies spend some of their innovation expenditure on university-related activities.
- A higher proportion of UK companies on the other hand are involved in joint R&D projects with universities.
- US companies value the contribution of universities more highly, particularly in relation to recruitment.



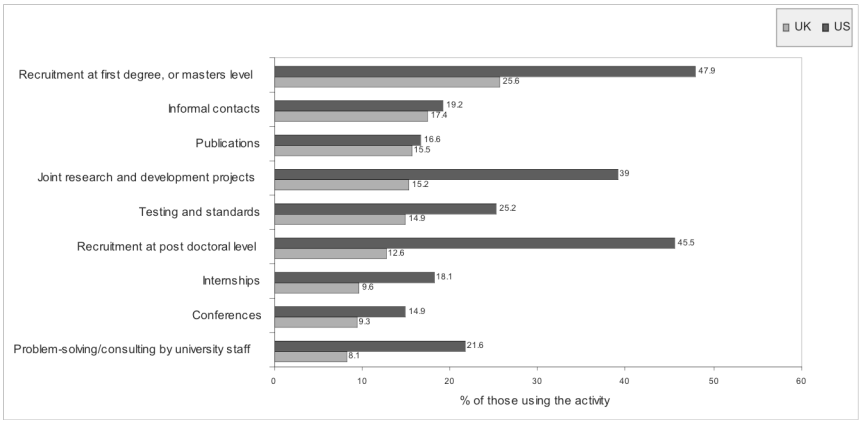

# Contribution of Universities

(% of companies involved)



# High importance of university contribution

(% of those who used the activity)

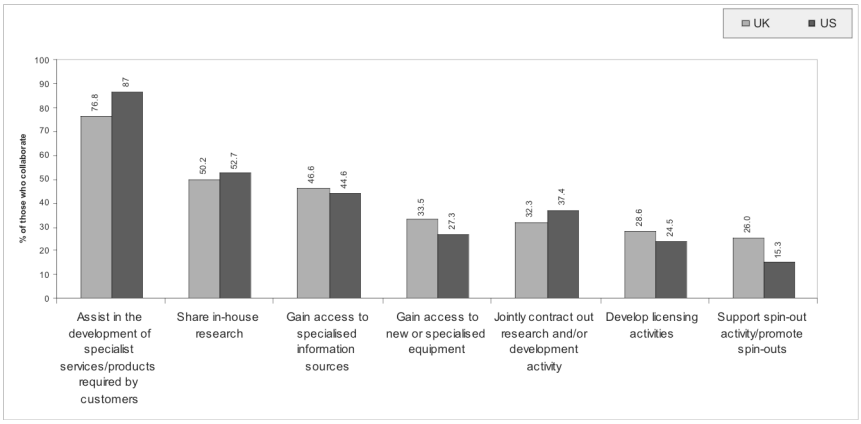






# Purpose of collaboration

(% of those who collaborate)



# Reasons for Collaboration

- Each of the reasons for collaboration was selected by between a quarter and three-quarters of those who collaborated in each country.
- The rankings within each country was very similar and the top three reasons were the same, but the US exhibits higher proportions in general.
- A higher proportion of those who collaborated with universities/HEIs selected each of the reasons, except for the joint purchase of materials or inputs.
- Collaboration with universities is multi-faceted with the development of specialised products/services and sharing in-house research most important.




# Implications for LIS policy

- Keep University role in context
  - Importance of other sources of technology
- Multi-dimensional nature of University contributions
- Relative importance of 'conventional' university outputs
  - Graduates, publications, consultancy
- Relative quantitative unimportance of spin offs from university

# Overall Conclusions

- A one-size-fits-all economic development strategy for universities is not appropriate.
  - All universities are not the same
  - High tech use as important as high tech production
  - Pay attention to services
- University economic development strategies should also be aligned with the particular development/innovation pathways of the industries in the region.
  - These change over time, differ across sectors
  - Hi tech spin-off activity is one part of a wider set of possible interactions
- It's a long game