LLAKES
CENTRE FOR LEARNING AND LIFE CHANCES IN KNOWLEDGE ECONOMIES AND SOCIETIES

Leading education and social research
Institute of Education
University of London

University Incubators and Knowledge Mediation Strategies: Policy and Practice in Creating Competitive City-Regions

Susan L. Robertson and Fumi Kitagawa

LLAKES Research Paper 28

Centre for Learning and Life Chances in Knowledge Economies and Societies

LLAKES is an ESRC-funded Research Centre - grant reference RES-594-28-0001.

To request printed copies of this paper or other LLAKES Research Papers,
please contact the LLAKES Centre - llakescentre@ioe.ac.uk.

To view this and other LLAKES Research Papers online, please visit www.llakes.org.uk.

ISSN 2042-5929

University Incubators and Knowledge Mediation Strategies: Policy and Practice in Creating Competitive City-Regions

Susan L. Robertson and Fumi Kitagawa

LLAKES, University of Bristol

Acknowledgements

We would like to thank the interviewees who were so generous with their time. Their knowledge, insights and feedback have been critical in conducting this work. Any remaining errors are solely the responsibility of the authors.

Contents

Abstract

Despite the growing significance attached to knowledge production, innovation, commercialisation, and 'third stream' knowledge exchange activities between universities and business, we know little about how, under what conditions and with what consequences, intermediary organisations—like university incubators and their managers—strategically manage their knowledge 'brokerage' (Meyer, 2010) or 'mediation' (Osborne, 2004) roles so as to promote the flow of ideas across university-business boundaries. To investigate these processes, we examine four hi-tech incubators, established in 2002, making up the SETsquared Partnership between four universities (Universities of Bath, Bristol, Southampton and Surrey) in Southern England. These university incubators act as 'boundary spanners', hoping to create new linkages and opportunities for sharing and learning between the university and the economy of the wider city-region. This paper reports on the aims, scope and outcomes of these incubators, focusing particularly on the knowledge mediation strategies of the Incubator Directors. We show how each SETsquared partner university has developed its own unique incubation centre and repertoire of knowledge mediation strategies; the result of wider institutional arrangements and mechanisms, on the one hand, and internal incentives and interests/capabilities of the key personnel, on the other. We identify a range of knowledge mediation strategies deployed by the incubator Directors as they enact the incubation process, such as trend spotting, talent spotting, ideas spotting and resource spotting.

1. Introduction

Over the past two decades, universities have been urged to become more accountable to the wider public and to contribute directly to local, regional and national economic development through taking on a range of 'third stream' activities. Such activities include the incubation of start-up firms, the commercialisation of knowledge, the development of knowledge transfer partnerships, and the delivery of entrepreneurship courses. This 'third mission' for the university now sits alongside its other two core functions – teaching and research. Developments of this kind within the sector have spawned a range of terms to describe the transformation of the idea of a university; the 'entrepreneurial university' (Clark, 1998; 2001; Etzkowitz, 2003); the 'service university' (Cummings, 1998); the 'enterprise university' (Marginson and Considine, 2000); and 'academic capitalism' (Slaughter and Rhoades, 2004).

Whilst universities have historically been involved with industry in a variety of ways (for instance, in areas such as agriculture, military activity, ship building, mining) (Lawton Smith, 2007: 98), it was not until the 1980s that an entrepreneurial role for universities became increasingly part of mainstream policy and practice (cf. Hannon and Chaplin, 2003; Feldman, and Desrochers, 2003; Slaughter and Rhoades, 2004; Kenny and Goe, 2004; Waters and Lawton Smith, 2002; Lawton Smith, 2007). Taking note of early developments in the United States of America, particularly as a consequence of BayhDole Act in 1980,[1] governments in a range of countries, including the United Kingdom (UK), Australia, Sweden, Germany, Italy and Japan, have all introduced policy measures to encourage such activities (Nedeva, 2008). Activities that many universities now engage in, and which constitute 'third stream' or 'third sector' include patents, such as pharmaceutical products, the trademarking of business ideas, spin-out firms that might involve investments from the university and the business sector and so on. These activities, however, are often viewed by academics as peripheral to the central task of teaching and research.

1 The Bayh–Dole Act, or University and Small Business Patent Procedures Act, is a section of USA legislation adopted in 1980 dealing with intellectual property arising from federally-funded research. Among other things, it gave U.S. universities, small businesses and non-profits intellectual property control of their inventions and other intellectual property that resulted from such funding.

In the UK, the government approached this newer mission for universities by promoting the idea of 'usefulness' (e.g. Lambert Review of Business–University Collaboration, 2003), supported by sizeable funding streams for universities (Lawton Smith, 2007; Waters and Lawton Smith, 2002) aimed at building competitive, 'knowledge-based' economies (cf. DTI, 1998). The UK government has also argued that universities could raise the innovative performance of industry, as well as to significantly contribute to city-regional development. In relation to the latter case, this view was encouraged by evidence suggesting proximity of firms to universities was critical for the transfer of knowledge between them (Saxenian, 2006; Goddard and Chatterton, 2003; Lawton Smith, 2007). As a result, over the past decade there has been a shift in government policy, from one focused upon research excellence and its dissemination amongst the academic community, to one which now includes a range of knowledge-transfer activities with the wider business community, and other stakeholders. In its 2009 policy framework, *Higher Ambitions: the Future of Universities in a Knowledge Economy,* universities were represented as "…the most important mechanism we have for generating and preserving, disseminating and transforming knowledge into wider social and economic benefits" (BIS, 2009a: 7). It is within this context that governments have been interested in supporting and realising high-tech innovation through university spin-off companies and hi-technology incubators (Wright *et al*, 2006).

Despite the growing significance attached to these developments, we know little about how these intermediary organisations strategically manage knowledge 'brokerage' (Meyer, 2010) and 'mediation' (Osborne, 2004) processes to ensure the flow of knowledge across the boundaries of different worlds. To investigate these processes, we examine four hi-tech incubators, established in 2002, making up the *SETsquared Business Acceleration Partnership* between four universities (Universities of Bath, Bristol, Southampton and Surrey) in Southern England. These university incubators act as 'boundary spanners' aimed at creating linkages and new opportunities for firm development as well as mutual learning between the university and the economy of the city-region. We are particularly interested in the role of the incubator Directors, because as Hannon and Chaplin note, "the provision of bricks and mortar alone may not be sufficient for effective policy implementation" (2003: 862). Rather, an understanding of the "…underlying *processes of incubation* may be far more critical

to achieving accelerated firm growth" (ibid; emphasis added). Therefore this paper asks:

- What are the institutional arrangements and mechanisms that shape the university-incubator-industry relation (including spatial location)?
- How are the 'boundary spanning' activities organised through the incubator space?
- In what ways, and with what outcomes, does expertise (capabilities) and available networks influence the relationships that are constructed across the interface?
- How do key incubator managers work with the incentive structures within and beyond the incubator (industry-university) in ways that enable knowledge flows?

A mixed methodology for data collection and analysis was deployed. We drew upon policy documents, briefing papers, newsletters, curriculum vita and extensive interview data collected across the four SETsquared partners – Bath, Bristol, Southampton and Surrey – as well as secondary literature. The main data collection was carried out between July 2009 and February 2010. The Directors in each of the four sites were interviewed using a semi-structured interview schedule around a set of common questions; we also interviewed key individuals in the technology transfer offices within the universities to build up a more complex picture of the overall shift within universities toward third stream activity over the period 2000-2009.

The paper begins by briefly elaborating the core conceptual concepts we use to understand the relationship between the wider structural and policy context and the possibilities for new knowledge mediation practices of strategic actors to emerge: (i) 'opportunity structures' (cf. Kitschelt, 1986; Tarrow, 1996; Dosi, 1997); (ii) 'boundary spanning' activity (Youtie and Shapira, 2008); and (iii) knowledge, learning and innovation (Lam, 2000) and 'knowledge mediation' (Osborne, 2004). Key to our argument is that it is important to locate knowledge mediation strategies within wider structural, cultural and political contexts. To this end we examine changes in the national policy context for universities in the UK as an 'opportunity structure' enabling the emergence of a range of third stream activity in universities, such as business incubators. The second half of the paper draws upon empirical evidence to explore the boundary spanning activity of SETsquared Partnership

incubators, and the knowledge brokerage and mediation practices of the incubator Directors, as they negotiate and give substance to third stream policy and practice.

2. Opportunity Structures, Boundary-Spanning, Knowledge Brokerage and Mediation

The concept of 'opportunity structures' can be found in the wider social science and economic development literature. Its more extensive use has been as a way of understanding the relationship between the wider political environment and the emergence of social movements (cf. Eisinger, 1973; Kitschelt, 1986: 58; Tarrow, 1996; Meyer and Staggenborg, 1996).[2] We found Kitschelt's elaboration particularly helpful; as specific configurations of resources, institutional arrangements and historical precedents for particular actions which in turn facilitate and privilege some groups' activities over another. Kitschelt shows that variations occur between groups over time, and across space; the result of the particular configurations of opportunity structures at work. Dosi (1997: 1532) also uses 'opportunity structures' to understand the relationship between technology and social change. He distinguishes between four inter-related elements:

- changes in *opportunities* – that is, the sources of change giving rise to this domain;
- the *incentives* to exploit these opportunities;
- the *capabilities* of the agents to achieve whatever they try to do; and
- the *institutional arrangements and mechanisms* through which such changes are implemented.

At the heart of Dosi's agenda is a conceptual approach that "…relax[es] the commitment to equilibrium, rationality and inter-agent homogeneity"; all difficult to sustain, he argues, in the face of current empirical evidence. These different elements illustrate how their combinations in space and time are often highly contingent; they are shaped by the different histories of the institutions, the affordances of the policy settings, and the capabilities of agents as they interact with these particular elements.

[2] Early versions of opportunity structures (Eisinger, 1973) were used to explain why social events, in this case riots, were more likely to happen in some US cities than in others; the result of differences in governmental structures. Tilly (1978), however, used the idea of political opportunity structures to show how states can repress or facilitate collective action by altering the relative costs of collective actions. Since then, the idea of policy regimes as opportunity structures has helped to explain the way in which some agents are able to advance their interests whilst others are not.

This more contextualised approach is resonant of Lam's (2000) work on knowledge, learning and innovation. As she notes, it is helpful to separate out the different dimensions of knowledge as 'tacit' or 'explicit', 'individual' or 'collective' – and how these are encoded or embedded in organisational and societal institutions.

In taking a wider view of knowledge, technology and innovation, as particular kinds of social practices, we draw upon Kitschelt, Dosi and Lam's work to examine university incubators; as particular configurations of institutional arrangements and resources. Specified in more detail, *innovative opportunities* are interpreted as essentially 'opportunity structures' for certain political, economic and cultural, as well as sectoral projects, policies and programmes. For instance, higher education policy, and its funding streams in the UK, have emphasised economic competitiveness and wider societal roles of universities. This new configuration of policies provides *possibilities* for new actors and initiatives to emerge with the potential to destabilise existing social practices, relations and boundaries.

The *incentives* to exploit (or ignore) opportunities refers to the incentive structures within the incubator itself, and the interdependent spaces that the incubator must interact with, such as the different departments within the university, the wider university culture, or the wider business environment. In terms of the 'incubator space' incentives might include the nature of the space that is allocated, the availability of mentoring, the costs of rent, access to university resources, access to networks, and so on. Similarly, the incentive structures in industry as they relate to university incubators might include talent and business venture scouting, professional socialisation (supporting these initiatives is part of professional practice), or access to resources through professional and industry networks.

The *capability* of agents refers to the specific knowledge and skills of the key incubator personnel – such as the Director – who determines the shape, pace of work and kind of personnel involved in the incubator programme. Here we draw on work on 'knowledge mediators' and knowledge brokerage (Osborne, 2004; Meyer, 2010). Meyer (2010: 118-19) describes a 'knowledge broker' as a person or organisation whose job it is to facilitate the creation, sharing, and use of knowledge. Osborne argues this is a two way process; one where the university "becomes more worldly"

and the "world becomes more like a university" as expertise is offered and knowledge brokered (Osborne, 2004: 432). Osborne contrasts a 'leverage' with a 'brokerage' model of expertise, arguing that in the leveraged model the expert seeks to gain a hearing through constructing a sphere of influence for ideas, whilst in the brokerage model the expert seeks to align the interests and concerns of different constituencies.

Finally, *institutional arrangements and mechanisms* refer to particular sets of structures and processes that, in turn, define the purpose of the incubator *and* its relationship between the university and the wider city-regional economy. Here the idea of 'boundary spanning' is used to capture the specific nature of the institutional arrangements and mechanisms which are constitutive of the incubators we are concerned with. Boundary spanning activity is intended to generate organisational change on one, or both, sides of the boundary, to enable a new kind of organisational form to emerge and flourish as a result of the synergies drawn from encounters with these two cultures. Boundary spanning actors may be person, unit, or organisation-based, whilst boundary-spanning activity may be either 'formal' or 'informal'; 'regulatory' or 'process-based'.

3. 'Third Stream' Policy as Opportunity Structure

In the UK, the importance for universities of generating commercial income was brought to the fore in the 1990s. Between 1989 and 1997 the proportion of public funding into universities significantly declined. This led to institutions having to generate more income from non-governmental sources in what came to be known as **'**third stream' funding (in addition to the primary sources for teaching and research), and to policy initiatives from the Government and funding councils to support such strategies (Shattock, 2003).

By the late 1990s in England the Higher Education Funding Council for England (HEFCE) introduced a new 'third stream' of funding to reward and to encourage universities to be more proactive in their outreach activity. Originally named the 'Higher Education Reach out to Business and Community Fund (HEROBC), this was

superseded in 2002 by a funding stream entitled 'Higher Education Innovation Fund' (HEIF). HEIF integrated several other schemes such as the 'Science Enterprise Challenge' and 'University Challenge Fund' launched by the government to improve the transfer of science and technology activity from the nation's research and knowledge base, in part through business incubators. HEFCE provided almost £800 million in constant 2008 prices over the period 2000/1 to 2007/8 to higher education institutions (HEIs) to support the building of the capacity and capability required to engage more effectively with the economy and society (PACEC/CBR, 2009: 38).

In 2002 the *Investing in Innovation* Strategy (DTI, HM Treasury and DfEE, 2002) highlighted issues surrounding the long-term sustainability of university research. It focused on the need to encourage greater collaboration between universities and the business sector through increased investment in knowledge transfer activities particularly through the expansion of HEIF. In December 2003 the Lambert Report noted that while there had been "a marked change of culture" (p. 3) among universities towards greater collaboration with business, and that government funding for knowledge transfer activities had been important in this change, the report also pointed out the lack of demand from the private sector for those knowledges and skills in universities. In October 2007, following a review of British science and innovation policy, Lord Sainsbury (2007) made a series of recommendations on universities, innovation and commercialization, including continued attention to supply-side factors, such as funding support and improvement in the teaching of science, technology, engineering; and demand-side factors such as procurement and regulation.

After a decade of national policy initiatives aimed at UK universities, significant changes have begun to take place with regard to third stream activity. Reports show some universities and departments are more actively engaged with businesses, and there are more incentives to engage with businesses (HEFCE, 2009a; PACEC, 2008; Galsworthy and Knee, 2007; PACEC/CBR, 2009; Abreu *et al*, 2009). HEIF funding has clearly played an important role in this (Galsworthy and Knee, 2007). The number of staff funded by HEIF and dedicated to third stream activity has also steadily increased, and financial income related to third stream activity has grown. However, measurement of third stream activity is a complicated issue (e.g. Molas-Gallart *et al*,

2002). Many of the output measures are recorded through HEFCE HE-BCI data. Studies also note increases in the occurrence of "enterprise training for staff and students" and "economic development and regeneration activities" (Galsworthy and Knee, 2007). The Wellings' Report on *Intellectual Property and Research Benefits* (2008) also notes incentives in place for staff in relation to IP matters, and recommends incentives linked to promotion and career development to encourage active participation.[3] It is acknowledged many universities are now playing a broader role in the regional and national economy by building bridge between businesses and universities and working with RDAs to support economic development in their regions. Furthermore, universities are asked to work more collaboratively with business in the design of the curriculum, the placement of graduate in local businesses and on knowledge and technology exchange (CIHE, 2008; CBI, 2008; CBI, 2009; BIS, 2009b; 2009c).

This wider policy environment can be viewed as an opportunity structure that gives rise to the possibility for, though does not predetermine, the emergence of new sites to be created, such as business incubators, for new relationships to be formed, and for new knowledges to flow across boundaries.

4. University Hi-Tech Incubators as Boundary Spanners

4-1. Incubators – a response to 'third stream' policy

In the UK, the emergence of technology-based incubators originates from an assumption by government that the promotion of such activity will foster the development of a knowledge-based economy (Patton *et al*, 2009). They are intended to offer a training ground for nascent entrepreneurs to be found within and outside of the university community. Incubators also serve as a mechanism for commercialising science and technology-oriented applications. As boundary spanners, they are intended to link technology, capital and know-how to entrepreneurial talent for the purposes of accelerating the development of new companies (Minshall and Wicksteed, 2005; Youtie and Shapira, 2008; Markman, Siegel and Wright, 2008), and

[3] The reports also point out that some universities have moved to centralise consultancy activities (e.g. Hertfordshire, Imperial College, Oxford, Portsmouth and Warwick) in order to manage the institutional and personal risks associated with consultancy work and to reduce systems failure.

thus speed the commercialization of technology. University spin-offs are believed to have several key benefits: in generating revenue for the institution; making the university more attractive to current and potential faculty members; and benefiting the community and the nation (Lerner, 2005). Universities claim that they can offer access to specialist, in-house facilities/expertise for spin-offs, although this may not always occur in practice (Patton *et al*, 2009).

For their part, university technology incubators aim to support networking opportunities by bringing in venture-capital investors from the wider business community (local, national and sometimes global), to negotiate relationships between the university and local government, to foster a business culture in a local area, and offer legal and daily business assistance (Peng, 2006). They attract local people and provide a space to develop new businesses as a result of interactions with researchers and research ideas generated in the universities, acting as what some have called a "knowledge hub" for the local/regional innovation system (Youtie and Shapira, 2008). And though it is difficult to provide a quantitative measure of how much university incubators can aid spin-off companies on the business side, such incubators are nevertheless considered as key to providing a 'community and nucleus' for start-up companies (Peng, 2006).

In the UK there has been considerable and growing interest from policy-makers in promoting spin-off companies from universities (cf. DTI, 1998; HM Treasury 2002). These developments, conceived of as a central component of innovation policy, is strongly justified, especially for 'less favoured' regions (Benneworth and Charles, 2005). Such support infrastructure can be accessed by external partners such as local businesses, and also by staff and students who want to create and nurture start up companies. The economic boom of the late 1990s, energised and enabled by funding schemes for new innovation support mechanisms, resulted in an upsurge in spin-off activity from UK universities. In 2006/7, the total number of active spin-off firms from universities exceeded 1200. In terms of survival rates, compared to 2003/4, 35% more formal spin-off companies are active after three years according to the 2005/6 HE BC survey (HEFCE, 2009a).

However, the Lambert Review of *Business-University Collaboration* in 2003 argued there had been too many spin-offs of low quality, and that university infrastructures were not equipped to support these ventures. There was also a concern that spin-offs were being given "… undue prominence in consideration of university performance in research commercialisation" (Minshall and Wicksteed, 2005).

In response to Lambert's concerns, UK Business Incubation (UKBI) launched a National Business Incubation Framework to support incubation management teams through various strategies, such as benchmarking, going beyond numbers of start-ups, and amounts of capital raised (Hannon and Chaplin, 2003). In reviewing their data UKBI concluded there was no single model or template for the running and structuring of a business incubation environment. It is against this background that we now examine the emergence of a hi-tech incubation project at the heart of this paper, the SETsquared Partnership

4-2 The SETsquared Partnership

The SETsquared Partnership was established in 2002 between the University of Bath, University of Bristol, University of Southampton and the University of Surrey. These four institutions are located in one of the strongest economic areas in England – the South of England – spanning the west and east regions. In combination these four universities hold research staff of 6,500 and a budget of £266 million accounting for 7% of the UK's research budget, suggesting that research activity is particularly strong. The development of the SETsquared Partnership has, over time, been funded through a range of Government programmes (see Table 1).[4]

The main purpose of the SETsquared Partnership is to increase the level of successful business start-ups, and to stimulate economic growth in the region's economy.

> *The Partnership supports the growth and success of new business opportunities through spin-outs, licensing and incubation. It also works with industry through research collaboration and consultancy. The SETsquared Partnership develops new businesses from university research ('spin-outs') and supports early-stage, technology companies with high growth potential form the wider business*

[4] Ibid; http://www.surrey.ac.uk/news/releases/01-1008funds.html accessed 21 February 2010

> *community. The partnership also provides access to UK and US markets through international collaboration.* [5]

A further motivation in forming the Partnership was to create a critical mass of research and development activity that would enable this region to compete with the top research universities - Cambridge, Oxford and Imperial College.

Whilst progressive rounds of funding enabled the Partnership to expand, this was not a straight-forward process. As one interviewee noted, the early collaboration between Bristol and Bath to secure funding from the University Challenge Fund was the outcome of a forced relationship by the Office of Science and Technology (OST).

> *"We both bid individually, and OST came back and said 'you've got to collaborat'... you won't succeed unless you collaborate' and so we therefore grudgingly collaborated"* (Interview with senior administrator).

Funding for this kind of third stream activity also demanded novel legal structures, but,

> *"... getting this agreed by the university was quite a tricky process"* (ibid).

It was also complicated because of the charitable and public status of universities, and because universities are traditionally/culturally risk averse when it comes to ventures with unpredictable outcomes. When faced with an additional university mission – that of enterprise and related commercial activity – the two institutions ended up expending a considerable amount of effort and funds on setting up a partnership agreement.

Over time, the creation of funding sources to support discrete third stream initiatives, and the enterprising approaches of by key personnel within the universities, established the basis for third stream initiatives. As interviewee observed:

> *"...on the one hand you've got a programme which is about seed-corn funding for spinouts, then you've got a programme which is about engagement with industry in a broader sense, and then there was a third programme called science and enterprise challenge"* (Senior Administrator, Enterprise Office).

[5] http://www.SETsquared.co.uk/About+us [accessed 21 February 2010]

The Partnership is supported by a 'central office' that is dispersed across the partnership sites. The range of activities under the Partnership is now relatively wide and includes a number of 'relationship-based' university-industry linkages (Perkmann and Walsh, 2007), such as academic consultancy, sharing facilities and student placements; it also supports spin-outs from the universities.

- **1999 - University Challenge Fund**
  A bid led by Bath to establish the Sulis Seedcorn fund with Bristol to invest in spin-out companies. The Fund was extended in 2001 to bring Southampton into the limited partnership, raising the Fund to £9m. (Surrey is part of the Cascade Seed Fund consortium.)
- **2001 - Science Enterprise Challenge**
  A second round Wessex Enterprise Centre bid with Southampton and Bath, led by Bristol. The bid value was £2.85m.
- **2002 - Higher Education Innovation Fund - HEIF 1**
  A £5m bid led by Southampton to establish SETsquared (incubation/ 'hatchery centres') with Bath, Bristol and Surrey (the Southern England Technology Triangle, SET^2, consortium).
- **2004 - HEIF 2**
  A successful collaborative bid secured £13m – integrating all HEIF activity under the SETsquared Partnership banner.
- **2006 - DTI Science Bridges programme**
  SETsquared Partnership was awarded £1.5m for a programme to support applied research and US market access with Southern California.
- **2006 & 2008 - HEIF 3 & HEIF 4**
  Under the institutional HEIF 3 & 4 programmes, partner universities continue to support the enterprise activities of the Partnership.

Table 1: Third stream funds accessed by SETsquared Partnership (1999-2009)

In the early days, the SETsquared Partnership drew inspiration for its approach to incubation from the global success story, Silicon Valley, and its link to Stanford University;

> "*…we had a very frothy economy…and I guess they looked at Stanford and said: 'Right how are we going to do this?' And it was to create that space. SETsquared's objectives were, you know, quite Californian - the private sector, early stage venture capital markets and so on. Get an idea, find some mentors for it who were experienced entrepreneurs … that becomes a kind of proto-advisory board, board of directors … raise some money, get it out of the incubator and move on to the next one"* (Interview, Incubator Director).

4-3 SETsquared Business Acceleration Centres

Incubation activities take place in SETsquared Business Acceleration Centres located in each of the four universities. The incubators aim to:

> … tackle a genuine need among early stage technology companies across Southern England, whether they have developed from university research or not…. Through SETsquared, the four universities give practical support to technology start-ups by offering infrastructure around which an entrepreneurial community and culture can provide your new company with professional facilities and access to a hugely experienced entrepreneurial community (SETsquared, 2010).

Each SETsquared Business Acceleration Centre has a Director and administrative support. They provide support services and office space for early stage companies to help them develop ideas into viable trading businesses. Each centre provides start-up companies "access to entrepreneurs, industry specialists and investors, along with business mentoring through our network of mentors and guidance from centre-based experts and panels" as well as "physical office space" (SETsquared website, 2010).

However, across the four incubators between 80-90% of the firms incubated come from ideas from outside the university (spin-ins) whilst the rest (10-20%) come from insider the university (university spin-offs).[6] These figures reflect the nature of the incentive structures in place: they are attractive to local entrepreneurs from outside the university because of the lower cost of rent for a start-up firm (begins lower then increases over time with the success of the start-up); they have shared access to administrative support; support through personal high quality mentoring (a combination of incubator personnel/business mentors); and access to wider industry and enterprise networks. However, the incentive structure for academics, particularly where academic publishing is highly valued, tends not to reward third stream activity in the same way[7]. Nevertheless, what makes SETsquared incubators unique are the potential benefits from being located close to the university, with access to university

[6] For a rough comparison, the proportion of high-tech companies established since 1990 with a founder from Cambridge University is around 17% (SQW, 2000). This is the proportion of firms established and it is necessary to take into account changes over time in relation to a proportion of corporate spin-outs, and the existence of research centres of large multinationals (see EEDA, 2010).

[7] In the UK this is likely to change if the 'impact agenda' is implemented as part of the new framework for allocation of research funding from HECFE. Impact indicators include largely 'third stream' activity.

facilities and resources, including academic consultancy, students for projects, and recruitment of graduates. The partnership of four universities also gives a powerful 'brand value' to attract investors.

The majority of the firms at the SETsquared Business Acceleration Centres have some linkage with the university (Marangos *et al*, 2010). In the last six years, companies supported by the Centres raised over £120 million and created more than 1000 jobs. 100 businesses have 'graduated' from the Centres, typically after 18 months to three years.[8] The four universities also run annual SETsquared Investor events in London. Beginning in 2006, the SETsquared Partnership participated in the UK's Science Bridges Programme with San Diego, in building collaboration with University of California, Irvine and University of California, San Diego, and in Global Connect programme. The UK's Science Bridges Programme is based on the belief that technology is 'global' from its birth; by providing research funding rewarding collaboration, the programme aims to stimulate international enterprise.[9] Under the programme, collaborative research activities were developed between SETsquared and university partners in the US, and private partners were drawn in for commercialisation of the research.

Whilst the remit of each Centre is more or less the same, the institutional context into which each SETsquared Business Acceleration Centre is placed varies significantly. Each SETsquared Centre has a distinctively different business model. When changes happen, they tend not to happen across the four sites. As one of the interviewees put it:

> *"… it's like a concertina: at no one time are all four universities on the same position. We constantly as a group are either amalgamating or breaking up the research and commercialization elements. …we're all moving in perfect asymmetry with each other."*

The Partnership does offer a means for mutual learning and support for the incubators, drawing in the tech transfer offices in each of the universities, as well as the SETsquared central office. The Incubator Directors, central management teams and

[8] http://www.SETsquared.co.uk/About+us/Business+Acceleration+Centres accessed 21 February 2010
[9] http://globalconnect.ucsd.edu/events/documents/SETsquared.pdf accessed 20 November 2009

administrator meet regularly, and Incubators share events such as annual investor event in London. As one Director noted:

> *"We share a brand name and we have, at times, been very collaborative, and then we've been not very collaborative, and we're in a phase of being quite collaborative. So it's about working together, sharing best practice, sharing opportunities ... we have a common mentor pool ... pool of mentors, people who give their time for free…. - closely managed pool. But we do operate quite different models ... but with some common tools and some common ... there's some central partnership people."*

The following paragraphs summarises some of the characteristics of each SETsquared Business Acceleration Centre in relation to the host university and its locality, history and the way each 'boundary-spanning' mechanism is organised.

The ***Bath Innovation Centre*** was set up in 2002 (pre-dating SETsquared Partnership), and hosts the SETsquared Business Acceleration Centre. Bath's Incubator Director was appointed in 2003 to Knowledge Transfer Services, and one of the first jobs was to 'accommodate' a SETsquared room.[10]

> *"So there was a physical room just up the corridor here which was going to have seven desks in, open plan, and each desk to be rented out to private companies, entrepreneurs, business leaders – one company desk, so very very small, for £100 per month, so you know, really subsidised…with the mentor programme and everything".*

However, as the Director notes:

> *"... the SETsquared initiative was imported into a department called Knowledge Transfer Services, KTS I believe ... you know when universities talk about knowledge transfer it is not the same as tech transfer. And so departmental objectives were about knowledge transfer, research collaborations ..."*

The idea of tech transfer is more limited; as referring the transfer of technology from one location to another. Knowledge transfer is much broader; it refers to a range of knowledges that might include social networks, attitudes toward enterprise, and so on.

[10] A second SETsquared Business Acceleration Centre was based at University of Bath campus in Swindon. This was closed in August 2008.

In Bath:

> *"The original SETsquared romance – translated into seven desks, seven entrepreneurs, £700 per month – that one or two, and maybe three of these would be academic entrepreneurs. In Bath it was never successful…it was successful for private companies, but that mode was never successful for university spin-outs. They tended to be much more complicated than that. We are also 2 miles from the main campus. So we spent a lot of time trying to wave to academics to get them to notice that we are here. There were also other structural issues, including the Research Assessment Exercise, which rewards academics differently. So getting academics as business leaders wasn't particularly easy"* (Director).

Following a round of restructuring in August 2008,[11] the Bath Innovation Centre was morphed into Bath Ventures, responsible for managing the University's Seed Fund, and its relationships with its funding partner, the IP Group, and the SETsquared Partnership. The Bath Ventures Innovation Centre provides 'hands-on support and expertise to new technology enterprises, as well as companies that emerge from the University's research, established either by academics or students'.[12] The Innovation Centre is located in the city centre, right next to the Bath Spa railway station - highly advantageous for accessing local businesses. More than 50 companies have been supported at the Innovation Centre, 90% of which came from the wider business community, and the other 10% are University spin-outs. In total Bath Ventures has generated businesses worth £10 million, and 160 jobs for the local Bath economy. The Innovation Centre sustains itself through membership fees from both residential (that is resident in the incubator) and non-residential firms. The Incubator Director has established a series of highly successful networks: *Silicon South West*,[13] *Low Carbon South West*[14] and *open MIC* (mobile innovation camp)[15]. The networks host events and provide a range of contacts and other opportunities for members. The range and size of networks promoted by the incubator director have grown rapidly in the region connecting entrepreneurs, industry and the university. They have created sector focused clusters of firms in the region and are open to firms at other SETsquared partners.

[11] Created on 1st August 2008, Bath Ventures brings together the Technology Transfer, Consultancy and Innovation Centre teams that were formerly part of Research and Innovation Services department.
[12] http://www.bath.ac.uk/research/mag/pdf/innovations07.pdf
[13] http://www.southwestengland.co.uk/case_studies/ict/SETsquared.aspx
[14] http://www.lowcarbonsouthwest.co.uk/
[15] http://www.lowcarbonsouthwest.co.uk/

The ***Bristol SETsquared Business Acceleration Centre***, launched in 2003, is located adjacent to the University's Computer Science department and Engineering Faculty, the two most enterprising parts of the University. The Centre more closely follows the original SETsquared model; of a graduated sizes of subsidised office spaces in central Bristol, with access to a network of entrepreneurs, 12 are mentors attached to the Centre, investment advisors, professional services firms and academics. The Centre creates linkages between the University and new high tech companies with emerging technology, through potential research collaboration, student employment and more general collaborative interactions. For instance, SETsquared's 'Entrepreneur in Residence' who is based in the SETsquared Business Acceleration Centre and runs enterprise modules for the Computer Science degree so that students get exposed to many aspects of business creation, planning and necessary skills to succeed in business. This articulates with the University's enterprise mission; of the availability of enterprise education as part of the student's overall education offer.

The Bristol SETsquared Centre was awarded 'Established Business Incubator of the Year 2008' by the UKBI, in recognition of its work with some of the early stage, high-technology, high growth start-up businesses. Within the University, the SETsquared Centre sits within the Research and Enterprise Development (RED) division. The University initiated Bristol Enterprise Network (BEN) in 2003, the network of high-tech, high-growth organisations in the Bristol city region. BEN is now independent from the University, and is associated with Science City Bristol, with support from the Universities of Bristol, Bath, West of England, and the South West RDA.[16] A number of SETsquared based companies are members of BEN. The Bristol SETsquared Centre founded the Bristol Incubator Forum in 2006 to connect practitioners and stakeholders of business incubation in the City of Bristol for the benefit of all early stage businesses. The membership includes UWE Ventures, Spike Design, BRAVE, Business Link and Bristol City Council.

Since its inception in 2003 as ***Southampton SETsquared Acceleration Centre***, some seventy business proposals have been considered by the Centre's Incubator Director;

[16] Highlight Report 08/09 Research and Enterprise Development at the University of Bristol, http://www.bris.ac.uk/red/downloads/red/highlight_2008.pdf

subsequently 28 (very early stage) firms have joined the incubator and 15 firms are current members. Like Bristol and Bath, the majority of firms (22) that have joined the incubator are external to the University. Nevertheless, some of the more successful proposals have been developed from within the University (Patton *et al*, 2009). The University of Southampton is considered to be the one of the most successful in the world, along with Stanford in California, in the creation of spin-out companies (Franklin *et al*, 2007). The University has created 12 spin out companies since 2000 and over 50 since 1969 [17] and, if the number of indirect spin-offs is taken into account, the number is over 100. Between 2001 and 2007, Southampton was one of the most successful universities in the UK in terms of investment in its spin-out companies.[18] The University has decided that enterprise is a key part of the University's culture, and a key part of the University's offering both to students and to staff. Based on that strategic decision, the University decided essentially to invest in enterprise and entrepreneurial activity. The SETsquared activities are funded by the institutional HEIF funding stream so that the costs of incubator activities are covered.

Southampton SETsquared is now co-located with the technology transfer organization in the university – Research and Innovation Services (RIS) and collaborate with broader knowledge transfer activities. Recently, the University established a new Entrepreneurial Internship Scheme in collaboration with Business Link and the SETsquared centre, funded by the Engineering and Physical Sciences Research Council (EPSRC) for early EPSRC researchers. Through this collaborative partnership, businesses selected to be in the scheme will gain access to talented young researchers, who have specified technical knowledge as well as receiving matched funding for their project.[19]

The Surrey Technology Centre is located on the Surrey Research Park, which is owned by the University of Surrey. The university itself has a long tradition for promoting innovation and new ventures and has extensive research contracts and links with industry (e.g. industrial 'sandwich' (co-op education) programmes). The Surrey

[17] http://www.soton.ac.uk/business/spinouts/university_created_companies_directory.html
[18] Southampton spin-outs secured nearly £50 million in venture capital funds, which was made up of just over £4 million per spinout. This meant that Southampton was fourth in terms of the total invested since 2001 (behind Cambridge, Imperial College (London) and Oxford) and second in terms of investment per spin-out company and per research publication (Sunley and Pinch, 2010).
[19] http://www.soton.ac.uk/mediacentre/news/2010/jan/b10_01.shtml

Research Park was originally promoted to extend this important policy of cooperation with industry. In 1986, the University opened the Surrey Technology Centre as a business incubator at Surrey Research Park.[20] According to Kirby (2006), two-thirds of the firms at Research Park have links with the University of Surrey and a number of university's own spin-off firms have located in the Research Park.

The SETsquared Centre started as an incubation facility on its own in 2002, and in 2006, moved to the Surrey Technology Centre for a strategic purpose. As the companies grow and start to build their teams, they can move from the SETsquared Centre (seen as a 'pre-incubator') to take space within the Surrey Technology Centre (incubator) and further to take larger space at the Surrey Research Park (Science park).[21] The Director of the SETsquared Centre acts as an operations manager for the Surrey Technology Centre and Incubation Director of SETsquared. The Research and Enterprise Support (RES) is the key unit at the University in forming spin-out companies and guides its academics through the process. Companies based at the SETsquared Centre pay a subsidised Membership Fee to be in the Incubator. When the company is ready to grow, they leave the Incubator and take space in the Surrey Technology Centre (the SETsquared Incubator has two units within the Surrey Technology Centre). The business support and membership of SETsquared remains, which provides a greater chance of success for the businesses involved, as they are still being supported.

Despite the physical distance between the University campus and the Surrey Research Park, there are a number of linkages. There are student placements (through schemes such as KTPs) and projects within companies at the Surrey Technology Centre, which are valued by entrepreneurs.[22] The University of Surrey 100 Club has been recently set up as to support venture creation in the region.[23]

[20] Currently, the Research Park accommodates approximately 110 technology based firms of various sizes and stages of development, and the Surrey Technology Centre houses approximately 70 New Technology Based firms (NTBFs). Tenant companies employ over 2,500 staff and many feed technology into local companies through partner arrangements.
[21] By collocating the SETsquared Centre, the Surrey Technology Centre and the Surrey Research Park, there is an 'integrated incubation process' (Kirby, 2006).
[22] A positive links between the incubator, Research Park and the University's entrepreneurship training (e.g. MBA Entrepreneurship, BSc in Entrepreneurship, IT Technology and Business, and through entrepreneurs in residence) is noted (Kirby, 2006).
[23] http://www.surrey.ac.uk/100club/

Across the four sites, there is growing collaboration bilaterally, or based on local proximity. Collaborations between Bristol and Bath centres are noted, through the Bristol Science City, Science Park (S-PARK) and BEN network. Many of the Bath Innovation Centre member firms are also located in Bristol. The three regional networks run by the Bath Centre support start-up firms, the business community and academia, in the Bristol-Bath area. Collaboration for events between Bath and Southampton, Bath and Surrey were also mentioned in the interviews. Southampton and Surrey Centres also collaborate due to their geographical proximity. However to date there have been no university spin-off firms at the Centres based on collaborative research between the partner universities.

4-4 SETsquared directors as 'knowledge mediators'

In this section we examine in closer detail how each Incubator Director talks about their knowledge mediation and brokerage roles, showing how each interprets and enacts their role. At the outset, it is important to note that each of these Directors came from industry rather than from within the university, as either an academic, or in some kind of academic related activity. Industry experience is clearly important, not only because of credibility issues and experience in having run a business, but because they also bring with them the potential to access networks.

Our research findings suggest that each of the Directors operates in a rather different way; these differences beteen are the result of their own philosophies and interests, their sense of their own expertise and experiences, the spatial and organisational 'proximity' of the incubator within the each host university, and the expectations of their universities. Differences in Director 'style' are recognised by our interviewees. As one noted:

> "*The Director in Bath is a marketeer, the Director in Southampton is a salesman, the Director in Surrey is experienced in operations, and I am more of a jack of all trades, but my interest is in people … absolutely in people. So you get that diversity."*

Bath's Director has background in the telecom sector, but not directly with technology. His job title is "Director of Incubation and Networks", and involves marketing Bath Ventures and its opportunities, as well as being director of the Innovation Centre/SETsquared Centre, and running a series of highly successful regional networks: *Silicon South West*,[24] *Low Carbon South West*[25] and *open MIC* (mobile innovation camp)[26]. The networks have grown rapidly in the region connecting entrepreneurs, industry and the university. They have created sector focused clusters of firms in the region and are open to firms at other SETsquared partners.

Because of its early location in the KTS department, the particular philosophy of the Incubator Director, and the networking capabilities of the Incubator Director, Bath's SETsquared activities look different to the original SETsquared model. Driven by a philosophy of being 'self-sustaining', rather than offering a fixed number of desks, the Incubator Director offered memberships to the innovation Centre. Membership, however, has to realise something of value. For Bath's Incubator Director, a membership fee of £500 per year results in access to the networks. For potential entrepreneurs from business, membership of the Innovation Centre also means contrbuting to the Incubator Director's objective of engaging with academics. For academics who become members, the Incubator Director is able to provide opportunities via the networks for engaging in knowledge transfer.

> *"It is nice for their CV that they spoke at an industrial conference which was attended by 160 businesses, that included Microsoft, Vodafone and Disney … I've got something that helps me with my academic relations, I've got something that acquires new clients for my innovation centre, and I've got something that allows me to favour on my existing clients. And, it pays for itself, and makes a financial contribution to the Innovation Centre. And you know the government agencies all love it because it is University innovation."*

Bath's Director views SETsquared as a 'methodology', and describes the process as "*moving from an innovation centre to a centre of innovation'*. As he observes: *I do have a start-up background … but I must say what I do really well is translate the regional economic policy intent and university policy intent into a language, or you*

[24] http://www.southwestengland.co.uk/case_studies/ict/SETsquared.aspx accessed 12 March 2010.
[25] http://www.lowcarbonsouthwest.co.uk/ accessed 12 March 2010.
[26] http://www.lowcarbonsouthwest.co.uk/ accessed 12 March 2010.

know, a brand, or...as my colleagues says, ***'a spin'*** *that sounds exciting and engaging to business."* Spotting possibilities that arising from the translation of policies, and setting up networks to support processes of 'translation', is critical to how Bath's Director works.

> *"... it was the home run with Silicon Southwest, Low Carbon Southwest looks like going the same way, and it's really good because its helping me on the campus front, getting good engagement from senior academics.*"

These networks have the capacity to change the world of the business community *and* the world of the academic. As the Director observes:

> "*I get highly energised by creating networks where the private sector companies make their own luck."*

Bath's Director has many of the characteristics of Osborne's (2004) leveraging and brokering mediators - able to leverage ideas by using the network as a sphere of influence for ideas, and able to broker knowledge through aligning the interests and concerns of the different constituencies inside and outside of the university. In assessing where most of his effort is directed he notes:

> "*I put more effort into building academic to business networks which you know have an intimacy with certain growth business sectors which allows me to insert and socialise academics, their work there, with the hope and expectation that we might sell some consultancy, license some intellectual property, achieve KTPs, and that sort of thing".*

However, Bath's Director is also a *translator* of policy trends into networks that are, in themselves, resources to address problems. These networks are timely, problem specific, highly visible, and knowledge rich. More importantly, each network is able to operate independently of the Director, opening up opportunities for a range of members to act as leveragers and brokers, depending on what issues need to be addressed, by whom, and with what potential resource. As the Director remarks:

> *"The network, it is not like cause and effect marketing where you send out a flyer, you get a response, you get some sales. It's an '****always on'*** *network; things, like little fishes, swim through it. Sometimes they are worth grabbing, and sometimes they are not. I mean, you just let it tick over."*

Bristol's Director has also "*run and grown and exited technology businesses",* and has a wide range of business experiences. He describes his approach as "*pre-incubation and grow-on",* and trying to build a 'critical mass' to ensure that there is a buzz around the place. He has also positioned the incubator as a 'shop window' for the university'. He says companies stay in the Bristol Centre longer compared with other centres, and that provides "*the power of interaction between the companies"*. Unlike Bath's Director, Bristol's Director primarily focuses on mentoring individual entrepreneurs. The SETsquared Centre is "centre of town on campus" adjunct to the University, but the Director points out the "physical limit of space" as a challenge for the incubator. He is part of the University's Research and Enterprise Development (RED). However, his office is located inside the incubator, rather than being within the universities Enterprise office (i.e. RED). Over the period 2008-2010, Bristol's SETsquared Director also served as Chairman of the Institute of Directors, Bristol Branch, and Director of several other organisations in Bristol.

The approach to incubation has stayed faithful to SETsquared's early mission. Nevertheless, the Director described the focus on early stage incubation in the technology sector as:

> *"… a formula picked out of thin air…that was the brief…and that's what we have continued, and that's what we have excelled at … they apply on-line and sometimes we get phone calls and we'll have a 5 minute phone conversation to see whether it's worth them applying … if we think there is a chance that they fit our criteria we'll meet them … we'll spend an hour with them … and we'll say to them: "Right! Tell us how you got to where you are, what have you got, and where do you want to go?" Because, as we are discovering in the conversations in this discussion, it's almost completely about the individual and not the business … it's about the individual, and their skills, their aspirations, their ability to drive this thing forward. We'll give them feedback on what we think the challenges are, and we'll give them some ideas of what they might do … which demonstrates really how we operate. And during that time we will assess; is it a high tech business? Is there potential for growth (and that means significant growth)? Is there potential even – you know – there'll be lots of risks, lots of challenges – but is there potential for it to be great? And then the criteria, the third criteria: can we add value?"*

Bristol's Incubator Director firmly believes that the way to add value quickly is through fostering person-to-person interaction. He notes:

> "*I'm a complete addict to the fact that people need to be together and stuff happens physically with people together."*

Important too is that the Director must quickly build trust and credibility. One way this is done is through demonstrating their knowledge of the sector, and making available the means to access expertise, new networks and contacts. The Director notes:

> "*I think what is most important is that I've run a technology business, because that gives you credibility with the people. Somebody comes in, they don't know anything about SETsquared, and they sit down with Dave [pseudonym] and I, and we understand their technology, or the basics, and within minutes of them explaining, we think: 'Well! You could do this, or you could do that'. So you say: 'Oh, well, you know that such-and-such is doing this…!' And you know the challenges. And when you say: "I've listed a company on the stock exchange", you get trust within 10 minutes, and so you can achieve so much. It's all about acceleration, you see. You can get trust very quickly, and the extension of that is understanding the things that are going on. And, it is all about networks. Someone says: 'I spoke to ...' And you say, 'Yes, I know them …', or 'You want to speak to such and such...!' You know that's very powerful. Not only from the trust, but from the expertise that you can bring to bear."*

The art for the Director is in being able to pick a potential entrepreneur through observing the approach of the person proposing the start-up.

> "*We do it in 5 minutes, when we meet them. It is the passion they have for what they are trying to do. But too much of that, or passion without the reality check and other skills, can be bad. They need to be open … open to ideas. If they say, well, I've looked at that so it's not going to be possible … then we know it is never going to work as they are closing the doors. And that's a fine balance. Between not taking in ideas and assimilating information, and then other people who just lap it all up, but then don't do anything. So it is very difficult to articulate. But it is mostly about the drive and the energy, and just getting on and doing stuff. And you can usually 'sus' that out very quickly, actually."*

Bristol's incubation model starts with heavily subsidised rent at the beginning but this is time limited, and initial intensive input and support.

> "*The idea is that the start-up grows into bigger space, and the rent goes up over time. So, after 2 ½ years, they are in a space which is above market rent, so they move out when they stop getting value from the centre. So all of the*

companies get the same quantity and quality of support. But, we move at the early stage … we'll push ... we'll push as hard as we can. And then they grow and they get things sorted out, and it turns into a pull mode, so that they take as much as they want. So, nothing's metered. So, they get the physical space of the furniture and access to the internet, and the meeting rooms and the reception, so all the kind of what we call 'tea and toilets'. And then they can have as much time from me and 'Dave' [pseudonym] as is available, and they take advantage of. We run workshops, investment readiness training, show case events, business review panels, ad-hoc conversations, and connections to the network and access to our mentors."

Bristol's Director can be described as a 'broker' (Osborne, 2004; Meyer, 2010) particularly as he aligns the interests of the potential entrepreneur with business mentors and venture capital. However, there is also something more going on here. The Incubator Director is also a 'talent spotter', able to test the attitude and aptitude of individual as a potential entrepreneur. Once potential is identified, the Director draws on his own tacit knowledge, experience, expertise and networks to accelerate the start-up. This is a mix of inspiration and motivation; of knowing when, how, and how long, to push, in order to enable the start-up to succeed, or not, and what to support as the business gets moving (or when to withdraw when it stalls). In speeding up learning and creating new entrepreneurial competences, described by the Director as 'acceleration skills', means being able to quickly communicate ideas, passion, expertise and credibility.

Southampton's Director was first appointed with the establishment of SETsquared in 2002. With a science and engineering background, he has previously been employed in blue chip companies (in R&D and sales) and ran his own business. Like the Bath and Bristol Directors, Southampton's Director brings "considerable experiential knowledge" (Patton *et al*, 2009) to assisting the start-up firms with a strong focus on business development. Southampton's Director also has an MBA and a marketing diploma. This is reflected in his approach to incubation as high impact business creation.

"*After a few years in engineering I moved into sales at a big computer company … technology products with very high ticket values. I think that the biggest one that I ever did was £120m. You know, big orders. And then I ran my own company."*

He has a central role in the range of third stream activities within the university – that includes the SETsquared Incubator, being the person responsible for regional development (and thus the university link to the Regional Development Agency), and student entrepreneurship. The SETsquared Centre is co-located with the universities technology transfer office – the Research and Innovation Services (RIS). RIS emerged from the Centre for Enterprising Innovation[27] following a restructuring within the University. According to the Director:

> "*We work very closely together on lots of things."*

The Southampton Director describes his role as *business creation* rather than that of incubation.

> "*I am looking for a new high growth potential business what will have huge economic impact, and I will invest time and effort to make that business successful."*

He notes:

> *"The way I tend to operate here is, I propose initiatives and projects, and deliver them, and we have within research and innovation services somebody responsible for all of the finances. They make sure that we have the appropriate budgets to finance particular projects. I am committed to performance, not covering costs; having a very big economic impact rather than finding a new SETsquared tenant because they will pay me extra rent."*

Observes the Director:

> "*My particular strength is in business development and getting companies moving. I understand why customers buy technology products and I understand the mechanics of running a company, so how you have to finance the operations of a company, and how you have to finance bringing on new staff and product development, and marketing and business development."*

The Southampton Director's approach has generated notable success stories – such as Symmetrica, with a £200m contract from the Department of Homeland Securities. Notes the Director:

> "*At any one time we have 12-15 companies we're working with. And over the years, it is around 30. But they have all had high impact. Companies tend to*

[27] The two people recruited to set up the Institute for Entrepreneurship were relocated in the School of Management when the Institute was folded into the Research and Innovation Services.

take about 3 years to take off. Initially the thought was that it would be 12-18 months. In reality, companies clearly find the university acting as a focal point for UK Trade and Industry missions, Regional Development Agencies, and so on, really useful. We host these organisations and they come and give presentations. It is an easy place to access services."

Surrey's current Incubator Director joined in 2004, as 'operations manager' for the SETsquared Centre and in 2006 when SETsquared moved into the Surrey Technology Centre (STC), was promoted to Incubation Director for SETsquared and Operations Manager for the STC. SETsquared is geared towards a high level of technology/science and began its life based in its own stand-alone unit on the Surrey Research Park (SRP). The first decision by the Surrey Director was to move the SETsquared Incubation Centre into the Surrey Technology Centre which houses over 70 Technology/Science and Health-related companies.

"*We had our own kitchen and meeting rooms, and we had a general area where we had pods, if you like, for all of the entrepreneurs to come and sit. So, when a company joined, they basically got their dedicated desk and access to the internet, with Business Support as the unpinning. But it was very much on its own in the park. Very isolating, for the Entrepreneurs, it made sense for them to based in a Centre where technology start-ups and SMEs were thriving …"*

Made are up of over 70 units ranging from 200 to 900 square feet, the STC is regarded as the flagship building on the research park.

In 2006, following a reshuffle within the university and the appointment of a new head of Research and Enterprise, SETsquared was moved to the Surrey Technology Centre. Companies are able to start in the SETsquared space. As they grow and build teams, they are able to exit the SETsquared unit and occupy a bigger unit within the STC.

"*SETsquared is funded by the Higher Education Innovation Fund and the companies pay a subsidised membership fee for their business support and space requirements. Our model allows us to grow companies into the STC where they begin paying a commercial licence fee to the University of Surrey. This allows us to show the value add SETsquared brings to the table. This also allows us to monitor further funding they receive, employee numbers, growth etc. This gives us very real and tangible numbers for our metrics and shows in real terms what SETsquared as an Incubator can achieve for the University, the Surrey Research Park and the local economy …"*

Surrey's SETsquared Incubator is therefore viewed as one unit in a process that moves from early start-ups to more full-fledged businesses. As the Director noted:

> "*We can see a company grow from a single entrepreneur right up to 60 or 80 staff. We haven't had anybody do that quite yet, but it is early days at present. What we are seeing now are companies who have grown over the past 4 years from the Founder sitting at a desk in SETsquared, to taking a unit within the STC and now having over 20 staff."*

Surrey's Director does not see herself as a high tech expert. As she observes:

> "*I don't have the experience of going in and saying to a company, 'I think you need to do this'. I utilise our mentor network, we do a matching service pretty much from day one; either as a sounding board, someone they can touch base with and run problems or ideas by. And then when it's needed we start bringing in more experienced mentor, sector specific or with specific experience. So if they have get to the point where they are struggling with sales strategy or their pricing model or with their business plan, we will bring mentors in just to work through these issues. We also use our Mentor Network to be a panel member on the quarterly reviews each Member company has."*

Like all of the firms in the STC, SETsquared start-ups have access to mentoring, investor readiness programmes, and other kinds of support. Surrey also started its own Angel Club, following the same model as the London Business School.

> "*We set about founding the Angel Club early 2007. We used all our contacts, all our networks to begin building the Angel invite list. In November 2007 we held our first Event. Since then we now run quarterly Surrey 100 Events with a yearly Gala Dinner. The Events usually start at about 4.30 in the evening, we have a catch up on University news, and they we have three to four opportunities which are mainly SETsquared companies. They do a 10 minute prepared elevator pitch to that audience (these are all Angels), and then after that we a drinks reception and a formal dinner with a Guest Speaker. This model has proved very successful. We've got to the point that two years down the road we're actually inviting companies back that presented at the first few clubs to relay their success stories. We take no percentage from the companies; we don't take any percentage of any money they raise, The club is there to facilitate an introduction between companies who need Angel funding, and Angels who are looking to invest in good quality opportunities. This all adds to the wealth creation and economic growth of the Surrey area."*

Surrey's Director is a highly skilled 'manager' of resources to support the development process. She not only manages the incremental space demands, but has put into place a model that is able to service the different phases of the development process, from start-up to larger commercial firms. Her capacity to create events, like

the Club, are available to start-up firms at a range of points across the development life-cycle. Being on the Research Park also influences her approach to development in general and to incubation in particular. As she notes:

> *"We're very, very business driven because the whole research park is commercially run. So the companies who are starting up in the SETsquared Incubator in Surrey, are already based in a centre that has a good reputation, and is based on one of the UK's leading Science and Research Parks. It does add credibility at that very early stage and sends a positive message to potential investors/customers that they are serious about their business ..."*

She adds:

> *"I am always aware when the companies in SETsquared need to grow into more space. I can help with this because of my responsibility for the STC; I'm able to help them grow slowly into their next unit, into their own space, and carry on the vital business support. So I'm very lucky in that, I have the 'grow-on' space to offer them ... I think that Bristol and Bath do have extra space that they can let to people, but only to a certain point. And then once they get to a certain stage, they have to lose them from the building completely."*

Managing space has considerable benefits. For instance, faced with a slowing economy, the SETsquared Director has been able to take contracting businesses and place them back into the smaller incubator unit.

> *"And that is the great thing about SETsquared being based within the STC. It has enabled us to support companies through tough times, when they have need to cut costs, we are able to take them back into the Incubator and then within a few months they begin to grow again. I'd say that the opportunity to have SETsquared in a building like this with varied space opportunities is that we have been able to help companies weather the storms. We have provided the opportunity for companies as large as 20 employees, to reduce their headcount down to 2/3 and work from the Incubator. To the outside world the company is still operating and with our help they grow back into their own units and some of those companies are now thriving again."*

5. Knowledge Mediation Strategies

In this final section we review the main insights to be gleaned from a comparative study of four university incubators under the SETsquared Partnership, focusing

particularly on the issues and challenges facing hi-tech university incubators, and what we can learn about knowledge mediation practices.

There is little doubt, given the small number of staff in each of the incubators, the SETsquared Partnership has achieved a great deal in terms of generating economic value for their wider city-regions. As one interviewee remarked:

> *"You know we've created across the 4 universities in the order of 150 companies. They've raised way over £100 million of venture capital. You know there's thousands of jobs that have been created at the high end; very high quality jobs in science and engineering companies that are generating profitable revenue. And we've done this with an incredibly small team. So in terms of impact, from the amount of money spent, it is extremely high."*

This level of success has occurred despite the incubators operating in an environment where publicly funded universities are necessarily cautious about the risky nature of commercial activity, and universities their own limited capacity to support commercial activity properly. Not only are "*start-ups particularly financially flaky"* (interviewee), there is also a strong chance that 1 in 10 initiatives will not get off the ground.

However, at present the success of university incubators, when measured in terms of the numbers of start-up companies, is dependent upon ideas for enterprises emerging from outside the university, rather than inside. In other words, across the four incubators in our study, around 80-90% of start-ups occur as a result of ideas from outside the university being bought to the SETsquared incubators. This is despite one of the objectives of HEIF funding – to establish innovations, like university incubators, in order to provide a mechanism through which good ideas within the university can turn into commercial successes. Viewed from the opposite direction, Incubator Directors, with their industry backgrounds, contacts and networks, also have limited networks *within* the university, and therefore limited capacity to mediate the directional flow of this knowledge across the academics.

One important reason for this is the continuing 'frictions' between the culture of the university and the culture of the world of industry and the difficulties of moving between the two. As one of our interviewees noted:

> *"... from a University point of view, they are too consuming for an academic to be able to follow a dual path of academic work along with ... and we don't have that kind of US culture where an academic moves out to be a CTO or a CEO for a few years and then moves back in – we haven't quite achieved that ... or maybe we don't want to achieve that."*

This is not a new point. However it does highlight that despite new streams of funding, these frictions continue to limit the easier movement of academics, their ideas and potential start-ups, between these cultures.

A further continuing cause of friction between the academic culture of the university and engagement with incubator and other third stream activity is the incentive structures for academics, particularly arising from the research assessment regimes that have been in place. Not only must academics prioritise the production of internationally refereed academic papers, but as one Director pointed out:

> *"... we don't get big points in Research Assessment Exercises for losing a 5 star research academic to a company for two or three years. We do get big points if we licence some of our research to a company, and the company continues on that path, and the academic continues to teach and research in our university. So you know the economics here is important. What goes on under the crust determines our behaviour."*

The challenge here for universities, of course, is how to hold both missions and their trajectories, in place, together. This will require more than a change in policy. The recent inclusion of 'Economic Impact' in guidance for research applications by the UK research councils (see RCUK, 2010) may influence the nature of research, and its interaction with wider society, along with the recognition of such activities. Current discussion regarding HEFCE's Research Evaluation Framework and Impact agenda (see HEFCE, 2009b) can be considered another factor influencing institutional perceptions and practices. However, as we have seen, simply putting policies into place is not enough to smooth the tensions in cultures. The incentive structures will need to alter, but in ways that both missions are not at odds with each other.

At the start of this paper we also asked whether the particular capabilities of the incubator Directors – such as their experience, expertise, institutional location, and so

on, influenced the content of the boundary spanning relationships across the interface between the university and the business community. In other words, could we see different kinds of mediator practices at work? If so, why? And, with what outcomes?

Our data suggests that each of the four incubator Directors engage in knowledge mediation practices very differently. In other words, there is a high level of plurality in the approaches to incubation. Lam (2000: 496) argues that diversity tends to occur when the knowledge mediation practices depend upon a high level of tacit knowledge, and where fluid, fast moving and experimental environments both demand, and produce ad-hoc-ery. As she notes: "This emerges from highly organic forms of organisation with little standardisation of knowledge or work process. It relies not only on the formal knowledge of its members, but draws its capability from the diverse know-how and practical problem-solving skills embodied in the individual experts." As we noted at the start, the only benchmark that applies to all incubators is that there is no one way to incubate ideas into start-ups.

However, Directors differed in their emphasis they gave to different knowledge mediation strategies they deployed. In the Bristol incubator, the Director's approach was shaped by his view of how change happened; through identifying talent, and then working intensively with the potential entrepreneurs to produce a start-up. This did not mean that the creations of networks were unimportant. They were. But they were not the central point of the incubation focus. Southampton's Director tended to focus on the viability of an idea as a potential project, and the possibilities it offered for generating a large economic impact. The locus of change here was for the Director to take an idea and accelerate it, rather than for the Director to work with an entrepreneur and their idea, and accelerate it. On the other hand, Bath's Director promoted the collective in the form of networks, above the individual. And whilst individuals were important, it was left more to the individual to see what opportunities there were across the networks and for them to make it work from there. Surrey's Incubator Director also tended to work at a more collective/organisational level rather than closely with individual entrepreneurs, creatively organising and reorganising resources and events to ensure that the development process is supported.

This diversity is contributed to by what we call *knowledge mediation strategies*. Osborne's (2004) knowledge mediation practices – of leveraging and brokering, were evident to greater or lesser degrees in each of the incubators. However we also observed other knowledge strategies involved in incubation. We regard these as 'strategies' as they are a means to achieving particular ends – in this case, the incubation of ideas into start-up firms to achieve economic development goals. Arising in large measure because of the fluid, ad-hoc, tacit knowledge base of university incubators, on the one hand, yet shaped by their experiences, expertises, institutional locations and personal philosophies, incubator Directors could experiment with, and embed, different knowledge mediation strategies, on the other. These included *trend spotting*, *talent spotting*, *ideas spotting* and *resource spotting*. 'Trend spotting' refers the strategy of reading the wider policy and problem environment, and constructing resources – like networks – that have the potential to act as a knowledge pool able to support strategic responses. 'Talent spotting' refers to the strategy of identifying potential entrepreneurs who are able to set up, and sustain, a successful business. 'Ideas spotting' refers to strategies that are deployed to identify potent ideas that can be transformed into innovations through incubation. Finally, 'resource spotting' refers to strategies that bring configurations of people/ideas/money, together to realise particular objectives.

What are the policy implications of what we have found? To begin with, policies focused on incubators need to pay attention to incubation as a process, rather than simply on the visible hardware. Realising successful incubation outcomes will also be dependent on the incentives structures on both sides of the boundary to enable knowledge to be transported and translated across the boundaries of different worlds. These would need to include mechanisms for either managing, or modifying the incentive structures that give rise to disabling frictions. Institutional policies also need to protect, and nurture a diversity of knowledge mediation strategies and practices involved in the incubation process. In other words, *there is no one way* to promote incubation. Whilst this is an obvious point, and one that that been noted elsewhere, the wider regulatory environment of universities, particularly as a result of the implementation of new public management, tends to undermine rather than contribute to diversity. Finally, we need to understand better the variety of knowledge mediation strategies, and how we are able to learn from those most likely to generate innovation.

This means identifying and studying at closer range incubation processes that might be more suited to working over both sides of the boundary between universities and industry in order to realise the overall goals of third stream policies and projects.

References

Abreu, M., Grinevich, V., Hughes, A., and Kitson, M. (2009) *Knowledge Exchanges between Academics, the Business, Public and Third Sectors*. UK Innovation Research Centre. http://www.cbr.cam.ac.uk/pdf/AcademicSurveyReport.pdf [accessed 12 March 2010].

Benneworth, P. and Charles, D. (2005) 'University spin-off policies and economic development in less successful regions: learning from two decades of policy practice', *European Planning Studies*, 13, pp. 537-557.

BIS (2009a) *Higher Ambitions: The future of universities in a knowledge economy*, November 2009
http://www.bis.gov.uk/assets/BISCore/corporate/docs/H/09-1447-higher-ambitions
[Accessed 12 April 2010].

BIS (2009b) *New Industry New Jobs*, April 2009,
http://www.bis.gov.uk/policies/new-industry-new-jobs [accessed 12 April 2010].

BIS (2009c) *Skills for Growth: a national strategy for economic growth and individual prosperity*, November 2009,
http://webarchive.nationalarchives.gov.uk/tna/+/http://www.bis.gov.uk/wp-content/uploads/publications/Skills-Strategy.pdf/ [accessed 12 April 2010].

CBI (2008) *Stepping Higher* Workforce development through employer-higher education partnership http://www.cbi.org.uk/pdf/cbi-SteppingHigher.pdf [accessed 12 March 2010].

CBI (2009) *Stronger Together: Businesses and universities in turbulent times*. A report from the CBI Higher Education Task Force,
http://highereducation.cbi.org.uk/uploaded/CBI_HE_taskforce_report.pdf,
[accessed 12 March 2010].

CIHE (2008) Developing Entrepreneurial Graduates, Briefing Note 1, January 2008
www.cihe.co.uk/wp-content/themes/cihe/document.php?file=0805DEGbriefingnote1.pdf [accessed 12 March 2010].

Clark, B. (1998) 'The entrepreneurial university: Demand and response', *Tertiary Education and Management*, 4 (1), pp. 5-16.

Clark, B. (2001) 'The entrepreneurial university: New foundations for collegiality, autonomy, and achievement', *Higher Education Management*, 13 (2), pp. 9-24.

Cummings, W. (1998) 'The Service University in Comparative Perspective', *Higher Education*, 35, pp.1-8.

Dosi, G. (1997) 'Opportunities, Incentives and the Collective Patterns of Technological Change', *The Economic Journal*, Vol. 107, No. 444 (Sep., 1997), pp. 1530-1547.

DTI (1998) *Our competitive future – building the knowledge driven economy*: *Analysis and Background*, December 1998.

DTI, HM Treasury and DfES (2002) *Investing in innovation strategy*, July 2002, http://www.hm-treasury.gov.uk/d/science_strat_sum02.pdf [accessed 25 Oct 2009].

Eisinger, P. (1973) 'The conditions of protest behaviour in American cities', *The American Political Science Review*, 67 (1), pp. 11-28.

Etzkowitz, H. (2003) 'Research groups as 'quasi-firm': the invention of the entrepreneurial university', *Research Policy*, 32, pp. 109-121.

Feldman, M.P. and Desrochers, P. (2003) 'The Evolving Role of Research Universities in Technology Transfer: Lessons from the History of Johns Hopkins University', *Industry and Innovation*, 10, pp. 5-24.

Franklin, R., Holi, M., and Lapinski, J. (2007) *Spinning out quality: University spin-out companies in the UK*. Library House, London.

Galsworthy, J. and Knee, P. (2007) *Higher Education Innovation Fund impact survey*. Quotec Limited, Amersham.

Goddard, J. B. and Chatterton, P. (2003) The response of universities to regional Needs, in F. Boekema, E. Kuypers, R. Rutten (eds) *Economic Geography of Higher Education: Knowledge, Infrastructure and Learning Regions*, London: Routledge.

Hannon, P. and Chaplin, P. (2003) 'Are incubators good for business? Understanding incubation practice – the challenges for policy', *Environment and Planning C: Government and Policy*, 21, pp. 861-81.

HEFCE (2001) *Higher education-business interaction survey: HEFCE Research Report 01/68.* HEFCE, London.

HEFCE (2009a) *Higher education-business and community interaction survey (HEBCI) 2007/8*. http://www.hefce.ac.uk/pubs/hefce/2009/09_23/ [accessed 20 March 2010].

HEFCE (2009b) 'Major consultation on the new Research Excellence Framework', published 23 September 2009 http://www.hefce.ac.uk/news/hefce/2009/ref.htm [accessed 2 March 2010].

HM Treasury (2002) *Investing in Innovation: A Strategy for Science, Engineering and Technology*, HM Treasury, London.

Kenney, M. and Goe, W.R. (2004) 'The role of embeddedness in professional entrepreneurship: a comparison of electrical engineering and computer science at UC Berkeley and Stanford', *Research Policy*, 33 (5), pp. 691-707.

Kitschelt, H. (1986) 'Political opportunity structures and political protest: anti-nuclear movements in four democracies', *British Journal of Political Science*, 16 (1), pp. 57-85.

Kirby, D. (2006) 'Creating Entrepreneurial Universities in the UK: Applying Entrepreneurship Theory to Practice', *Journal of Technology Transfer*, 31, 599-603.

Lam, A. (2000) 'Tacit knowledge, organisational learning and societal institutions: an integrated framework', *Organisation Studies*, 21 (3), pp. 487-513.

Lambert, R. (2003) *Lambert Review of Business-University Collaboration: Summary of Consultation Responses and Emerging Issues*. HM Treasury, July 2003.

Lawton Smith, H. (2007) 'Universities, innovation and territorial development: a review of the evidence', *Environment and Planning C, Government and Policy*, 25, pp. 98-114.

Leitch, S. (2006) *Leitch Review of Skills*. December 2006. HM Treasury. http://webarchive.nationalarchives.gov.uk/+/http://www.hm-treasury.gov.uk/leitch_review_index.htm [accessed 12 March 2010].

Lerner, J. (2005) The University and the Start-up: Lessons from the Past Two Decades, *Journal of Technology Transfer*, 30, 1-2, pp. 49-56.

Marangos, S, Kitagawa, F. and Warren, L. (2010) 'Networks and Spatiality of University Incubators: Global and local links amongst SETsquared Spin-off firms at Universities of Bath, Bristol, Southampton and Surrey in England', *Orkestra Territorial Competitiveness Working Paper series.*

Marginson, S. and Considine, M. (2000) *The Enterprise University*. Cambridge University Press, Cambridge.

Markman, G. Siegel, D. and Wright, M. (2008) 'Research and technology commercialisation', *Journal of Management Studies*, 45 (8), pp. 1401-1423.

Mayer, D. and Staggenborg, S. (1996) 'Movements, Countermovements, and the Structure of Political Opportunity', *American Journal of Sociology*, 6, pp. 1628-1660.

Meyer, M. (2010) 'The rise of the knowledge broker', *Science Communication*, 32 (1), pp. 118-127.

Minshall, T., and Wicksteed, B. (2005) *University Spin-Out Companies: Starting to Fill the Evidence Gap*, London: St. John's Innovation Centre.

Molas-Gallart, J., Salter, A., Patel, P., Scott, A. and Duran, X. (2002). *Measuring third stream activities*, SPRU: University of Sussex, a report to the Russell Group of Universities.
http://www.lse.ac.uk/collections/CCPN/pdf/russell_report_thirdStream.pdf
[accessed 20 March 2010].

Nedeva, M. (2007) 'New tricks and old dogs? The 'third mission' and the re-production of the university', in D. Epstein (ed.) *Geographies of Knowledge, Geometries of Power: Framing of the Future of Higher Education*. World Yearbook of Education 2008. Routledge, New York, pp. 85-103.

Osborne, T. (2004) 'On mediators: Intellectuals and the ideas trade in the knowledge Society', *Economy and Society*, 33 (4), pp. 430 – 447.

PACEC (2008) *Analysis of HEIF 4 Institutional Strategies: Overview Report*. A report to HEFCE, 2008/35. http://www.hefce.ac.uk/pubs/hefce/2008/08_35/08_35.pdf
[accessed 12 March 2010].

PACEC/CBR (2009) *Evaluation of the effectiveness and role of HEFCE/OSI third stream funding.* Report to HEFCE by PACEC and the Centre for Business Research, University of Cambridge.

Patton, D., Warren, L. and Bream, D. (2009) 'Intangible Elements That Underpin High-Tech Business Incubation Processes', *Journal of Technology Transfer*, 34, pp. 621-636.

Peng, X. (2006) 'University spin-offs: Opportunity or challenge?' *Nature Materials*, 5, 923–925, http://www.nature.com/nmat/journal/v5/n12/full/nmat1790.html
[accessed 12 March 2010].

Perkmann, M., and Walsh, K. (2007) 'University-industry relationships and open innovation: towards a research agenda' *International Journal of Management Reviews*, 9, pp. 259-280.

RCUK (2010) *Our vision for excellence with impact.*
http://impacts.rcuk.ac.uk/cmsweb/downloads/rcuk/publications/ImpactsSmall.pdf
[accessed 12 April 2010].

Rothaermel, F. T., Agung S. D. and Jiang, L. (2007) 'University entrepreneurship: a taxonomy of the literature', *Industry and Corporate Change*, 16, 4, pp. 691-791.

Sainsbury, D (2007) *The Race to the Top: A Review of Government's Science and Innovation Policies*. October 2007,
http://webarchive.nationalarchives.gov.uk/+/http://www.hm-treasury.gov.uk/d/sainsbury_review051007.pdf accessed 26 March 2010.

Saxenian, A. (2006) *The New Argonauts: Regional Advantage in a Global Economy*. Cambridge University Press, Cambridge, Mass.

Shattock, M. (2003) *Managing Successful Universities*. SRHE and Open University Press, Buckingham.

Slaughter, S. and Rhoades, G. (2004) *Academic Capitalism and the New Economy: Markets, State and Higher Education.* Johns Hopkins University Press, London.

Tarrow, S. (1996) States and opportunities: the political structuring of social movements, in D. McAdam, J. McCarthy and M. Zald, *Comparative Perspectives on Social Movements: Political Opportunities.* Cambridge University Press, Cambridge, pp. 41-62.

The Times Higher (2001) *Does Labour come up with smelling of roses?* http://www.timeshighereducation.co.uk/story.asp?storycode=164143 [accessed 12 March 2010].

Tilly, C. *From Mobilization to Revolution*. Addison-Wesley, Reading, Mass.

Waters, R. and Lawton Smith, H. (2002) 'RDAs and local economic development: scale and competitiveness in high technology Oxfordshire and Cambridgeshire', *European Planning Studies*, 10, 5, pp. 633-649.

Wellings, P. (2008) *Intellectual Property and Research Benefits*. Lancaster University, Lancaster.

Wright, M., Clarysse, B., Lockett, A. and Binks, M. (2006) 'University spin-out companies and venture capital', *Research Policy*, 35 (4), pp. 481-501.

Youtie, J. and Shapira, P. (2008) 'Building an innovation hub: a case study of the transformation of university roles in regional technological and economic development', *Research Policy*, 37, pp. 1188-1204.

For more information, please contact
llakescentre@ioe.ac.uk
LLAKES Centre
Institute of Education
20 Bedford Way
WC1H 0AL
London
UK


National
Institute of
Economic and
Social Research


University of
BRISTOL


UNIVERSITY OF
Southampton
School of Education


E·S·R·C
ECONOMIC
& SOCIAL
RESEARCH
COUNCIL