Bringing Cambridge to Consett? Building university-centred entrepreneurial networks in peripheral regions


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1. Introduction

Innovation is currently a vital part of the contemporary production process, and is increasingly seen as integral to economic competitiveness and success (Porter, 1998). With increasing globalisation of product markets, alongside fragmentation of consumer demands, the ability to differentiate products through innovation, and flexibly respond to new market demands is central to the competitive success of modern businesses. Although there is considerable debate over the broader implications of these economic changes, there is a consensus that “the major source of added value is knowledge” (Stehr, 1994, p. 62), leading to a general acceptance of the idea of a ‘knowledge economy’ in which knowledge as much as capital and labour drive productivity, wealth and ultimately, standards of living.

One issue which arises in the knowledge economy is identifying how less successful regions can participate in this new knowledge economy; these less successful regions face both an absolute shortage of knowledge capital, and barriers to building that capital, because of the importance of agglomeration and critical mass in knowledge work. Innovation potential and capacity is unevenly distributed over space, and this regional dimension broadly matches the regional distribution of economic problems, meaning that poor regions tend to be characterised by low levels of knowledge capital. Knowledge capital is distinct from other forms of capital in that there are no diseconomies of scale (Romer, 1994; Solow, 1994), which means that less successful regions are at a competitive disadvantage to build the necessary critical mass of knowledge activities which can create positive overspills for firms located there. There has been much interest in recent years in trying to promote knowledge activity in less successful regions, because globalisation/ internationalisation has meant that these regions no longer have the option to compete on low costs in the face of extreme cost competition from newly industrialised areas, in Eastern Europe, Latin America and the Far East (Milward, 2003).

This seems to pose a real problem for identifying the place of less successful regions in the new knowledge economy, where they are at a competitive disadvantage to both knowledge rich and low cost locations. A consensus has emerged that the only rational course for these places to pursue is the ‘high road’ approach, to attempt knowledge...
accumulation and competition. However, they face two barriers to building a critical mass of knowledge capital, firstly that their regional environments discourage innovation by offering low levels of return to knowledge investments, and secondly, through the outflow of knowledge capital that has been witnessed from peripheral regions in recent years. In this paper, we ask the question “how can university spin-off companies contribute to the accumulation of knowledge capital as an initiator for knowledge-based region development in the periphery?”.

In this working paper, we explore whether USOs do materially improve the environment for other high-technology small firms through three mechanisms, by opening up the university to outside influences, by actively transferring technology into other firms, and by helping to improve the ‘thickness’ of the regional innovation support infrastructure. Our model is that USOs help with the creation of a ‘territorial knowledge pool’ that firms can draw upon in their own innovation processes, and helps them to achieve more in innovation than would otherwise be possible. We focus on three mechanisms by which USOs support the creation and maintenance of a territorial knowledge pool. From this, we reflect on whether this improvement in regional economic environment is sufficient in magnitude to be considered an economic development.

In this report, we focus on one particular such peripheral region; we use the concept of ‘peripherality’ to refer to a place within a broader political-economy, that is to say a region which is dominated by externally controlled activities, rather than geographical or cartographic remoteness. The region we focus on is the North East of England, a region which has been experiencing industrial decline for most of the last century. Despite this industrial decline, the university has a strong tradition of links with industry (Potts, 1997) and has been in the vanguard of universities developing interactions with industry. The university also has a good record of spinning off companies in the last 10-15 years, albeit – as well will see in Chapter 5 – somewhat sporadically. This research is part of a larger comparative study also involving the region of Twente, in the Netherlands, another peripheral region with another active university. That report has been published in parallel with this first working paper, and there will be a series of comparative working papers published in the course of 2005-07. This report sets out research undertaken in the North East of England from March to June 2004 as well as work undertaken early in
2005 for Newcastle University’s senior management in support of the Newcastle Science City proposal (cf. Chapter 9). This research was funded by the UK’s Economic and Social Research Council, under grant RES-000-22-0659, and we are extremely grateful for ESRC for their support in this regard. We would also like to acknowledge to contributions of time and support from the participants in the research, as well as the institutional support from Newcastle University in producing this work. Any errors or omissions remain of course the responsibility of the authors.
2 Spin-outs in the knowledge economy: building a denser innovation and entrepreneurship environment

2.1 Introduction

Although it has long been recognised that human capital is critical to economic development, central to notions such as the Schumpeterian entrepreneur (Schumpeter, 1934), the notion that knowledge capital differs from other factors of production has emerged only comparatively recently. At a macro-economic scale, Romer (1994) and Solow (1994) both identified that knowledge, at least in the sense of intangible forms if investment, could account for potentially half the productivity growth in the long post-war growth period. Temple (1998) terms the theories subsequently developed as the “new growth theory”, and notes that it is predicated on the notion that productivity growth is driven by investments in knowledge capital which differs from other forms of capital in not suffering from diseconomies of scale. Consequently, further investment in knowledge always brings marginal improvements in productivity. Coupled with increasingly globalised production systems where advanced producer economies no longer have the capability to compete purely on cost, this produces a neat conceptual framework for the idea of the ‘knowledge economy’ as one driven by investments in innovation, research and design activities.

Consequently, there is a clear geographical dimension to the new economy: knowledge capital stocks are extremely unevenly distributed, with competitiveness, productivity and ultimately wealth dependent on those unevenly distributed stocks. This unevenness seems to be a barrier for less successful places to develop economically. Consequently, knowledge production has become increasingly centralised and we have seen the emergence in recent years of a knowledge production hierarchy. This creates significant problems for those less successful places which lie at the bottom of this global ‘command-and-control’ networks (Yeung et al., 2002). The macro-economic knowledge economy, or the new growth theory, emerged at a time when there was also interest in a number of very successful regions, such as Emilia-Romagna who appeared to have
succeeded precisely because they had territorial production systems well-organised to deal with a competitive global environment.

Although many argue that the case of the Italian industrial districts are so specific to their context that more general lessons cannot be derived from them, a number of case studies were developed in other regions which began to support the theorisation of those successful places in terms removed from their more general context. As Hassink & Lagendijk argued (2001), theories were developed in ways that allowed them to be easily transferred between places, without necessarily considering whether the contextual factors were sufficiently similar between those places to justify that transfer. Massey et al. (1992) noted that this led to perverse policy outcomes, where knowledge economy economic development policies brought the greatest benefits to those most successful regions. More generally, this all comes together to suggest that as a consequence of this, less successful regions have difficulties in ‘finding a place’ in this new knowledge economy. They have difficulties in accumulating sufficient knowledge capital to create economies of scale which offer a sufficiently favourable environment for regional economic development, and appear to suffer from perpetually being ‘held’ in subaltern positions in the knowledge production hierarchy. This raises a problem in understanding how knowledge activities can promote economic development in less successful places. To explore this more general conceptual issue, we focus on one such new economy activity, university spin-outs, which have been an important part of the stories that people tell about this new economy.

2.2 Spin-offs outside core knowledge agglomerations

In this paper, we focus on one element of the knowledge economy, University Spin-Offs (USOs). By USOs, we begin from Pirnay et al.’s (2003) generic definition as “[n]ew firms created to exploit commercially some knowledge, technology or research results developed within a university” (p. 356). USOs therefore embody knowledge capital in a relatively pure form, and there has been increasing interest in policy-makers in promoting spin-off companies to generate stocks of knowledge capital in less successful regions. The policy promotion of USOs has certainly produced results in terms of numbers of new firms created (AUTM, 2001; HEFCE, 2002; ARC, 2003). Association of University
Technology Managers (AUTM) figures suggest that US universities created around 500 new firms in 2001 (AUTM, 2003). Other countries have also followed American practise; in 2000, 199 spin-offs were formed in the UK whilst 47 spin-offs were formed in Australia (HEFCE, 2002; ARC, 2002).

However, it has not been established that USOs are ubiquitously beneficial, and frequently valuations of USOs rely more on faith than fact. The past experience of science parks (cf. Massey et al., 1992) suggests the success of knowledge-based economic development policies are much more dependent on the underlying strength of the regional economy rather than an intrinsic quality of the policy. Given that knowledge capital has a tendency to accumulate in successful places, this suggests that USOs might have fewer benefits for less successful places than the discourse of the new economy intuitively suggests. The general problems with the knowledge economy paradigm take on a particular form with regard to spin-off companies.

Firstly, in less successful regions, where economic conditions are less prosperous, and entrepreneurial environments tend to be less munificent (Dubini, 1989), one would expect USOs to more difficult to generate, and require greater effort, government support and subsidy to produce a lesser effect. This assumes that a USO in a less successful region will be less profitable and hence less competitive/ productive than had the same resources been deployed in a more successful region which has an agglomeration of knowledge capital. Because knowledge-based firms access local networks and spill-over effects to cut the costs of innovating, in less successful environments those firms perform less well than firms which have easy and regular access to knowledge resources which exist in knowledge agglomerations. Indeed, there is much disagreement in the role and significant of USOs in the Cambridge phenomenon, between those who regard them as a by-product of an already strong R&D base against those who argue that they have become an integral part of the science base driving the economic success.

“In a developed environment there is already an entrepreneurial community with the capability to select the best projects and allocate resources to them … In contrast, in environments with less demand for innovation, characterised by a weak entrepreneurial community and a lack of other resources, [research
institutions] may need to play a more pro-active incubation role” (Claryss et al., 2004, p. 1-2).

The second issue is that as USOs emerge in less successful regions, it would be expected that they would move away from those regions, either through direct relocation or through take-over and rationalisation by more competitive businesses in more successful places. Lycos is a famous example of a spin-off company which formed in Boston despite being a spin-off from – and partly owned by – Carnegie Mellon University in the rustbelt city of Pittsburgh. More generally, Elgen et al. (2004) have highlighted the fact that many university spin-outs – particularly knowledge-intensive business services (KIBS) – have a tendency to relocate to larger cities in core areas rather than making a positive contribution to the area around their parent institution. This is particularly worrisome given that these KIBS firms are seen as being an important constituent of those knowledge economies which USOs are supposed to build.

These two issues together might reduce any capacity that USOs had to improve the economic performance of less successful regions, much less to reduce the agglomeration advantages that core regions have over LFRs. The archetypal places where USOs have succeeded (e.g. Route 128, Silicon Valley, and Silicon Fen) already have agglomerations of knowledge capital; further knowledge activity adds to the concentration of knowledge, a ‘win-win’ situation. However, the economic development benefits of USOs depends on existing stocks of capital meaning that USOs in those regions benefit from the multiplier effect of the USOs. Although USOs might appear to be beneficial to less successful regions, this seems to imply what those regions really need is to begin to accumulate knowledge capital stocks to drive regional economic growth. However, this particular analysis is based on an over-socialised reading of peripheral places as lacking any kind of capacity to challenge the relationships by which they are held in their subaltern positions.

In this research project, and this report, we are interested in identifying mechanisms by which regions can tangibly improve their position within a broader political-economy. Consequently, we not turn to develop a model for considering how spin-offs can make such a contribution to their regional economies.
2.3 Towards a model for USOs contribution to regional peripheral development

Deducing that there is no role for university spin-off firms in supporting economic development in less successful places is intuitively problematic, because it does seem to run counter to broad swaths of recent analyses which have demonstrated that USOs do act as drivers of economic development in ‘ordinary’ places (Asheim & Coenen, 2003). This is a fundamental tension in conceptualising the territorial economic development of less successful places, what Cooke (2004) calls the ‘scalar envelope’. The issue is the mutual irreconcilability between perspectives which focus on the apparent value of local activities and initiatives, and analyses which look at the subaltern ‘place’ of less successful regions in the global knowledge hierarchy. As Cooke notes…

“As a consequence … economic geography tends to be dominated by (ideographic) case studies, broad (and untestable) stylised statements on what propels regional economic development, or, even less productive, high-level theory discussions that remain uncoupled to real-world experience.” (p. 8).

This idea of a scalar envelope leads directly to the main research question we explore within our research, namely

“how can university spin-offs rework political-economic relationships in ways that improve the situation of their host regions in wider knowledge-based economies”?

Our approach is rooted one step back from the political-economic model, noting that as a consequence of peripherality, less successful regions have fewer resources available for innovation, which in turn makes them less attractive places for external actors. We assume that improving the position in the political economy will take place if the regional environment becomes more attractive for external actors, which gives local actors more leverage in their relationships with external agents, which increases the stickiness of particular forms of knowledge, and also contributes to placing the region more centrally within the spatial imaginaries of policy makers allocating state resources which play a significant role in shaping regional innovation systems (Saxenian, 1999; Charles & Benneworth, 2001).
To operationalise these ideas, we consequently begin from a resource-based model to the geographies of innovation. If an innovative firm has a problem, and it does not have the internal resources to solve that problem fully, then external resources can be accessed if they are locally situated and do spill-over. Munificent environments like Cambridge have these in abundance, whilst in less successful regions, there is not ready access to these assets (Johannisson, 1993), and consequently there is a correlation between the geographies of innovation, and the geographies of economic success. A simple resource-based model of the innovation process might be that USOs work with universities and other innovative firms in creating collective innovation assets (cf. Klein Woolthuis, 1999). The heuristic model is that the environment is improved if a USO creates an asset which spills over, and that those collective innovation assets are what improve the environment. This means they create resources which other actors are able to access more easily, at a lower direct cost. Although this is a pleasing heuristic, it requires a degree of rationalisation to explain what precisely is regionalised in this process.

Muller & Zenker (2001) have developed a model of the mutual interdependence of high-technology consultancy activities which they conceptualise in terms of a co-evolution process, in which consultants and high technology firms both innovate together, but build a shared knowledge pool between them. This shared knowledge pool facilitates future collaboration, but also gives each of them an advantage in the wider KIBS process, which they can exploit in working with other firms. Wood (2002) gives examples of how these activities have been territorialised into the kinds of arrangements that Lundvall (1998) sees as being national ‘styles’ of innovation. Our argument is that one overspill mechanism that such a shared knowledge pool builds up between university and USO, and that other firms are able to draw on this as an asset in solving their innovation problems. Thus, although a peripheral region may lack many free-floating innovation assets, this knowledge pool – between university and USO - is available to other firms to augment their resources. This allows those firms to achieve better innovation outcomes than their internal resources alone would permit, in the absence of other external innovation resources due to their location in a peripheral, sparse innovation environment.
The concept is that an iterative accrual of these assets over time corresponds to an improvement in the entrepreneurial environment. Event-specific outcomes are broadened to become territorial collective competences more open to others in that particular territory (Lawson, 1999; Maskell & Malmberg, 1999). Storper’s (1995) example of the creation of a ‘regional specialised labour market’ is beneficial because it allows others to benefit directly from the recruitment effort originally expended, without reincurring that expenditure. Fontes & Coombes’ (2001) offered the notion of ‘densification of the techno-economic network’ (p. 84), in referring to the process of universities and firms working together to create new innovation assets. This idea of ‘densification’ provides a means to bridge between micro-scale activities and meso-level developments in particular regional economies.

We have elsewhere worked through this idea and highlighted three sets of key relationships which influence this collective asset creation process (Benneworth & Charles, 2005). Central to the model is the notion of a ‘regional knowledge pool’ which exists between universities and their spin-offs (cf. Muller & Zenker, 2001). However, the regional knowledge pool – as a technological transfer between universities and firms – is sustained by various other systems of relationships that support and regulate access to the pool. We have developed a model which endeavours to show all these relationships, how the knowledge pool between university and USO is sustained by other relationships. The model is shown in figure 1 below, and in particular, we highlight three important networks and sets of relationships which have to be explored in order to make sense of the regional impact of USOs:-

- Spinning off firms can make universities more open to other commercial collaboration activity, helping SMEs to access their knowledge resources,
- USOs can interact with other HTSFs and partnerships and helping them solve their innovation problems, and
- USOs can work with policy-makers and development agencies to help them to be better at working with HTSFs.
2.4 Opening the black box of the regional TEN: exploring the sub-systems

‘Densification’ is not a singular process, and it possible to think of a number of different dimensions along which network densification can vary. Within any network, some densification involves actions on nodes, whilst some may involve actions on linkages. The second variant in densification is whether the densification involves creating new elements (nodes or linkages) or increasing the strength of those that already exist. Within a territorial entrepreneurial network, for example, a new joint venture represents a new node, whilst a new profit centre within an existing firm strengthens the existing node.
Likewise, in terms of linkages, a novel collaboration represents a new linkage, whilst changing the collaboration with a partner from product supply to co-development is a strengthening of that linkage. This 2x2 scheme ( {node, linkage}; {more, stronger} ) provides a means to explore the extent of densification activity involved in particular entrepreneurial networks.

The framework we use is that the central asset is the territorial knowledge pool in which experiences and relationships build up, and become habituated into routines, and cultures, which are more general innovation resources as is seen in entrepreneurial cultures elsewhere. This can be conceived of as a knowledge pool into which other local actors can dip to supplement their internal resources. We assume that this knowledge pool is territorial in the sense of Lorenz (1999) because although the assets in the knowledge pool can be accessed by those outside the region, they are dependent on relationships between people. Consequently, they embody significant elements of what Lundvall calls “know-who” (1992), the least codifiable and stickiest form of knowledge. The territorial knowledge pool is held in place by further regional specificities, contexts and relationships which contribute to that stickiness, as outlined in figure 1 above. We highlight in particular three sets of relationships, the university’s internal culture of commercialisation (which tie the assets to university-based actors), with relationships with other firms (which further anchor the knowledge in the region) and with policy-makers that regulate the policy-environment and shape the other, complementary territorial innovation assets available.

The first network and set of relationships, (1) is largely internal to the university, and that is the formation of the commercialisation activity within the university. To answer the main research question, it is necessary to explore how these changes in policies affect the overall knowledge pool; whilst it has been assumed that professionalisation of the technology transfer community is largely beneficial, when the impacts on the knowledge pool are considered, professionalisation can be a problem as much as a benefit. Professionalisation seeks to ensure that firms do not rent-seek on university knowledge, but the difference is that knowledge can have greatly differing value to universities and to firms. In particular, policies which stop MNCs free riding on university research programmes also have the potential to stop low-selectivity entrepreneurs dipping into the
tacit knowledge pool at universities and exploiting discrete bits of know-how. This is an intriguing tension for universities to manage because even at a heavy discount, the potential future value of bits of unknown technology are very high, whilst indeterminacy makes their value to SMEs very low. How universities manage this relationship will clearly play a significant role on the openness of the university to local businesses, and hence the accessibility of the regional knowledge pool

The second relationship (2) is between the university and the business support organisations. To some extent, this relationship is traditionally regarded as unproblematic, that universities transfer their technologies in ways that are coherent with other partners’ regional development strategies. In this perspective, the university has the capacity to be a much more active partner in regional development, and to improve the regional innovation environment. However, when universities start producing USOs (and those USOs are the result of university strategies) then this creates a new market for business support services in which universities have interests because those services contribute to equity growth in their companies and also create a beneficial environment in which other companies can form. Again, the model suggests that the key research interest in these relationships is how they sustain the knowledge pool, encourage SMEs to access it and ensure that there is a high level of exchange between actors. However, as Cooke found, it is not enough just to create new regional organisations, these organisations themselves have to produce tangible outcomes and sustain themselves.

The third relationship (3) is between USOs and other businesses, supporting access to and participation in the knowledge pool. Part of this activity might be thought of as clustering, working collaboratively to solve innovation projects, and more generally from benefiting from proximity. USOs may play a role in shaping the regional trajectory of a place, and potentially its local style of innovation, if they come to play a big role in working with other firms. Wicksteed’s (2000) and Lawton Smith et al.’s family trees from spin-off firms in Cambridge and Oxford respectively are interesting illustrations of how this can happen in more successful regions. Equally, deeper webs of relationships between USOs, their spin-offs and other firms may improve the innovation environment in those places.
3 Methodology

In this study, we are interested in the evolution of four sub-networks within the regional innovation environment, in which we have identified actors in four main fields. The thesis is that the experience of spinning off companies, and the development of regional specific experience in spin-off commercialisation has positively co-evolved with these three networks, namely the connection of the university to other businesses, the connection of university to other innovation providers and the impact of USOs on other firms innovation. This question is one of a family of lines of inquiry in regional development theory which are seeking to explore whether a particular set of local changes constitute an improvement of the situation in a particular region (cf. Hassink, 1992; Yeung et al., 2002; Chapman et al., 2004; Hospers, 2004). Our focus is on a less successful region, because of the problems associated with demonstrating convincingly that such changes have overcome the problems that less successful regions face in beginning an accumulation of knowledge capital, which Cooke (2004) refers to as the scalar envelope.

We undertook this research in one peripheral industrial region, the North East England (cf. section 4). We already had undertaken a series of research projects which had established that university spin-outs around Newcastle might be contributing significantly to the economic development environment in the North East, which is why Newcastle was chosen as the study region. This past research is summarised in section 5 below. Section 5 also draws upon 15 interviews undertaken within the last five years to put together a background to spin-off activity at Newcastle University, (8 from 1999, 2 from 2002, 5 from 2003). However, this material is only used descriptively in section 5; the analysis in sections 6 to 9 is based on the standardised methodology outlined below.

The main research question we have posed above has been operationalised to ask to what extent is USO activity contributing to strengthening three kinds of network, and so the approach in the research focused on exploring the dynamics and evolution of the networks in the North East of England, and ultimately how they cohered into elements of a strengthened regional innovation system. In the literature review above, we have set
out what we wished to explore, whether particular sub-systems had become stronger and better connected, along two dimensions, with regard to their situation within global knowledge hierarchies, and in terms of the breadth of the activities covered in the network, namely, to what extent they have become more generally accessible as a territorial innovation asset.

Such a research project is inevitably grounded in realism methodologies, recognising that places containing similar underlying causal relations and structures will in practice appear different (Scott, 2000). Our approach was also informed by critiques of unselfconscious realism embedded in a number of ‘new regionalist’ analyses, in which empirical findings have been overly structured by theoretical frameworks, ignoring significant differences between places (Lovering, 1999; Hudson, 2003; Lagendijk, 2003). In this working paper, we have attempted to establish a single - if partial - history for the evolution of the three networks, to try to identify similarities in structures of relationships. From this, the analysis argues that such structural similarities may constitute the kinds of regularities which warrant regarding as place-specific assets. I assume that similar phenomena are linked through similar underlying causes and structures, and this then allows the answering of the questions about whether the set of activities has in toto constituted a change in the regional innovation environment.

The research was undertaken through a set of interviews with key actors within the North East England. From our past research we already had contacts with a number of the managers of Newcastle University as well as members of the industrial liaison office (which by the time of the research was included as part of the Business Development Directorate.) We followed a snowball methodology (cf. Yin, 1994) in which we identified who were the key partners of prior interviewees, and then interviewed them, to build up a picture of the university network. We undertook a first round of interviews in March/ April 2004 with university managers and BDD employees, and then rolled out the ‘snowball’ in May and June 2004. In these interviews, we sought to snowball out to firms and USO with whom they had some kind of working relationship about which they had something interesting to say. We identified that there were five communities that we were interested in, university managers, academic staff, spin-off staff, other firms working with USOs and regional institutional partners. It became clear in the course of
the interviews that the picture was more complicated that that, because many of the academic staff were also the principal agents in spin-offs. In table 1 below, notwithstanding this difficulty, we enumerate the interviews undertaken during this period.

*Table 1 The interviews undertaken during the research period*

<table>
<thead>
<tr>
<th>Category of interviewee</th>
<th>Number</th>
<th>Category of interviewee</th>
<th>Number</th>
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<tbody>
<tr>
<td>University senior managers</td>
<td>2</td>
<td>Spin-off/ not academic</td>
<td>3</td>
</tr>
<tr>
<td>University BDD</td>
<td>4</td>
<td>Spin-off/ previously academic</td>
<td>5</td>
</tr>
<tr>
<td>Academics/ spin-off owners</td>
<td>8</td>
<td>Third party firms</td>
<td>4</td>
</tr>
<tr>
<td>Business angel</td>
<td>1</td>
<td>Student</td>
<td>1</td>
</tr>
<tr>
<td>Former spin-off, now academic</td>
<td>3</td>
<td>National policy-maker</td>
<td>1</td>
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</tbody>
</table>

The interviews followed a semi-structured pattern, focusing in each case on the core activity and what had been done to build up and develop the particular activity, and how USOs had related to this. Because of the diversity of the interviews, the particular questions and thematic focus varied in each interview. Drawing on past work on university/ business interactions (Benneworth, 2001; Benneworth & Dawley, 2004), in each case our questions reflected how the knowledge pool assets were used by the individuals and their organisations to accumulate knowledge capital activities. With the academics, for example, the interviews examined the balance between undertaking high quality research, running their own small business and commercialising their research through other routes. The business development directorate interviews examined how the universities had supported individuals wanting to spin-off firms, to ensure that it contributed to the growth of the university. With third party firms, the interviews explored how working with universities and university spin-offs has contributed to solving their own innovation problems and growing their business. The student and business angel interviews reflected the fact that not all the contacts and activities in the networks were in categories which had been anticipated *ex ante.*
This working paper presents a first analysis of the situation in Newcastle, to run in parallel with a similar analysis of the situation in Twente, and then to lead to more detailed comparisons of the dynamics and changes in particular parts of the system in each region. For the knowledge pool and each of the supporting three sub-systems identified in the literature review, we have attempted to examine how the network has grown, and whether there is sufficient growth to suggest that it is a qualitative strengthening of the knowledge asset base in the region. For each of the three sub-systems, there are three dimensions explored, whether the nodes are bigger/stronger, whether connections are more numerous/higher quality, and whether the shape of the network has changed (and whether the North East’s position in that network has improved). This is done in each case to examine whether the changes have improved the position of the North East in the wider political-economic situation within which it finds itself. These four analytic chapters form the basis of chapters 6 to 9; in order to grasp the significance of the analysis, it is necessary to have an understanding about the North East, the importance of universities to the regional economy in the last ten years, and Newcastle University’s own approach to commercialisation and regional engagement. It is to those issues in Chapters 4 (the North East) and 5 (Newcastle University) that we now turn.
4 The North East England as a peripheral industrial region

The North East economy was one of the first regions to experience industrialisation, in the late 18th Century, with increasing exploitation of indigenous coal reserves providing the foundation for the emergence of a strong local production complex best described as ‘carboniferous capitalism’. This pattern, of coal, steel, and metal-using industries, has been a common feature of industrialisation, and has often been associated with subsequent industrial decline, such the fate of the famous Montanenindustrien in Germany’s Ruhrgebiet (Cooke, 1995). The rise of the regional industrial complex occurred at a time when all government orientation was extremely laissez-faire in outlook, with no strong nationally-driven development industry emerging in the UK as was to happen in Germany, or the emergence of strong oligopolies in the USA, the two economies first to overtake the UK. Ownership of strategic industries remained fragmented within local owners, and the collapse of local banking systems in the 1860s and 1870s systematically choked off the flow of development finance to these industries at a time when their main overseas competitors were investing heavily in new production technologies and techniques. By the turn of the century, although the UK in general, and the northern region in particular, had the most significant coal, steel and shipbuilding industries in the world in terms of volume, their quality, position, competitive strength and future prospects no longer dominated the global economy as they had in earlier decades.

4.1 The roots of decline 1900-1945

Since the turn of the last century, the defining feature of the North East economy has been the decline of its traditional industries. It is possible in this period to distinguish a number of parallel causes of this industrial decline. Elbaum & Lazonick (1986) ascribed indigenous decline of manufacturing in the UK to a system of mercantile capitalism that encouraged cost reduction over innovation and adoption of competitors’ best practice. Heim (1996) argued that poor management, characteristic of the UK as a whole, was responsible for the decline. Alternatively, Tomaney & Heyward (1996) argued that a
focus on financial concentration in the City of London undermined independent industrial capital in the peripheral regions. There were a number of clear phases in this industrial decline, and in the first period, the first world war created demands for the raw materials of war and then reconstruction produced in the North East of England, which masked the enduring and underlying structural problems in those industries. However, from 1929, as international reconstruction efforts faltered in the light of the fall-out from the stock market crash, UK heavy industry found its overseas markets collapsing under the burden of its poor competitiveness.

Support for industry was hindered by the dominant ideological perspective in the Government of the day, the so-called Treasury view. This view was predicated in an almost religious belief in market mechanisms and balanced budgets, which significantly blinded them to the problems of industrial blight in those regions most adversely affected by the cessation of the European industrial reconstruction effort in the 1930s. The only concession to this position came in 1934, with the creation of the Special Areas Commissioner for the particular areas most adversely affected by the Depression (Loebl, 1978). The transgressive nature of this development against the Treasury view led to its description of the development of advance factory units by the Commission as “a most interesting experiment in state socialism”. However, what really made the difference to the regional economy was not the Special Areas Commission, but re-armament after 1936, which once more created localised monopolistic opportunities for small and otherwise uncompetitive producers in coal, steel, shipbuilding and armaments. This policy situation changed in the post-war period, with the dismantling of the Treasury view, and its replacement with a fiscal commitment to Keynesianism, and a political commitment to greater intervention in key industrial sectors.

4.2 Nationalisation, restructuring and retrenchment 1945-1975

During the period 1945 to 1975, UK industry was aggressively reorganised by the state through nationalisation and planning controls (McKay & Cox, 1979; Stråth, 1987; Roberts, 1993). Both sets of policy measure aimed to modernise the UK economy and spatially restructure it with the South East and West Midlands as the production laboratory, and the remainder of the country as its workshop (Buswell & Lewis, 1970).
The industrial composition of the UK periphery, in which the North East was located was profoundly affected by these policies, particularly those relating to the nationalisation of strategic industries, spatial planning for new high-technology industries and the policies for state-led high-technology industries (Watts, 1992; Howells, 1992).

In the post-war period, there was considerable pressure in old industrial regions - arising from a curious coalition of the national government and local industrialists - to avoid the establishment of new industries which would increase employment competition with traditional industries. Consequently, much of this activity was concentrated in the Midlands (Buswell & Lewis, 1970; Hudson, 1989). There was however no such pressure to prevent the establishment of firms employing those outside the sector, in particular in the types of industries drawing on a female workforce. In contrast to the North West of the UK, where the strong textiles industry had created an active and mobilised female workforce, the dominance of mining and heavily engineering meant that there was a reserve female labour army in the North East, with relatively large numbers of women available for employment at a relatively low cost (Stubbs & Wheelock, 1990). Because of relatively low regional skill and wage levels, this increased the attractiveness of the North East for those firms who wished to site routine manufacturing operations in the context of an heavily protected economy still largely shielded from overseas wage competition. This in turn favoured the attraction of particular types of inward investment of the general form of branch plants. As the decline of traditional industries intensified in the 1960s, the attraction of inward investment appeared to offer the potential to create an alternative economic base for the region (Hudson, 1995). This became increasingly important in the 1970s and 1970s with the recognition of the need for the creation of new employment to replace jobs lost through the restructuring of nationalised industries, and to deal with rising male unemployment.

However, prior to 1975, nationalisation was broadly speaking a positive experience for the North East. In the post-war period, the region did benefit from the whole nationalisation process, because what it did permit was some strategic investments of the kinds that had not been possible under the fragmented ownership of the private industries. In particular what was notable was the investment which was channelled towards strengthening the region’s R&D base in steel, gas, electricity, and shipbuilding, whilst
coal’s decline was sensitively managed; however, the decline of the coal industry could not be arrested by innovation because the industry was so outdated and overmanned (Stråth, 1987, Roberts, 1993). Much innovation in the region was concentrated in the older industries; for example, the Consett Steel Company was at the forefront of the development of spectrophotometric techniques in the 1950s to analyse the purity of high-specification steel\textsuperscript{1}. Likewise, British Gas had a large Engineering Research Station in the North East which thrived under state ownership of the gas sector; it was the (much later) privatisation and regulation which squeezed the company’s R&D funds and led to the rationalisation of R&D onto one site in the Midlands (Benneworth, 2002). Consequently the subsequent politically-inspired run-down of the older industries disproportionately undermined the research and development activities of the North East (Marvin & Cornford, 1994). Questions of whether the detrimental effects of privatisation would have been ameliorated by a more devolved management structure ignore the intense pressures that the privatised industries were later placed under by their regulators as well as international competition (Marvin & Cornford, 1993)\textsuperscript{2}. As Table 2 shows, the worst period of decline for the main heavy industries in the region was the period from 1971 to 1981, as Britain suffered from national and international industrial crises, including several devaluations, an emergency IMF bailout, and a poorly-thought out flirtation with extreme monetarism.

\textsuperscript{1} Electronics Company Interview, 9\textsuperscript{th} August 1999.
\textsuperscript{2} The closure of the British Gas Research Station did not arise because the British Gas managers rationally evaluated the North East against a set of qualitative factors and adjudged it inferior to other regions. Rather British Gas was an organisation in crisis because of demands placed on it by the regulator, it had developed a lavish research headquarters at Loughborough and chose to concentrate its R&D at a single site, a decision with debatable merits. The structural explanation of the concentration of R&D also fails to capture the benefits of the closure, the creation of a number of consultancy firms selling their expertise back to British Gas which recklessly dispensed with much of its own technological and professional capacity, but also enabling these new firms to compete for business with other firms.
### Table 2 Population and employment in carboniferous capitalism in the North East, 000s

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<tbody>
<tr>
<td>Population</td>
<td>617</td>
<td>942</td>
<td>1458</td>
<td>1995</td>
<td>2515</td>
<td>2610</td>
<td>2678</td>
<td>2636</td>
<td>2602</td>
</tr>
<tr>
<td>Coal miners</td>
<td>23</td>
<td>50</td>
<td>96</td>
<td>165</td>
<td>188</td>
<td>118</td>
<td>64</td>
<td>39</td>
<td>11</td>
</tr>
<tr>
<td>Iron &amp; Steel</td>
<td>-</td>
<td>13</td>
<td>31</td>
<td>34</td>
<td>23</td>
<td>57</td>
<td>56</td>
<td>22</td>
<td>10</td>
</tr>
<tr>
<td>Shipbuilding</td>
<td>-</td>
<td>7</td>
<td>15</td>
<td>42</td>
<td>51</td>
<td>64</td>
<td>39</td>
<td>26</td>
<td>8</td>
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*Source: Tyneside Papers in Social Research (1926-33), Challenge of the Changing North, NOMIS (1998).*

One of the main weaknesses in the industrial base came about through state-led corporate reorganisation, which was driven by the policies of the Industrial Reorganisation Corporation and the National Research and Development Council (Hague & Wilkinson, 1983; Webster et al., 2003). The basis of this approach was on the one hand the development of ‘national champions’ through a series of mergers in the high technology sector, and on the other, a series of barriers reducing the incentives on universities to commercialise their research (*qv*). Whilst not an immediate problem in this period, this did leave key decisions affecting the R&D assets in the region in the hands of the private sector, as did the subsequent privatisation of the nationalised corporations. These firms responded to problems of profitability by divesting their corporate R&D assets in favour of the purchase of externally-developed technology (Charles & Benneworth, 2000). The IRC’s attempted to build national champions through mergers which inevitably increased centralisation of control around London, so that when the companies underwent restructuring, activities in the North East tended to be sold off or closed, whether branch plant such as GEC at Newton Aycliffe or Plessey at South Shields, or high technology, such as Vickers Joyce Loebl in Gateshead.

During the period of the dominance of Keynesian statism in the UK, nationalisation of old industries was accompanied by the emergence of new industries, which remained largely beyond direct state control, although their geography was influenced by planning policy as well as government decisions over public spending on R&D and procurement (Heim
1988), and of course, the activities of IRC ensured a continual process of restructuring and reorganisation favouring the South Eastern regions. Because of the national logic of economic regulation, these new industries, such as automotive and aerospace, emerged in new industrial spaces in the UK, rather than in the established industrial areas such as the North East. Two main drivers underlay the national regulation. Firstly, it was believed new industries in old industrial areas would draw labour away from traditional manufacturing, entirely feasible given the conditions of full cyclical employment of the time (Hudson, 1989a). Secondly, these new industrial spaces were indeed more attractive than old industrial areas for a number of reasons, related both to their industrial history as well as patterns of government expenditure (Buswell & Lewis, 1970).

The absence of any commitment to regional growth poles outside the greater south east and a reluctance to create alternative demands for skilled labour in regions like the North East meant that the composition of these new industries was predominantly low-skilled and low-paid, with an almost total absence of higher-order functions such as R&D. The overall effect was that a branch plant economy grew largely unseen. When later restructuring adversely affected the core heavy industries, which dominated R&D and innovative activity in the region, the overall economic structure that remained was that of a branch plant economy. Manufacturing in the region remained reliant on very large externally-controlled enterprises, with a workforce highly specialised in particular state controlled industries. Combined with a preponderance of Government R&D spending in the South East, this reduced the degree to which new industrial sectors emerged in the North East.

The emergence of the branch-plant economy into the North East is well documented, and by the time of accession of the UK to the EU, there was a foreign-owned sector (mainly of US origin) of some importance in the North East. Smith and Stone (1989) estimated that in 1971, there were 24,400 jobs in foreign firms, rising to 53,000 in 1978, at a time when total employment in the region was at a level of approximately 1m (NOMIS, 1997). These jobs were predominantly in manufacturing, and Hudson (1995) estimates that 75% of the jobs created to that date by inward investment were in six sectors:-chemicals, mechanical engineering, electrical engineering, rubber, automotives and printing.
The geography of the development of the service sector in the UK in the post-war period demonstrates a spatial division of labour as extreme as that in manufacturing (Aksoy & Marshall, 1992). Government policies had a strong influence on the patterning of employment in the service sector. Organisation of manufacturing around a national logic (‘national champions’) in turn created pressure for the organisation of business services around a parallel national pattern. The continuing strength of the City of London throughout this period ensured that as service industries grew in importance, essential business services were concentrated in London and later the South East (Allen, 1992). Business service growth in the South was paralleled by a growth in other high-level professional services, connived at, if not driven, by central government. The current spatial division of labour is based upon the concentration of the high value-added business services in the core regions, especially London (Kirby, 1995). Producer services by this time were highly concentrated in London, and to a lesser extent, the South East (Wood, 2002). The peripheral regions, by contrast, tended to have a much higher concentration of consumer services such as retail and construction, as well as higher employment in public administration, education, health and caring (Charles & Benneworth, 2001).

4.3 The move to a post industrial economy 1975-2000

The next significant period in the economic decline and restructuring of the North East of England was precipitated by international events in the 1970s, not least the two oil crises, UK relations with the IMF, and the accession of the UK to the European Economic Community. Against this gloomy economic background, the Wilson and Callaghan governments struggled to preserve economic stability and full employment, and then from 1979 onwards, the incoming Thatcher government shifted the target towards purely monetary stability, initially removing much of the regulatory apparatus upon which less successful regions had depended, then undertaking an extensive privatisation programme.

Early on in this period, the Northern Regional Strategy Team, established at the suggestion of Central Government, developed an analysis of the economic situation in the region, which was remarkably prescient, alongside an action programme which was never implemented due to the unfavourable economic, then later political, climate for direct
regional intervention. By 1975, the economic problems of the North East were severe; there was a large branch plant economy which had very little stability, with plants closing or massively downsizing during economic downturns. Alongside this, the nationalised industries and the public sector in health and education were facing heavy expenditure squeezes. Tight public finances alongside a Labour government committed to full employment led many public sector employers to maintain employment levels whilst cutting investment and expenditure programmes, particularly problematic for the already underfunded nationalised industries with decreasing competitiveness. This underfunding frequently meant that later on, in order to survive as privatised industries, firms were forced to hugely cut employment, which would not had been necessary had there been sufficient long term investment in those industries.

From 1979 onwards, there were severe problems across manufacturing industry in response to the monetarist ‘squeeze’, in which interest rates were set to hit strict money supply targets without concern for the impacts on the real economy. Contemporaneous sources estimate that around one third of manufacturing employment in the UK was lost in this period, not merely in branch plant activities, but in activities that would have, during healthier economic times, been dynamos of economic growth. The response to this situation was the promotion of new waves of inward investment, despite the fact that inward investment was at least partly responsible for the North East’s structural problems. Clearly, inwards investment was a part of the hidden emergence of the branch plant economy which meant that in times of downturn, the region had little control over its destiny.

What really created an environment in which inwards investment was seen as the solution to the ‘regional problem’ was the Nissan investment, announced in 1982, and which opened to great fanfare in 1987. That particular investment was economically and symbolically important, and was legitimated by both regional and national policy-makers as Japanese investors bringing new techniques and innovations to a region with a problem in promoting innovating. Nissan’s insistence upon just-in-time manufacturing techniques ensured that a number of its suppliers also opened production facilities around its’ Washington site. By the late 1990s, this Washington production complex had cemented both its own longevity and status as the most productive car plant in the whole of Europe.
The success of Nissan awakened policy makers to the apparent potential of inward investment to help deal with the economic problems of the region. It is possible to differentiate two, overlapping, periods in which inward investment attraction was seen as the solution to the North East’s economic problems. The first was through a number of high profile investments in ostensibly high technology sectors, such as electronics; Samsung (1987), Fujitsu (1989) and Siemens (1995) were all hailed as proof that inward investment was turning the North East economy around, as each represented a deeper form of investment than previously. Samsung was an electronics company (perceived as more ‘high technology’, and with the promise of a micro-chip factory), Fujitsu was a micro-chip factory, and Siemens was a state-of-the-art micro-chip facility, with the promise of further later investment in R&D. It was assumed in the popular discourse that the fact that these investors were in high technology sectors that they would help the North East to rebuild the R&D activities which public sector mismanagement had eroded within the region in the previous half-century.

The second phase of inward investment related to the attraction of a large number of ‘call centres’, offices in which telephone inquiries for customers are dealt with in a centralised ‘back office’ environment. The North East was a natural home for such call centres because of the large amount of office space available, and low prevailing wage rates in the region. The sector grew quickly in Europe in general in the 1990s, and in the UK in particular; although the growth was not particularly extraordinary in the North East of England. As Richardson et al. (2000) note, the North East was somewhat overrepresented in the sector on account of its small workforce. Although at the time there was some policy consideration that the sector could become an important employer for the region, Richardson et al. questioned the sustainability of the jobs, both from competition from other places, but also with the introduction of new technologies removing the need for human agents. Indeed, since that time the North East has already lost jobs explicitly to other Anglophone countries with lower wage costs, in a number of high profile announcements, from amongst others Lloyds TSB.

Despite the failure of inward investment to materially improve the position of the regional economy with respect to other competitor regions, it is important to stress that the region still has some economic strengths. The chemicals industry, although it has
reduced in size, did successfully diversify in the post-war period, and the pharmaceutical industry has to date been successful in the region, and more latterly, some diversification into biosciences has taken place (Benneworth, 2004). There are a number of exemplar local innovating SMEs, which have grown and created new employment, and there remains an active regional economy in diverse elements of engineering. There have been some new knowledge-intensive business services created, in engineering consultancy, for example, and the public sector, health and education particularly, are important sources of high productivity, high value added employment. However, the region’s relative wealth with respect to the rest of the UK has dwindled in the last thirty years, to a point where it is some 80% of the national average, what the HM Treasury would regard as a £12bn productivity gap with the rest of the UK.

4.4 Conclusions: the economic challenges facing the region

In each of the three periods described above, the overriding concern has been the continuing economic decline of the North East of England. Throughout the last century, there has been a recurrent failure by industry to invest in the creation of new forms of knowledge, and to promote competitive strategies based on quality and innovation rather than cost reduction. This has been compounded by a view from the central government of the ‘place’ of the North East which has undermined the technological modernisation of the region, and detached the management the problem of economic decline from the associated problem of finding a new role for the region in the national space economy. These changes remain as acute today, albeit manifested in different forms; the lack of Government spending on R&D in the North East either through new centres or relocation (such as the Met Office) has undermined changing the external image of the region by others. There is a problem with the retention of control over decision-making in the region, which exacerbates the adverse economic climate by reducing the number of autonomous actors able to innovate and drive productivity improvements. Throughout this period, however, the universities in the North East have played some role as autonomous institutions with strong knowledge bases available for the improvement of regional industries. As background to the analysis of the role of spin-offs, this report now
turns to look at how one of those universities, the university of Newcastle, has chosen to engage with the regional economic environment.
5 The changing policy environment at Newcastle University.

The most obvious feature of regional engagement at Newcastle University is that it was built centrally into its mission. Early discussions around the desirability of a university for the North were initiated by T. M. Greenhow, who in a lecture to the Newcastle Literary and Philosophical Society in 1831 argued that the inaccessibility of Oxford and Cambridge to all but the aristocracy, and the remoteness and licentiousness of London, meant that the north required a university to promote the economic development of the region.

“Indeed, the increasing wealth, population and intelligence of the country must soon call into existence such establishments in various parts of the country, appears not only probable … but almost a necessary consequence of the increasing (sic) demand for knowledge, and the total inadequacy of existing academic institutions to satisfy the demand” (p.7).

Moreover, Greenhow argued that the presence of a university would act as a great stimulus to existing industry, and help with processes of adaptation and change.

“The probable failure of old channels of trade and the necessity of discovering new ones, which may not only supply their place, but afford encreased (sic) opportunity for disposing of the immense surplus produce of our several branches of manufacturing, and give employment to the rapidly accumulating capital of the country” (p. 8).

It took a further forty years for Greenhow’s vision to be realised in Newcastle; Newcastle University as an entity is itself a recent creation, which came from the granting of an autonomous royal charter to King’s College Durham (Potts, 1997). King’s College was itself created from a merger between Armstrong College, and the Durham Schools of

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3 T. M. Greenhow (1831) “The expediency of establishing an academic institution, of the nature of a college or university, for the promotion of literature and science, more especially amongst the middle classes of the community, briefly considered”, Paper read to the Literature and Philosophical Society of Newcastle upon Tyne, April 5 1831, 13pp. Available in Newcastle University Library Archive.
Medicine and Dentistry in 1937 (Loebl, 2001). The faculties of Agriculture and Engineering were created in the 1871 as Armstrong College in response to particular needs of regional business communities (Chatterton, 1998). The current strengths in marine engineering are a consequence of 150 years of collaboration between the various versions of the university and the shipbuilding industry, and more recently in the 20th century, the chemical engineering department developed strong links as Teesside became a focus for the activities of Imperial Chemical Industries (ICI).

However, despite these apparently auspicious origins, a number of factors reduced active collaboration between the university and its’ industrial partners over the second half of the 20th Century, as outlined in Chapter 4. The role of the North East itself changed, and there was a loss of high-technology R&D functions from the region of the type that could have engaged with the university. As mentioned at some length in the previous chapter, the national framework for science and technology at this time did not encourage regional collaboration. As all intellectual property was owned by a government agency, the National Research and Development Corporation (NRDC, later 3i), and grant funding provided specifically for teaching and research, there were both disincentives to and a lack of rewards for, pursuing regional economic activities. Moreover, the policies of the university itself, such as they were, did not encourage academics to engage with industry. However, there was some interest within the university in regional engagement at this time, but not in a co-ordinated manner. Despite this lack of focus on regional engagement, some local firms built strong links with universities and became adept at exploiting their technological advances (Benneworth, 2001a). As the founder of one such company, Herbert Loebl, was to write,

“In 1953, Joyce-Loebl undertook its first licensing agreement, with the [Durham] Medical School [i.e. Newcastle University]. We engaged undergraduates from the university, most of our scientific instruments were first tried out in the University, and we sold some to the University. We also received technical advice from members of staff” (p. 233).
5.1 The changing regional policy environment

By 1989, however, there was some concern that this lack of oversight had allowed these beneficial activities to drift to the point where there were clear costs to the region in not exploiting the universities’ strengths. The North East by this point was emerging from a particularly difficult period in its’ industrial evolution; the harsh recession of 1980-81 coupled with an unwillingness of the Government to support regional industries and a particularly misguided enterprise policy had created a huge problem of unemployment (Greene et al, 2004). The Government’s solution to this policy issue was two-fold, to try to remediate the worst of the unemployment through the attraction of new inward investment projects, and to deal with the physical debris left by this deindustrialisation through the creation of the Urban Regeneration Corporations.

The key issue with this central government response is that it was primarily an amelioratory response, rather than attempting to sow the seeds of new growth in the region. This created something of a regional vacuum for growth-promoting activities, and the universities began to play something of a regional role because of their possession of such potentially economically valuable assets around high technology activities. Subsequently, the 1980s saw a number of activities which led to attempts to increase the formal role of regional engagement by Newcastle University. This process latterly became tied up with an emerging regional agenda for universities to engage with ‘their’ regions. The North East universities were at the forefront of policies to support regional development. This fitted very well with Newcastle University’s pre-existing orientation towards commercial engagement as an applied engineering university (so-called redbrick) with strong links to industry.

5.1.1 The first phase of this new regional engagement

In the 1980s, there was a slow gathering momentum of the regional agenda in the North East, as the universities slowly began to work with each other in ways that would later become a model for all the English regions (CVCP, 1994). Higher Education Support for Industry in the North (HESIN) was created by the five regional universities in 1984 as an attempt to create a single gateway for firms to access university services. This first service offered by HESIN faltered to some extent because of the lack of resources to
ensure that queries met respondents in the universities willing to listen, and then help
them deal with their problems (Benneworth 1999). The first real initiative of substance
achieved by HESIN was to create a single framework for continuing professional
development for engineers; HESIN bid to the research council responsible for
engineering (SERC) to run such a programme in the North East, and they were granted
this, and also they changed their statutes to allow themselves to confer joint degrees. As
a SERC initiative, the DTI did not penalise the universities for accessing this funding;
however, the initiative quickly ran its course, the potential pool of recruits was exhausted,
and consequently the universities ended the programme. HESIN was not particularly
well-funded, and was run for several years by one individual who managed to access
various European regional development initiatives, without ever building very much
beyond those particular initiatives4. That is not to say that HESIN did not have its uses,
and was engaged by the regional development community as a regional asset; given the
emphasis from the 1960s onwards amongst regional policy makers in promoting inwards
investment, it is unsurprising that the universities became enrolled in supporting this
process. As one interviewee on a former project put it …

“[The Northern Development Corporation] used HESIN whenever they needed to
put some clever bastard in front of the inward investor to prove that there was
specialist knowledge in the North East”5

The universities comprising HESIN gradually awakened to the idea of regional
engagement. When the Department of Trade and Industry changed the funding rules in
1995 for European Structural Funds, making ERDF supplemental rather than substitutive
- the idea of properly funded and permanent regional activities seemed to be a greater
possibility. Before that time, universities who went to the trouble of accessing these
funds experienced a direct, pound-for-pound reduction in their core grant, making them
worthless as sources of corporate investment. Consequently, universities tended to

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4 Much of this section is based on research undertaken in the framework of a previous project in 1999; this
involved 9 interviews with university employees active in regional development as well as regional

5 From note of interview 05/11/99

stakeholders.

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involve themselves in projects for which they did not receive direct funding, which led to the activities being regarded as outside the core concern of the university. These changes also provided resources to run a more properly funded set of regional activities and in particular for a permanently established organisation such as HESIN. The first initiative to be proposed with the revised funding regime was called “Knowledge House” (in its first incarnation). Although very different to its current form, it was created to act as a knowledge bridge between industry and academics, which ensured that SMEs received a response to their enquiries, providing some seed funding to stimulate academics to involve themselves. As one university senior manager noted, it had a very simply philosophy.

“It was based on the idea that if an SME rang a university and said they were from Scrotum Manufacturing, and were looking for some way to stick cardboard to steel, they would get nowhere. They would get a very courteous academic who would put them through to someone they thought might know about it, and then after a number of attempts to transfer the individual through the system, they would fall prey to an electric glitch and fall into an electronic black hole. There was no way forward from this, unless you were to put a lot of numbers in the phone book, but for SMEs to use those numbers properly, they would have to understand how the universities worked, so what they really needed was a sign-posting service.”

The consequence of the fact that it was funded from a regional fund meant that all the universities had to be involved with it, rather than representing a single university technology transfer mechanism. A second initiative was the “Three Rivers strategy”, named after the three principle waterways in the region, the Tyne, the Wear and the Tees (cf. Potts, 1998). The idea was that a technology centre to exploit university knowledge would be created in each of the three localities. All three still exist in some form but the

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6 From note of interview 02/11/99
links with the universities are perhaps less than anticipated in 1995/6. All of these activities were funded by the ERDF, but not at the kind of levels that ensured the sustainability of the programmes; consequently, these activities were permanently engaged in seeking continuation funding, which undermined the perception that potential users had of those organisations. Fraser (1999), for example, sets out the problems that the European Process Industry Competitiveness Centre (EPICC) on Teesside faced, despite a seven year grant to support its existence, leading to its’ incorporation in 2002 into one of the five regional extra-university Centres of Excellence as part of the regional science strategy.

Shortly after its inception, in the subsequent funding round, the local Government Office in the North East demanded that universities no longer propose projects as individual universities, but to co-ordinate the bids amongst themselves. HESIN had had been run as a meeting of Pro Vice Chancellors, university senior managers, and predominantly of those with responsibilities for regional engagement. The new demand that they speak with one voice meant that HESIN could not provide that voice, because a single voice, rather than collective action, demanded agreement between the universities’ chief executives, the Vice Chancellors. A lengthy period of negotiations followed in which several things became clear. The most significant of these was that following an election in 1997, the new left-of-centre Government was intent on creating a new set of regional

7 The Teesside Centre, the European Process Industries Control Centre (EPICC) still exists today and works closely with the Process Industry Centre of Excellence (qv); The Wearside node, the European Centre for … evolved into the Institute for Automotive and Manufacturing Advanced Practise. The Tyne Centre, The European Centre for Advanced Industries, was originally conceived as a place to host clusters in pipeline engineering and marine technologies, but was reoriented towards semi-conductors, with the arrival of Siemens, and some of its purpose has been restored with the reopening of the Siemens facility. The centre which has retained closest links with the university is the Resource Centre for Industrial Design and European Design Centre at Newcastle University, but this was never part of the Three Rivers Strategy. Or, as Lagendijk (1999) put it (p. 200)

“Initially, there was the intention to establish a ‘low-volume’ engineering centre of excellence on the northern bank of the Tyne (ECAI), as part of the ‘Three rivers strategy’, complementing the ‘high volume’ centre on the bank of the Wear (CAMM) and the process-oriented centre on bank of the Tees (EPICC). ECAI, the European Centre for Advanced Industries, was initially seen as providing, among other activities associated with marine engineering, a new home for the RSC and various clusters. ECAI was presented as a flagship regeneration project on the north bank of the Tyne symbolising the striving for economic renewal in the area. However, when Siemens announced its massive investment in a silicon chips factory on Tyneside, ECAI was ‘hijacked’ and renamed as the North East Microelectronics Institute - Centre for Advanced Industries (NEMI-CAI).”
development institutions. This suggested that it could potentially be greatly beneficial to the universities if they had their own regional association to deal with the new regional development agency.

5.1.2 North-eastern universities and the new English regional agenda

“Universities for the North East” was created in April 1999, almost exactly at the same time of the official launch of the Regional Development Agencies (Benneworth, 2001). This was enormously beneficial for regional engagement, because the first main tasks for the newly created RDAs was to draw up regional economic strategies for their regions. Given the relative poverty of the North East in comparison with other parts of the country, and the absence of good regional ‘success stories’ for economic development policy, the universities were one of a relatively select group of regional actors with genuinely global scope and who were internationally competitive. This was reflected in the emphasis which the strategy placed on universities, and in the final strategy, launched in November 1999, the fourth out of six themes to the strategy was “Placing universities and colleges at the heart of the region”, on a par with regeneration, creating employment and increasing the regional enterprise culture. This relationship developed and in the revised strategy, completed in 2002, universities remained with their own theme, “Recognising our Universities and Colleges at the heart of the region’s economy”.

A second element was that the newly formed organisation began building up its’ own capacity to deliver particular outcomes and creating what could be described as “regional added value”8. Although the Vice Chancellors led the organisation, much of the work was undertaken by its’ various committees, which covered both the purposes of universities (teaching, research and the so-called ‘third strand’) and special purpose committees which worked where there was value-added in collaboration to address common issues. There was a committee, for example, which provided a single point of contact in the development of the final (unsuccessful) bid for City of Culture in 2003. A range of activities were developed, exemplified creating a regional music degree pathway

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8 Interview 01/12/03
for talented students linking with the new Sage music centre. The idea was one of ‘critical mass’, addressing the peripherality and small size of the region by bringing the universities together to act as one. In the case of the music degree, the idea was to attract and retain musically talented students by linking them with expertise in different musical genres in the different universities.

A third element of this relationship between the universities, the region and the regional development agency can be seen in the creation of the regional science policy for the region, *Strategy for Success*. This strategy has its origins in the North West, where the threatened closure of a large Government research laboratory in Cheshire stimulated a regional backlash against centralising research around London and the South East. To defuse these tensions, additional funds were provided to regional science actors in the North West, and a report was commissioned from a science consultancy, Arthur D Little. The success of the North West stimulated the North East to respond, and they likewise commissioned a report from the ADL consultants (Charles et al, 2003). However, in the North West the problem was one of weak bridges between universities and industry and the absence of Government research laboratories, whilst in the North East, the main problem for university commercialisation activity was that the user community for science was relatively weak (Benneworth, 2004).

What emerged from the consultancy exercise in the North East was a proposal to create five new centres of excellence in five scientific areas in which the North East had a world-class technological base, and to use these new centres to stimulate user demand as well as act as a bridge between science and industry. One NorthEast decided that the fundamental problems afflicting the region, low rates of enterprise and growth and weak employment could not be addressed without finding a place for the region in the new knowledge economy. They therefore decided to invest heavily in this programme, directing £200m over 5 years to the project. However, the bulk of this money was to be

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9 This was the subject of a previous ESRC Project managed by Beth Perry at SURF, Salford University. ‘Making science history’: the regionalisation of science policy? Award Number: L144 25004. More information on this project is available at [http://www.surf.salford.ac.uk/TerritorialKnowledge/MakingScienceHistory.htm](http://www.surf.salford.ac.uk/TerritorialKnowledge/MakingScienceHistory.htm)
invested in the centres of excellence with only very limited funding made available to the regional universities. Thus although universities might have featured prominently in the rhetoric of the RDA, it was less clear to what extent the RDAs were in reality willing to fund the universities’ activities.

*Figure 2 The schematic outline of the strategy for success, and the role of the regional universities, 2001*

5.2 The new regional engagement at Newcastle University

Within Newcastle University itself, as was previously noted, individuals were involved with local firms and organisations throughout the post-war period, although there was no strategy for engagement. Potts (1998) in Chapter 5 of his Ph.D. thesis, provides a detailed overview of the history of the engagement of Newcastle University with local industry. Potts highlights that the period 1945-1970 was a period of vacillation by policy-makers and university staff, and the formation of the Industrial Design Unit in 1970 was the first real attempt to co-ordinate central activities for the benefit of industry. However, he also notes that in the departments he studied, there were much stronger informal links between the university and industry, mediated through the departments,
firms and industrial associations, including the North East’s only industry research association, the British Shipbuilding Research Association (Buswell & Lewis, 1970). There were a variety of attempts by both policymakers and the university managers to formalise this regional engagement, but it had not been successful. There was an attempt to create a ‘Science City’ in Peterlee, according to Potts (1998), with close links to the university computer science department. When this failed in the late 1970s, the next proposal was for a Newcastle Technology Centre, strongly encouraged by W. Reay Atkinson in the Regional Office of the DTI.

The history of the Newcastle Technology Centre is an interesting one, because it is an example of what Vestergaard calls (2004) “The Newcastle Model” in action, using the research base within Newcastle University to inform policy decisions. Loebl (2001) notes that the original idea for the Newcastle Technology Centre arose from a paper written by Alfred Thwaites, at the time a researcher within CURDS. Although Loebl is very critical of what emerged, the original proposal was an attempt to create an office to make existing university activities more accessible to small firms, such as the Micro-Electronics Applications Research Institute (MARI) and the Mechanical Engineering Design Unit. The Newcastle Technology Centre was separate from the main university, and a number of the older spin-offs in this research project mentioned that they had had some contemporaneous involvement with it. The NTC was involved in providing basic support services like market research and business planning advice.

An unforeseen consequence of the existence of the NTC was that it in turn provided the rationale for the implicit university policy of benign neglect, in which firms emerged, “escaping from the university”, “despite rather than because of university policies”. Loebl and Potts tell similar stories about the decline of the NTC, that it failed to have sufficient impact and in particular was unsuccessful in getting technologies out from the

10 “Proposal for a Newcastle Technical Centre” was a discussion paper written by Alfred Thwaites; his archive on the establishment of the centre is currently in our possession.

11 Forms of these words were regularly used by the interviewees, in the older companies as well as the new technology transfer community within the university to describe the policy of benign neglect.

12 Although they are not independent; Loebl’s discussions with Potts formed part of a process whereby Loebl was gathering his thoughts for completing the manuscript for his own memoirs, Loebl (2001).
university. The failure of NTC in 1989 therefore removed this rationale for the university to take no action, and so it was in direct response to the failure of the Technology Centre that NUVentures was created, the next attempt or commercialisation regime within the university (Loebl, 2001).

“In the summer of 1989, the University asked Mr. Whitworth, a retired industrialist, to examine whether it would make sense to establish its own technology licensing organisation … As a result of his report, NUVentures Ltd was established to exploit the University’s discoveries and innovations” (p. 288).

NUVentures therefore became the de facto guardian of intellectual property in the university, and at that time, a number of companies were formed which have survived in some form to this day. As part of this, the University was involved in creating the Quantum investment fund (Potts, 1997). The university placed £½m into this fund, along with similar funds from local companies, to invest in university spin-off companies. As trading company shares was outside the permitted activities of the university as an educational charity, a specific company was set up for the purpose, which is what NUVentures was, and this received both university and central government support (Potts, 1997). This was ultimately an unsuccessful venture, and following a number of problems relating to the relationship between the university, potential entrepreneurs and their host departments, NUVentures was substantially changed, with a new manager appointed to focus on licensing technologies to large companies with the resources to pay for them.

Alongside this development of the regional agenda implicit in attempting to increase commercial engagement, a parallel and very significant step in the development of the regional agenda at an institutional level came with the appointment of Professor Andrew Hamnett to the role of Pro Vice Chancellor (Research). Hamnett had arrived in 1989 from Oxford to a chair in Inorganic Chemistry, and was rapidly promoted to the PVC (Research) position. In the governance system at the time, there were two Pro Vice Chancellors, responsible for Teaching and Research respectively, subordinate to the Vice Chancellor, the Chief Executive of the university. Although the position did not formally stipulate that the PVC was responsible for regional engagement, his own background was
on the research on fuel cells, something with a strong industrial orientation, and he was interested in commercial engagement and the regional agenda. Consequently he began to assume a greater interest in so-called ‘third strand’ activities alongside his formal research remit; as Potts (1997) points out, his fellow PVC Teaching was formally responsible for, but less interested in, the regional engagement dimensions of teaching. The experience of HESIN was that the university was remarkably positive, almost naively so, about regional engagement. Some resistance was to arise later, but within the context of increased pressures to perform research to maximise performance in the Research Assessment Exercise.

5.3 Building a regional engagement mission (1995-2001)

In 1996, the next step was taken to institutionalise this regional engagement issue with the appointment of a Regional Development Officer (RDOs), something which was relatively uncommon within universities in the UK at the time, although much more commonplace amongst US universities following the passage of the Bayh-Dole Act. The appointee, John Dersley, came from a civil service background, and was appointed at a time when there were few other RDOs there were in the UK, something he experienced when he attempted to define his role by contacting others with similar responsibilities elsewhere in the UK system. In parallel with the creation of the regional development office, the remnants of NUVentures had evolved into an entirely separate organisation within the university, the Technology Transfer Office, under the control of the titular head of NUVentures, with three operational officers. The role of this technology transfer office was to seek the best routes for the commercialisation of technologies, but which, because of the aversion to spin-offs, tended to focus on licensing to large companies. As one individual interviewed in this research noted:-

“The thrust was to be licensing … looking for technologies, and seeking routes to license them to big companies, preferably companies with capitalisation at least the size of the university”\textsuperscript{13}.

\textsuperscript{13} Interview 11/03/04; the significance of this comment becomes apparent later on.
In parallel with this, Newcastle was beginning to develop a research competence in the field of universities and regional development, building on the research activity which had led to the development of the admittedly ill-starred Technology Centre. The Committee of Vice Chancellors and Principals (CVCP), the national group representing universities through their vice chancellors, commissioned CURDS in 1994 to carry out a piece of research, *Universities and their Communities*. This high profile report was the first substantial contribution to a growing realisation in the UK that universities had a significant role to play in the development of their regional economies\(^\text{14}\), and led to follow-on work from a range of sources. These sources included the Department for Education and Employment, Government Offices in the South East and North East, and ultimately to the OECD Institutional Management in Higher Education programme. The Professor responsible for this, Professor Goddard, had also in the 1990s been part of attempts by the then-Vice Chancellor to consider non-traditional funding routes, such as “additional places” for students. Goddard had then moved to become a third PVC, responsible for the implementation of an accounting software system in the university.

The real take-off point for the regional development agenda within the university strategy dates to the time when there was a concordance of three forces, Hamnett, a manager committed to the idea, Goddard, a manager supportive of Hamnett and with expertise in the subject, and Dersley, the regional development officer with capacity to initiate and progress regional activities. This development was not entirely endogenous; it was clear there was a growing regional agenda in England from the creation of the Government Offices (prefectures) in 1994, and certainly consolidated following the 1997 election (cf. 5.1.2). Of course it does not make any sense to view those changes in isolation from the creation of Universities for the North East, and the lessons of the HESIN experience. Particularly notable was the immediate shift towards far greater regionalisation of economic development activities in England, with the presumption that this would be

\(^{14}\) The report into the future of higher education which really set the post-enlargement landscape (fees and competition) was commissioned by the last Conservative government under the Chairmanship of Lord Dearing. Lord Dearing was aware of the work that Profir Goddard was doing onto universities and regional development through his chairmanship of the inward investment agency the Northern Development Corporation. Subsequently, a full chapter of the Dearing report (9) was focused on this dimension, and Profir Goddard provided a lengthy written annex for the Inquiry.
followed by political decentralisation. It is perhaps unsurprising that universities would face increasing incentives and pressure to regionalise their activities, or at least become more regionally engaged, but it appears that Newcastle were well advanced in making these changes with respect to some other institutions, and indeed to have institutional capacity, if not total commitment, to this emerging regional agenda. Consequently, as these opportunities arose, what could be considered as the new ‘regional engagement triumverate’ (Hamnett, Goddard, Dersley) were well positioned to respond and exploit them for the benefit of the university.

The first of these schemes emerged from the Department of Trade and Industry, who provided funds through a bidding process for universities to improve their engagement with business and the community (the project was called Higher Education Reach Out to Business and the Community, most often referred to by its acronym of HERO-BAC). HERO-BAC was also significant because it was a grant to all universities, subject to a bidding process to ensure that the bid met quality thresholds and the intentions of the scheme. This was the first in the line of a set of funding streams for university commercialisation at the same time as a general government tendency towards concentrating research funds on funding fewer ‘excellent’ universities, predominantly located in the South East of England.

Although this was not explicitly a regional fund (for example, a North Eastern university could have applied for funds to work more closely with London-based companies), in the case of Newcastle, the decision was taken to apply for funds to promote regional engagement. The Newcastle proposal (qv), submitted on 14th September 1999, had at its core the appointment of four Business Development Managers to co-ordinate the exploitation of knowledge within the university. When the results were announced on 30th November 1999, Newcastle University had indeed been awarded the full £1.1m for which it had bid, and duly began the process of appointing four business development managers to begin this process of ‘opening up’ the university. Obviously, there was considerable overlap with the existing technology transfer officers within the Technology Transfer Office, and it remained to 2003 for this issue to be properly resolved from an organisational perspective (cf. section 7.1.2).
Recruitment of the BDMs was not a simple process, not least because the university wanted to recruit **senior staff** with the **capacity to involve themselves in strategic change** within the university as well as straightforward commercialisation activities\(^{15}\). Particularly difficult to secure was agreement that the posts would be paid as “ALC 5”, the highest scale open to administrators, library and computing staff. The posts were also difficult to appoint to, and so by late 2000, two were appointed, along with a further two the following summer. It is perhaps worth reiterating that all these changes happened under the old regime of Professor Wright, and many activities were created which were then subsequently mainstreamed.

The focus for the mainstreaming of these activities was a change at the top of university. Around the same time as the arrival of the BDMs, the university appointed a new Vice Chancellor, who arrived from Imperial College of Science and Medicine to improve the fortunes of the university. The appointment was made specifically with a view to strengthening regional engagement as well as international research excellence.

“The University is seeking to appoint a [Vice Chancellor] … as it strives for excellence and the further strengthening of its position as a major high quality research and teaching institution of international, national and regional importance”\(^{16}\).

The analysis of the new senior management team was that there had been a historical pattern of substantial underinvestment in the university, particularly estate and central services, which the current *ad hoc* approaches to regional engagement could not turn around. Restoring the position of the university required creating a permanent internal investment stream within a broader context that new automatic funds from the government were unlikely to substantially increase. At the same time as the BDMs

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\(^{15}\) This becomes significant when thinking about the role of the BDMs within the community of practise, because they had been recruited in such a way that they were almost part of central management in a way that a more free-standing “Industrial Liaison Office” in the Klofsten *et al.* manner might not have been (*cf.* 7.2.3).

\(^{16}\) “University of Newcastle upon Tyne: Office of Vice-Chancellor”, Report from the Joint Committee on the Vice-Chancellorship, Appendix I to Minute of Joint Meeting of Senate and Council, 23 May 2000. Senate Minute120, Council Minute 160.
arrived, and began started to have an impact on commercialisation, the new Vice Chancellor was also implementing a large programme of redundancies, the so-called voluntary severance scheme, in parallel with a significant organisational restructuring of the university. The most two striking features of the new business plan were firstly that it created a 3% headroom fund for future strategic investment, and implemented a huge organisational change, rationalising 7 faculties and 78 departments into 3 faculties and around 30 schools. The aim of the restructuring was to rebuild the university to deliver a new business plan which set targets for the constituent elements of the university, in contrast to the previous business plan which had brought together the various strategies of the university components. The business plan set targets for generation of revenue from ‘third stream’ i.e. Commercialisation funding, and for the creation of spin-off firms. The purpose for this was to ensure that there was a 3% fund which could usefully be reinvested in the areas which had hitherto been neglected, and allow the university to be more proactive about shaping its own future form rather than reacting to particular central government proposals.

The new business development managers therefore found themselves in a very chaotic situation in which to be encouraging staff to establish companies. However, the university’s statistics (cf. figure 3 below) indicate that the BDMs were successful in raising the level of commercialisation activity. What was also serendipitous was that in 2001, a spin-out company from the ‘benign neglect’ period of the late 1980s, in which the university had a 15% shareholding, was bought out by an Australian collaborator, realising £6m at the same time that the university faced a £6m deficit. This ensured that the restructuring deficit did not precipitate emergency financial measures, although the funds so raised were hypothecated for investment programmes. A bid to the successor programme to HERO-BC programme, the Higher Education Innovation Fund (HEIF), in 2001, was unsuccessful, in part because it had been organised as a regional bid, trying to

17 As one Dutch interviewee pointed out, universities in the UK as much as the Netherlands do not run on expectations announcements but on cash in the bank, so a deficit can be an immediate and grave problem for a university. By preventing the university having to begin emergency measures, the deficit could be managed without precluding using the £6m from being invested productively, which is what happened in this case.
reconcile the divergent interests of two research-intensive and three teaching-intensive universities. The university did successfully bid for and receive funds under HEIF 2, the successor for HEIF, in a bid that developed the BDM roles and devolved them to the faculties (cf. 7.3.3).

The final element of the development of innovation services to the time of this research came with the reorganisation of all those central elements responsible for business development. There had been some hybridisation and cross-fertilisation between the business development managers and the technology transfer office before 2003, when they were moved into a single office (cf. 7.2.3). The BDMs had provided Newcastle University’s input into the North East Centre for Scientific Enterprise, which was a TTO responsibility; likewise, when there were staff shortages within the BDM team, then the technology transfer officers involved themselves in supporting the BDM roles. It was clear that there was both the opportunity and potential to rationalise the activities, and the university convened a group to explore the issues involved. One of the outcomes from that group was the decision to appoint a senior member of staff to take responsibility for all business development and commercialisation activity in the university. Dr. Robertson was appointed to this position in 2003, and began to build the Business Development Directorate out of the various teams with cognate responsibilities across the university. The arrival of Robertson was the final element in the development of the university’s commercialisation services by the time of the research (spring/summer 2004).

5.4 The 2004 Newcastle University commercialisation context

Having set out a brief recent history of Newcastle University’s commercialisation activities, it is worth perhaps saying a little about the state of those activities at the time of the research (March-July 2004). At the time of the research, commercialisation activities were at something of a high water mark, with the appointment of the new director, and the creation of a single directorate for all the commercialisation activities. The university had received plaudits in 2003 for the fact that it had the highest income from spin-off companies, due to the sale of Novocastra, from which the university had received around £6m. The new BDD website suggested that there was a qualitative increase in the number of companies formed in response to the changes initiated since
1996. Figure 3 below charts the rise of spin-offs at Newcastle University as recorded in the BDD website.

*Figure 3 The number of spin-offs from Newcastle University as recorded on the BDD website, 2004*

The table on the website is not complete for a number of reasons, not least because of the benign neglect shown by the university towards its spin-out companies prior to the 1990s meaning that it was not aware of all those companies which had formed during the 1990s. Consequently, the chart does not show any of the failures that happened during the NUVentures period. Also, a number of companies are omitted from the list because of a breakdown in their relationships with the university; these companies have been captured in work such as Potts (1997) and Benneworth & Dawley (2002). In the study, although we have managed to interview one failed company, Epitope Custom Peptides, which we included in the study, we did not seek to go after companies which no longer had good relationships with the university. Table 2 below gives some outline details of the companies which are included in this study, their date of formation, the academic founder and the first manager (cf.. 6.1.3)
Table 2  The spin-off companies interviewed in this study

<table>
<thead>
<tr>
<th>Company</th>
<th>Date</th>
<th>Academic Founder</th>
<th>Department</th>
<th>First manager</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seabait</td>
<td>1986</td>
<td>Peter Olive</td>
<td>Marine Science</td>
<td>Peter Cowin</td>
</tr>
<tr>
<td>Novacastra</td>
<td>1989</td>
<td>Wilson Horne</td>
<td>Pathology</td>
<td>Ian Milton</td>
</tr>
<tr>
<td>Epitope CP</td>
<td>1991</td>
<td>Ian Corbett</td>
<td>Pathology</td>
<td>Lynne Scott</td>
</tr>
<tr>
<td>NUWater</td>
<td>1993</td>
<td>Paul Younger a</td>
<td>Civil Engineering</td>
<td>Alan Lowdon</td>
</tr>
<tr>
<td>Xcellsyz</td>
<td>2000</td>
<td>Steve Yeaman</td>
<td>Biochemistry</td>
<td>Reza Halse</td>
</tr>
<tr>
<td>Bioprofiles</td>
<td>2001</td>
<td>Kirsten Woolf</td>
<td>Biology</td>
<td>Marie Hale</td>
</tr>
<tr>
<td>Arjuna</td>
<td>2002</td>
<td>Santosh Shrivast a</td>
<td>Computer Science</td>
<td>Steve Caughey</td>
</tr>
<tr>
<td>Envision LLP</td>
<td>2002</td>
<td>***</td>
<td>Marine Sciences</td>
<td>Bob Foster Smith</td>
</tr>
<tr>
<td>Hale Stephenson</td>
<td>2002</td>
<td>Jack Hale</td>
<td>Mechanical Eng</td>
<td>Robin Stephenson</td>
</tr>
<tr>
<td>Newchem</td>
<td>2002</td>
<td>Goulding</td>
<td>Chemistry</td>
<td>Bob Tyson</td>
</tr>
<tr>
<td>Orla</td>
<td>2002</td>
<td>Jeremy Lakey</td>
<td>Biochemistry</td>
<td>Dale Athey</td>
</tr>
<tr>
<td>Viratom</td>
<td>2002</td>
<td>Geoff Toms</td>
<td>Pathology</td>
<td>***</td>
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<tr>
<td>Biofresh</td>
<td>2003</td>
<td>Jeremy Barnes</td>
<td>Biology</td>
<td>Phil Harley</td>
</tr>
<tr>
<td>SCHIN</td>
<td>2003</td>
<td>***</td>
<td>***</td>
<td>Ian Purves</td>
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</tbody>
</table>

Spin-outs were an important element of the way that Newcastle University viewed its research valourisation. Figure 4 below shows a web-page from the university web site in March 2005, which is intended to encourage firms to want to collaborate with the university. The activities mentioned in figure 4 will become recurrent themes within this report as activities in which Newcastle University was very proud during the period of the research. Figure 4 also implicitly carries the university management narrative towards spin-out companies, which is the argument that commercial benefits are a consequence of both an active commercialisation infrastructure as well as high quality research in the university.
A second factor was the university estate was being re-planned to consolidate activities around the three new faculties, and the master planning was starting to reshape the estate. The new Devonshire Building had just been opened, to bring together all researchers in the field of Environmental and Sustainability research across social sciences and engineering, whilst engineering consultancy services had been consolidated in the Stephenson Building. The MEDSPAN project was already underway, in which the medical activities adjacent to the Royal Victoria Infirmary site were being rehoused on the same site, but within new and refurbished buildings. There were plans already well advanced for the development of new sites to hold new research and commercialisation.
activities, including the so-called “CultureLab” site for promoting commercialisation and entrepreneurship in the areas of culture and digital media. The concept for the master planning of the estate was to concentrate activities in three faculty areas, linked through shared facilities which encouraged movement into and within the university; the concept is shown in figure 4 below.

Figure 2 The concept map for Newcastle University Master Plan, 2002

The third issue was that there was a significant organisational infrastructure supporting the new commercialisation activities. The university had placed regional engagement and commercialisation as a central part of its strategy, and all three faculties had been set targets for raising revenue from third stream activities. This was set in the high level objectives in the business plan, including “to produce a more entrepreneurial environment with much clearer incentives for income generation; …to enable us to engage with the city and region at the appropriate level with the services that are in demand and to
contribute to the strengthening of the North East of England”\(^{18}\). The Business Plan also included a specific section (3.3) on Third Strand Activity, giving it some parity with the teaching and research sections (3.1, 3.2). Each faculty was set a target for increasing third strand income during the planning period, and given specific areas on which to focus, with HASS focusing on student fees, and both Medical Sciences and SAgE prioritising consultancy.

As part of this, the reorganisation of the university had produced a significant commercialisation support infrastructure, including:-

- Business Development Directorate: this was a central service responsible for the co-ordination and control of business and regional development activities in the region, directed by Dr. Douglas Robertson, and with 57 staff. This included
  - Regional Development Office: responsible for co-ordinating relationships with regional partners and the drafting of bids for external engagement funds.
  - Business Development Managers: there were three of these for Engineering, Humanities/ Social Sciences and IT.
  - Technology Transfer Officers: responsible for managing licensing and use of technologies, licensing to large firms or spin-offs.
  - The Equity Committee: chaired by Richard Maudsley, this group was responsible for considering business plans prepared by academics seeking to use university IP in spinning of a company, in return for a stake in the company.
  - The Research Beehive: a formal infrastructure for technology transfer activities, housing the business development team, but also with space available for short-term placements of cross-functional and multi-disciplinary teams.

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\(^{18}\) University of Newcastle Business Plan (2002), p. 15
The Institute for Nanotechnology Exploitation (INEX): a research and incubator facility funding with Government and European funds for the commercialisation of nanotechnology through product-market research work, technology transfer and spin-offs; this also functions more generally as a University Innovation Centre.

The Research Institutes: each of the three faculties designated ‘Research Institutes’ in which to concentrate research activity and resources, and to create simpler faculty administrative research structures (see table x below).

*Table 3 The Research Institutes at Newcastle University, 2004, by Faculty*

<table>
<thead>
<tr>
<th>Arts, Humanities, Social Sciences</th>
<th>Medical Sciences</th>
<th>Science, Agriculture, Engineering</th>
</tr>
</thead>
<tbody>
<tr>
<td>Newcastle Institute for the Arts, Social Sciences and Humanities</td>
<td>The Institute for Ageing and Health</td>
<td>The Informatics Research Institute</td>
</tr>
<tr>
<td>The Institute of Policy and Practice</td>
<td>Institute for Cell and Molecular Biosciences</td>
<td>The Institute for Nanoscale Science and Technology</td>
</tr>
<tr>
<td>Institute for Research on Environment and Sustainability (with SAgE)</td>
<td>The Institute of Human Genetics</td>
<td></td>
</tr>
<tr>
<td></td>
<td>The Institute of Neuroscience</td>
<td>The Northern Institute for Cancer Research</td>
</tr>
</tbody>
</table>
6 University spin-outs building a territorial knowledge pool

In the model proposed in chapter two, we identified that the ‘knowledge pool’ effect appeared to be the main mechanism whereby regional territorial advantage was built by spin-offs companies. Although the literature review suggested that there were other important mechanisms by which the ‘pool’ was built, developed and sustained, at the heart of our model is the idea of this ‘pool’. The basic idea is that the process of spinning off a company makes the university better at working with other companies, and hence makes the university more competent at working with these firms. It is possible to envisage a range of mechanisms by which this would occur, such as the professionals or academics being involved with spin-offs becoming more commercially minded, or the improvement of technology transfer institutions, projects and routines within the university. In this chapter, we look in more detail at the process of building a territorial knowledge pool, and the operation of those mechanisms. The conceptual basis of the pool begins from the assumption that spin-off activity contributes to building particular shared territorial innovation assets which are more readily available than previously. Because the North East of England is a poor environment for innovation and entrepreneurship, this would –if true – constitute an improvement in the overall regional economic situation.

In this chapter, we begin by considering who are the key actors in the process of spinning off, and how the particular activities they undertake become ‘regularised’ into ‘assets’ which can be used more repeatedly by others. We then consider the nature of the general assets which are produced at a regional level, and the extent to which these things are genuinely ‘regional’, in being more open and accessible. We in particular problematise the basic mechanism outlined above, and highlight some of the key issues which seem to be affecting the operation of the knowledge pool in the North East of England. We then conclude the chapter with a more general discussion of how the spin-off process is directly contributing to a densification of the territorial innovation environment.
6.1 **The key actors in the knowledge pool**

In this research, we are concerned in the kinds of knowledge which are rooted in particular places, and have some kind of ‘stickiness’ which allows them to become the basis for particular innovative and competitive businesses. This concept of knowledge is as a very tacit form of knowledge, incorporating a great deal of know-how, know-who, and learning by doing, to situate knowledges in particular places, and to increase the access and uptake of the knowledges – codified and tacit – held within universities. Tacit knowledge and know-how are embodied in particular individuals, so as a first step in the analysis of the knowledge pool we turn to look at the individuals who participated in technology transfer activities in which spin-offs were significant elements. There were four main groups involved in this process, the technology transfer professionals, entrepreneurial research staff in the university, professional managers within spin-offs and third party firms seeking access to knowledge. In this section, we analyse their participation in the knowledge pool as distinctive groups.

6.1.1 **Business Development Managers & technology transfer officers**

At the time of the research, there had been significant attempts to integrate the various professionals involved in technology transfer into a single structure within the office, although the roles were separately demarked, with TTOs focusing on IP management, and the BDMs on deal flow for equity activities (*cf.* 7.1.2). The individuals involved tended to feel that they were, certainly informally, well-integrated and to some extent interchangeable. One of them, for example, remarked that a potential entrepreneur had tried to play off a BDM against a TTO, but because the two groups communicated effectively and informally with each other, that particular attempt had failed. Thus, when we talk of Business Development staff or managers, we are referring to this extended group of BDMs and TTOs, numbering in total seven, but for a variety of reasons, considerably less at some points in time. Using the larger business development group also has the advantage of beginning to anonymise the accounts given by particular interviewees.

The main role of the Business Development staff was in providing services for spinning off, both to people thinking about spin-offs as well as to firms seeking access to expertise
in the university. Although there was a division of labour between the team, there were certain core tasks that all performed. Firstly, all were a first point of contact for academics interested in commercialisation; each had a particular set of disciplinary areas, generally corresponding to a faculty area, and they were also responsible for raising interest in entrepreneurship amongst university staff. This dual role translated into the second set of activities; they got involved with the presentation of ideas to the Equity Committee (qv), and in negotiating with the university about the ‘deal’ – the exchange of IP for equity. In this area, they performed two distinct roles, which at different times sat uneasily alongside each other.

- Firstly, they were responsible for negotiating on behalf of the university when the academic entrepreneur wrote the Heads of Agreement with the university and the subsequent licensing deal, to ensure the university was properly represented.

- Secondly, because of the way that the technology transfer process worked, they retained a mentoring/ ‘hand-holding’ relationship with the academics, encouraging them to persevere through a set of systems which were often very frustrating for particular academics.

As one BDM noted, success in spinning out a company for a BDM involved

“getting to know the academic and an academic team to the point where they trust you to hold their confidence, whilst bearing in mind the fact you have a duty to the university, as employer”.

However, there were people who were spoken to who felt that this dual position compromised the value of the business development staff, or at least it hindered the staff working to their full potential. As one spin-off noted:-

“in the beginning, we couldn’t really place the manager, I think it depended on what they told him from above, I think. It was very changeable, and then later, let’s say the last … 2 years he has been much more helpful, and much more friendly. At least, two years ago, he said well, we’ve had enough of this, just go ahead and do it, and just write something on paper, put it on paper - a page,
whatever- just have an agreement with your head of school, and we won’t bother you if you won’t bother us”.

Within this dual role, there were clear differences in the way the individuals found a balance between those two positions. This did reflect both their own interests, but also the original positions to which they had originally been appointed. Each came from very different backgrounds and each of their experiences influenced what they brought to the particular job; all had had extensive business expertise, and three of them had run their own company. One member of staff had run an engineering company previously for which he had won a number of SMART awards, small government grants which subsidise small firm R&D activities. He was also active in helping university spin-off firms write SMART awards, and a number of the firms with whom he worked developed SMART awards in concert with him. Another BDM had spun-out a business unit from an existing company, and had much greater experience of running a large business; his focus was on trying to get potential entrepreneurs to think of what a potential operating business would be rather than simply planning a set of incremental steps from where they currently were. Their positions within this group were not fixed, and indeed, the group had a relatively high turnover; one BDM was recruited but left shortly after appointment, and another BDM undertook a couple of secondments during the life of the HERO project. A third BDM had just left before the research began, to run the start-up company that he had worked on establishing with the academic.

Part of the differences in behaviour within the team reflected the best routes to market for each of the types of technology. It was recognised by the team members that the appropriate routes to market varied by sector. With medical technologies, there were much greater opportunities to protect IP and then license that to a company or spin-out. By contrast, engineering depended both on an effective solution but also the speed to market of that solution, so IP was not as important to them. With IT and computer software, there were very few effective routes for IP protection because of the weakness of copyright protection, which meant that know-how was most important, which in turn meant that it was much harder to protect the university’s position.
There was also a change in the status of the various members, starting the year before the research began. The BDMs had originally been brought in to bring a set of fresh perspectives on commercialisation, but that capacity had quickly been exhausted, and they found themselves becoming bogged down in various activities which were in some ways quite remote from the strategic culture changing role for which they had been introduced. In part this was because the turnover of staff within the team meant that they were having to cover for each other, but also because they were fully funded, regional development agencies and the university administration were drawing on them as capacity to deal with liaison with the local development agency and city council. This change in role was recognised by the university and reflected in the way the university bid for follow-on funding from the HEIF (Higher Education Investment Fund) 2 fund. When a second set of BDMs were bid for (and won), within the HEIF 2 project, the university decided that their focus would be operational, and created the positions within the faculties and research institutes rather than being attached to the central organisation (cf. 7.3.3).

6.1.2 Professors and other entrepreneurial employees

The second group active within the knowledge pool were those university academic and research staff who were involved with spin-outs, but in a part-time capacity, retaining also their position within the university. This was generally only possible when the individual had a permanent academic position; research staff on fixed term contracts tended to leave the university to set up their firms (2/14), but with the professors and senior academic staff, in a majority of the cases, they were able to use the commercialisation activities to produce benefits for themselves and the university. Of course, the benefit to the university was largely in the form of retaining high quality staff members who were able to oversee somewhat autonomous research units with a steady throughput of students, post-docs, projects and papers. To some extent, these activities (commercial and university research group) overlapped, although the university’s aim was to ensure that the firms did not free-ride on university facilities and infrastructure, without being concerned if the university was deriving similar free-riding benefits from the commercial activities undertaken within this extended research group. Many of the
firms did pay money into the university to perform research and consultancy for them, and by the time this research study was being done, the university was assiduous in levying a 105% overhead on that contract work to ensure that the university was not exploited by its’ spin-offs for private gain.

The precise nature of the dual roles of academic and research manager depended on the importance of R&D, and in particular, academic research to the company. For biotechnology companies, the role of the professor tended to be as a scientific director, as an essential part of the team within the company, and to whom the venture capitalists were looking as a key part of the future value of the company. With the biotechnology sector, in many cases there was a need for academic research to prove the validity of ideas and establish the therapeutic or diagnostic value of particular innovations, and so in some cases the firms retained academic staff to undertake research work which helped to validate the technologies developed in the particular companies. In the engineering sector, by comparison, the role of permanent staff was more as an employee or associate, having the capacity to do the research work, or to arrange the work to be done within the university’s research group. In the software sector, the firms tended to be formed of full teams which left the university at the end of a project or in response to some other stimulus; as the teams had been responsible for developing the software, they retained much looser links back to the professors, much more around informal network and exchange of ideas than either providing them with blue-skies research or work capability.

6.1.3 Professional Managers

The use of professional management did vary between the companies, although most of the companies employed someone with a responsibility to run the business. The businesses tended not to be run entirely within the university, except at the early stage in their lives, when they were just informal consultancy activities. There were a number of companies who had established themselves by just being shells, and winning work, then paying the university to do it, including the 105% overhead by that time insisted on by the university. However, academics tended to find that a wearisome approach, not least because each piece of work had to be dealt with them as a special and one-off project each time they won new work; they would have to negotiate with colleagues, research
staff and students, and then themselves be liable for the successful completion of the work. Consequently, there was a tendency to try to recruit professional managers who could deal with a ‘base load’ of work themselves, possibly recruiting other employees, and then pass on the most lucrative and complex work back to the originating professor as required.

The role of the professional manager tended to be to ensure the commercial viability of the company, which in turn tended to relate much more to the generation of sales and finding new investment – often venture funding – rather than undertaking new commercialisation research. Because of the diversity of activities and styles of innovation in the various spin-out companies around Newcastle, there was no one single model for the use of a professional manager, but there were some similarities. There was very little use of interim or professional managers, that is hiring someone through an agency to establish the company. Consequently, the professional managers which came into the spin-outs were already known to the academic founders. In many cases, they were either researchers or students of the academic founder – out of 14 spin-offs interviewed, 3 were initially managed\(^{19}\) by former students, and three by former post-docs. Interestingly, in two cases, academics recruited people who had previously funded their own research, and who were looking for a change of direction for their own careers. Two companies had recruited business development managers from the university on some kind of basis to do the basic management. In three cases, the firm left the university entirely and so the research leader became the manager. Only in one case did the professor also act as full-time managing director for the company.

6.1.4 Third party businesses

What we will refer to in this report as the ‘third party businesses’ were those that came into contact with the university and drew on the knowledge in the ‘knowledge pool’, that is got involved in commercialisation through contacts through at least one of the three previous groups of actors. In the research, we spoke to five third party businesses, and it

\(^{19}\) This form of words is used because some of the spin-offs interviewed were well-established, and so had been through changes of management.
is clear that their involvement in the knowledge pool was not as simple as previously thought. Certainly, they did not simply ‘dip into’ the pool and take away pieces of discrete knowledge that had been ‘fixed’ in the region by the spinning off process; only one of the five relationships followed this pattern. Their involvement was rather in some cases more complex, and typically, they were already involved with the university, and that became a mechanism for supporting the USOs.

The Business Development Managers were obviously a key mechanism for involving third parties in the knowledge pool, because at least a component of their remit was in marketing expertise within the university to businesses. Unfortunately, that did not result in large numbers of local SMEs getting involved with the university, because of the pressure to concentrate on larger firms, recognising that small (local) firms would not have the resources to license a technology from the university; thus the BDMs tended to be pressurised, albeit informally, to ignore local SMEs and so the informal networks were not built up as perhaps might have originally been anticipated. There were some examples of BDMs building up relationships with local firms, but those tended to be light touch, about understanding the local sector in the region and future potential, rather than transferring lots of technology repeatedly into local firms.

The other interesting difference between what was observed in the case of Newcastle, and what had been expected in terms of the heuristic process was that the USOs tended to draw on the knowledge pools between the university and third party firms in a variety of ways. As the BDMs built up their contacts, they became aware of local innovating SMEs. Consequently, when potential spin-offs (i.e. academics and research staff) came to them looking for local partners, they were able to point them towards the local SMEs. Likewise, such pre-existing relationships between academics and firms were also helpful when those academics were establishing USOs, helping them build their ‘softer’ networks. Just as pre-existing relationships with businesses were useful to a number of firms to find managers, they provided other assets for USOs. One new firm spun-out of an existing large business in the region and to make a clean break with its parent, rented some space in the university, and found itself next to a laboratory hosting another newly formed USO. They decided – as two newly-established micro-businesses – to collaborate on a joint project, and won a SMART award, which helped to capitalise the USO rather
more than the other firm, which had already had had some considerable success in raising venture finance. However, the firm did also benefit by recruiting staff from the university whilst located within the laboratory area, which helped to cement the relationship between the USO and third party. Two of these firms had directly recruited staff through their relationship with the problems, although four of the five also recruited other Newcastle University graduates outwith the direct professorial relationship.

6.2 Processes of participation in the knowledge pool

Each of the various groups outlined above had their own reasons for participating in the knowledge pool, and which stimulated the group in aggregate to function as a broader network, and their network gave rise to regularities in routines and attitudes which could in turn be considered as a territorial activity and even (perhaps stretching the analogy) as a pool. Broadly speaking, the universities were interested in increasing their resources to spend on core activities (mainly research), the spin-offs were interested in accessing assets which helped them as high-technology small firms, and the third party firms were interested in using university expertise and resources to support their own innovation processes. To get a sense of the scale of the activity, and consequently of the magnitude of the knowledge pool, it is worth turning briefly to look at how each of the various groups, the university, the spin-offs and the third party firms, involved themselves in the regional technology transfer activity.

6.2.1 University participation in the knowledge pool

We have already noted that there was a policy of benign neglect in the university’s technology transfer policies in the 1980s and late 1990s, which partly embodied an assumption that commercialisation and spin-off activity was broadly neutral towards the university, or at best could bring a range of benefits to the university. Broadly speaking, the spin-offs were contributing (by the time of this study) four elements to the university, the direct cash they brought in, the interactions and support they had with the academic founder’s/ founders’ research group, the assets they provided access to, and their value as a long-term research partner. In the research we found that there was a wide variation in what the various spin-outs brought to the university in each of those four categories, both
in terms of the quantity but also the quality of the interaction. In one case, arguably the most negative outcome, the spin-off was almost neutral to the university, in that the cash ended up being spent on the wages of the professional manager, and running the company had distracted the academic and reduced his capacity to do other commercialisation activity. In two other cases, the spin-offs were a reflection of much longer term collaborative activity between academic and commercial partners which eventually found expression in spin-offs. However, there was evidence that there was in many cases a significant flow of resources back into the university in terms of all four factors.

In terms of the first factor, cash, the most significant example of this was the £6m raised from the sale of Novocastra, which was at least partly reinvested in the redevelopment of the Medical Site adjacent to the RVI, the so-called MEDSPAN project. Some of the directors of Novocastra also invested some of their sale proceeds back into university research in some form, increasing the impact of the sale. Novocastra had also paid a dividend to the university during the period 1995-2002, and there were a number of companies who as part of their licensing deal with the university were paying a royalty. Under the new arrangements, USOs were also expected to pay for the costs of the university defending the IP, and so although some of that did go to the university’s legal advisors, some of that was also involved in offsetting the other costs of the business development directorate. The three businesses that were filtering and channelling consultancy back to their academic founders professors were likewise generating cash which helped those faculties to meet their third strand inputs, and two of the firms also contributed directly to the salary costs of the academic founder, one at 100%, one at 20%. Five of the 14 were also involved in funding Ph.D. studentships within the academic founders’ research group. In summary, in 6 of the 14 cases, the total cash contribution was small (rent and equipment use), in five cases they were significant (£10,000-25,000), and in two cases they were around £100,000. The money was paid for a variety of different services, and activities, and much of it bought time of employees rather than representing a license fee type of free cash which could be invested elsewhere.

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20 The figures are not directly comparable; in some cases, they are the last year, in some cases, they are the average of the last few years to smooth out anomalous events like the Novocastra sale.
The second benefit that the university received from the spin-offs was that they contributed to the life of the academic founders’ research group. In most cases, the spin-offs were a consequence of an active research group, and they merely formed a strengthening role, through the funds they brought directly (as funders) and indirectly (as industrial ‘clients’ for research council grants) into the research group. However, in two cases, the spin-off had been more intimately involved in the emergence of a research group within the university. In one example, the firm had placed significant sums back into the research group to pursue an entirely new research theme related to commercial questions facing the company, thereby creating new research skills within the university research team that would not have existed had the company not stimulated the activity. In a second, the company became a means for a non-professorial staff member to build a team within the university over a much longer period, culminating in a research group of three academic staff and 6-7 students. Obviously, this benefit has not been created in the three of the fourteen spin-offs where a research team left the university.

The third element that firms were able to bring to the university was through helping with the university in meeting its other targets. A number of the spin-offs were involved in education within the university, in a variety of ways. Firstly, one firm has offset its rent of university premises in return for delivering a Master’s course. A second spin-off entrepreneur teaches a course on commercial aspects of the technical subject relating to his company, and he brings guest lecturers in drawing on his own commercial contacts. A number of former members of the university negotiated some kind of visiting lecturer/professor status for themselves within the university, in return for helping with teaching at the university. Some of the USOs were also helping to provide the university with research projects for undergraduate and masters’ students, although the capacity of the firms to deliver them does vary over time. The links between the teaching base and USO are also important in terms of developing other links with companies, as demonstrated in terms of the links with the third party firms. A number of the academics have developed and undertaken teaching company schemes, CASE studentships and received masters placements from third party firms with whom they have contact from the spin-off.
6.2.2 **Spin-off participation in the knowledge pool**

The second group to involve themselves in the knowledge pool was the spin-off companies themselves. The initial rationalisation for their involvement was that they needed to have the technology transferred into them, and it was this technology transfer process about which the university learned, which made the university more effective as a contributor to regional economic development. The spin-offs participated in the knowledge pool at a range of times, including in the assembly of assets to form the company, during the spin-off process itself, and then as the company sought to grow and establish itself from the university. However, in agreement with Dahlstrand (1999), it is clear that the relationship between the firm and university is not all that close during all those periods, and some of the firms did move away from the university towards full independence, establishing the kinds of relationships that the university enjoyed with other firms.

The nature of the initial relationship with the university was naturally strong, which is hardly surprising, as the nature of a spin-off company is one in which the roots of the company lie in the intellectual assets developed within the university. The largest number, 8 companies, were developed to exploit particular technologies and techniques which research had produced, but in which the technology was tangential to the main thrust of the academic research. Three of the companies had been incubated within the university as a research team, and then subsequently set up the company on the basis of this research team, taking the staff, existing contracts and other resources which meant that at the point of formation, they were able to take from the university a number of the elements of commercial stability. Two of the remaining three were set up as a means to leverage value for professors in having someone to manage their consultancy load, and allow them to maximise their day rates\(^{21}\).

The next step in the spin-out process was the step moving from having a legal company registered with Companies House to having a real company populated with employees,

\(^{21}\) The final company was set up in such a particular way that to describe it or the process would breach the confidentiality of the research.
working capital, premises, and sales (although this was not a significant issue for the three extant research groups). The role of the university was also significant in this, particularly for the more recent companies. The Government SMART award became a very common way for small companies to capitalise their research in the North East, as previously noted, and the BDD became adept at encouraging and supporting SMART applications from their companies. Secondly, the university helped three of the academic founders enter and win Business Plan Competitions from their respective science councils. These competitions brought access to resources, in one case helping with winning a six-figure Government commercialisation grant, which contributed significantly to creating a fully capitalised business. Finally, the fact that from 2002, all applications had to progress through Equity Committee meant that all the companies had some capital, even if it was held in the form of intellectual property. The Equity Committee were interested in ensuring that the companies were suitable vehicles for the exploitation of research, so even if Equity Committee did not add to the value, those companies that emerged from the Equity Committee process were ‘real’ companies with some assets in them.

A number of the companies also used the university as an incubator; the INEX centre (qv) was a formal incubator centre in which 2 of the firms were based; all but one of the USOs had rented some space (not necessarily INEX) from the university at an early stage in their life, such rentals being associated with access to other researchers, knowledge, equipment and potential employees22. For biotechnology companies, the university was also important for meeting particular regulatory demands, because a number of them were dependent on using tissue samples, were producing clinical waste, or required particular certificates for hazard control which would have been expensive to arrange themselves. Although the university did apparently price access to these services fairly, there was an issue of accessing these kinds of services, and as spin-offs the staff had a familiarity with regulatory regimes and university’s compliance regimes, which reduced the negative costs of compliance in the start-up process. The presence of the Institute for

22 A number of interviewees noted that one advantage of the university was that it was poor at issuing invoices for consumption of resources. However, in a couple of cases, where SMART awards expenses required claiming within a limited time period, this could also pose a financial threat to the company.
Human Genetics at the Centre for Life also meant that these services could be provided off-campus, upgrading the quality of incubator units by embedding scientific services on the location.

The final stage of the spin-off process was certainly typified through a weakening of the linkage to the university as the firms established themselves away from reliance on the explicit subsidies and hidden supports of the university system. The two oldest companies retained some research relationship to the university, in part through retaining the academic founder in a research role within the business. The third oldest of the businesses was a consultancy business exploiting the reputation of its academic founders, and thus retained close links back to the parent institution. The case of Mindware [a pseudonym] is interesting, because the firm was originally formed and spun out in 1998, and then was bought by a supplier to a top computer manufacturer, who were themselves bought out that top company. The Mindware Laboratory was closed down by the new management, and the Mindware team span themselves out once more, back towards the university, locating within the incubator and using links with the department to help maintain their technological development at a time when the commercial focus was on finding new funds.

6.2.3 Third-party firm participation in the knowledge pool

Much has already been written on the diverse nature of university/business interactions, and the interaction and participation with third party firms around Newcastle was as diverse as the literature would suggest. The original mechanism suggested in the conceptual framework was that the spin-off experience would open up the university departments in ways that made them more accessible to third party firms. The heuristic for this was that a professor, having started a business, and then retired to a safe distance, would be sufficiently commercially minded to be better at working with other businesses. Drawing on Muller & Zenker’s model, for example, the idea would be that the spin-off company would be exploiting a particular technique, and there would be other applications and domain fields to which the application could be applied, and the professor would be better at transferring the technology to the new company.
The research did not discover this mechanism in operation in precisely this fashion, although there were two types of example where a similar process took places. Firstly, there were two examples where university academics left one company, and then started up another company, often not directly linked to the first. In one of those two examples, this second company developed a very close relationship with a non-university spin-off firm, and they began a collaborative project. The second process was that in the consultancy businesses, the professors were acting much as Muller & Zenker’s model suggested, that they worked with a range of clients to solve their particular problems, although there were relatively few examples of where this worked in the region. There were two companies, both themselves spin-outs of much larger established concerns, who had developed close working relationships with universities through consultancy work undertaken with the USO, and who valued that relationship – both had sponsored both short-term consultancy, but also longer-term and more expensive doctoral research. In one case, the third party firm had developed a series of multi-disciplinary projects within the university which expanded that firms access to academic knowledges, from engineering into computer science, for example.

6.3 Solidifying shared territorial assets within the knowledge pool

The next step in the analysis is to move from the analysis of what each group of actors was deriving as benefit from the knowledge pool to looking more closely at how one-off transactions were producing more stable entities that could be regarded as territorial innovation assets. The idea of a boundary spanning function is already well developed in writings about university/business interactions, and so we would expect to see the creation of such ‘boundary spanning’ institutions in the North East if all the activities, transactions and exchanges were densifying the regional innovation system. Critical to the model we have adopted is that the boundary spanning functions involve all three elements of the spin-off system we have identified, the university, the spin-offs and the third party firms. In this next section, we outline some of the tangible boundary spanning institutions which have emerged from all this activity, and separate out those which have a formal institutional role from informal, but nonetheless territorial, habits and routines, and the creation of regional network activities.
6.3.1 New spaces of knowledge production: the ‘hard’ infrastructure

Perhaps the most notable feature of much of the spin-off and technology transfer activity in Newcastle University is the extent to which it has inserted itself around the spaces of ongoing research and teaching activities. Many of the activities either buy time from ongoing research teams (particularly the consultancies) or occupy marginal space within the university as a precursor to moving out into their own accommodation. In part this reflects the fact that the university did not at the time of the research have a formal science park on its estate\(^2^3\). Much of this spatial location, we have argued, is bound up with academics’ – i.e. entrepreneurial professors – strategies in managing commercial and academic consultancy as two parallel and mutually reinforcing strands in one location. Three of the spin-offs were nurtured to such a size within this system that at the time of their departure from the campus, commercial space was actually preferable to them rather than some kind of flexible incubator.

However, these kinds of activity (informal space within universities) are notoriously difficult for those outside the university to access, despite a rhetoric within the university’s senior management about bringing entrepreneurs onto the campus. By the time of the research, there was only one example where we found that a third party firm had been brought into the campus on similar terms to those enjoyed by the USOs which evolved into those spaces, although that company had clearly benefited from its time there in terms of its subsequent sustained growth and R&D levels. During the research, the medical faculty was being restructured through the MEDSPAN programme to attempt to create new entrepreneurial spaces, and bring new firms onto the campus, but few resources directly applicable to small firms had been created and was accessible by mid-2004.

There was one example of a ‘hard’ infrastructure asset built on the university campus which was intended to help entrepreneurial new firms come into the campus, thereby helping both spin-offs and non-spin-off start up firms. This was the Institute for

\(^2^3\) There had been some attempts in the region to create science parks but they had not been particularly successful in terms of developing close business/university linkages
Nanotechnology Exploitation (INEX), which did bring together university, spin-offs and third party (‘spin-in’ type) companies (cf. 8.4.2). At the time of the research, it comprised a set of clean manufacturing and research facilities, as well as office and incubation space for companies. Only one of the nine tenants at the time of the research were active in nanotechnology, although there was another company in the interview sample who had located there because it was close to university colleagues. There were examples of the INEX management helping their tenants to develop links with other local companies, and so assisted with the transfer of technology into other local businesses. The INEX example does illustrate the fact that the technology transfer process is not the simple heuristic portrayed within the model, but is instead dependent on a number of relationships which come together in particular times and places. One of the spin-outs in INEX had commissioned work from another spin-out, was doing work for one local firm, and was potentially going to develop a manufacturing process for another spin-off. It is important not to attribute the success of that dynamic entirely to the hard infrastructure, but it is inter-related with the building of a more general territorial expertise in nanotechnology in the North East of England (cf. chapter 8 for more detail about this specific nanotechnology case).

There is another example of the three sectors coming together in a constructive way elsewhere in the city, but the particular example lay not in the university campus, but on the International Centre for Life, where a set of activities had built up, particularly around bioinformatics, namely the automated processing and analysis of biological data. The centre is home to the Institute of Bioinformatics, a partnership of the regional universities and a number of related companies. Up to 2002, the ICfL hosted BioSci North, a representative body for life sciences in the region, and an organisation which a number of the spin-offs cited as being useful for particular elements of their work. The site also hosts the Institute for Human Genetics, the Genetics research capacity of Newcastle University, who have achieved a public profile recently for their work on stem cells and human embryo cloning. Two of the spin-offs and one third party firm had been located there in the year preceding the research, and there was also another high profile bioinformatics company. The value in ICfL, as much as with INEX, is not in instrumentally mediating between companies and the university, but providing a space
where the activities were actively cross-fertilising. This concept is intuitively problematic because it lacks a concrete mechanism, but there appears to be something significant in these activities, even if it is not immediately clear from which processes the advantages derive. More is said in detail about INEX and ICfL in Chapter 8.

6.3.2 New institutional arrangements for university/business interaction

There has been a considerable reorganisation of technology transfer activities within Newcastle University since the period of benign neglect in the 1980s, and there has been a concerted attempt to promote spin-out firms. This has corresponded to attempts by public sector agencies to encourage new firm formations from universities, and so there have been the emergence of new institutional arrangements attempting to increase university entrepreneurship which have affected Newcastle University. In terms of external actors, the regional development agency for the North East, One NorthEast (sic) (ONE) has been aggressive in developing a regional science strategy which is dominated by intermediary institutions trying to help new firms get to market (cf. Chapter 5, figure 2). Within the university, the business development managers and the Equity Committee both represent institutional forms which aim to exploit the technologies whether through a licensing deal or forming a spin-off.

In terms of external institutional forms, ONE has been active in promoting the idea of centres of excellence as new institutions which promote university/USO/spin-off interaction. The centres of excellence were intermediary institutes which channelled seed-corn finance to new ventures from either regional universities of other businesses. Alongside this, a regional venture capital organisation was capitalised, called Northstar, to provide gap and first round finance to local businesses. Two centres of excellence have been particularly successful in establishing themselves with respect to Newcastle University, and one has a member of the BDD team on their board (Douglas Robertson, Northstar). Another centre of excellence was working both with a university spin-off, and a spin-off of theirs, in joint ventures, and has established a significant physical test site within the region, as well as providing funding for equipment purchase within Newcastle University.
Within the university, the Business Development Managers were an attempt to create a system which could organise and assemble a functional network of linkages with business, and to some extent they were successful. They did help to open up the university to companies that were not already working with the university, although it is not necessarily the same as saying the university did not have the capacity to deal with them previously. The BDMs appeared to increase the capacity of the technology transfer officers to deal with business, and to increase the total amount of commercialisation activity flowing through the university. Each of the BDMs did spend significant amounts of time in the early stages of the tenure of their posts building up relationships with potential future collaborators for the university. It is possible to draw up for each of those in the core BDD technology transfer team a set of connections to other innovative and entrepreneurial actors, and they were clearly key actors in mediating the territorial knowledge pool. This is dealt with in more detail in the following chapter, although the seeming reliance of the network on this limited group of individuals, at most seven, also raises issues concerning the sustainability and durability of the network, and the extent to which it can be regarded as having been materialised into something more durable.

Spin-off and third party companies have also been involved in the development of engineering consultancy services in Newcastle University. During the period of the research, a number of disparate activities were reorganised into the so-called “Stephenson Group”, named after their shared building24. One of these services, the Resource Centre for Industrial Design (formerly the Regional Centre for Industrial Design, Potts 1997) was established in 1995 using European funds to extend the commercialisation of an existing Engineering Design Centre to small firms in the region. It originally functioned through a £12k annual charge for members, and following winning continuation funding from the physical sciences research council (EPSRC), evolved into a more open service organisation. Although none of the original members of RCID were spin-off firms, a

24 Which was in turn named after engineer and entrepreneur Robert Stephenson (Stephenson Centre brochure, 2004) “Robert Stephenson (1803 – 1859), an MP and North East entrepreneur, was one of the founding fathers of the railway age. He, with his father, created the first locomotive factory in the world where the Rocket, the first passenger locomotive, was designed and built. Major projects led by Stephenson included the construction of the London to Birmingham Railway Line.” Available at http://www.stephensongroup.ncl.ac.uk/Brochure/Document%20Library/StephensonCentre.pdf
number of spin-offs and third party firms were involved through RCID, in co-operation in
the Regional Cluster project. Again, it is important to stress that a lot of the collaboration
preceded the spinning-off activity; in one case, an RCID member was doing a Teaching
Company Scheme with a company, and then ended up getting involved with mentoring as
they spun-off the company, via the Research Council business plan competition which
provided the start-up impetus for them. The USO was in this case involved in the
network but as a recipient of the benefit, rather than its’ initiator.

6.3.3 Building a cadre of regional entrepreneurship mentors

The third element of the knowledge pool was in providing knowledge about access to
other assets, not necessarily those in the knowledge pool, as it were, but to a set of assets
which are more generally accessible by those in the region, and others in the knowledge
pool are able to signpost others to them. By assets, we mean significant resources, such
as venture capital investments, or new technologies, or significant new sales
opportunities. The Cambridge example is regularly cited as a place where the abundance
of finance means that good ideas make it easy to obtain funding. Conversely, the North
East of England is often regarded as a place where such assets are not readily available, a
sparse environment for entrepreneurship and innovation (Benneworth, 2005). The
question is whether the knowledge pool can compensate in some way for the dearth of
such resources and help regional firms to access other resources elsewhere.

One example of this in action was with one company proposal which came into the
Equity Committee, on which the Vice Chancellor sat. He had already established a
spin-off company and led it through a successful syndicated venture funding round. He
recognised with one of the proposals that it would require an investor with an unusual
interest in the field. He had such an investor as a friend, and as a consequence of Equity
Committee, the firm was able to identify a an investor and non-executive director for the
spin-off.

One group of mentors active within the region were successful regional entrepreneurs, of
whom it must be said there are not a great abundance in the North East. One individual
who had sold his own company and made a significant profit for his investors, some of
whom were based in the region, and subsequently sat on the board of a number of
regional companies to reassure venture capitalists that their funds were being well invested. Three of those firms with which he has been involved are spin-offs, two from Newcastle and one from Northumbria University. His presence has been associated with, but not necessarily the cause of, a number of investments from the lead investor.

A number of the third party firms were themselves spin-offs of local companies, particularly fine chemical and pharmaceutical firms, as well as local utilities firms, both activities with high levels of development activity, and some research work. Some of the connections and linkages between individuals came from networks built up in these companies. Two particularly important networks from the perspective of the spin-outs came from the former British Gas activities at Killingworth (cf. Benneworth, 2003) and also the Northumbrian Water Research and Technical Centre at Longhorsley, west of Newcastle. Alongside this, there are lots of individual knowledge connections from individuals in a range of firms with each other, which influenced the operation of the knowledge pool. **What this does show is the importance of other forms of knowledge network beside the university to the knowledge transfer process, and the operation of the knowledge pool.**

### 6.4 Problems and issues in the creation of territorial innovation assets

Although the narrative in the previous section outlines the construction process whereby territorial assets were built, there were clearly problems in the regional creation of territorial assets. In a less successful region, it is intuitive to expect that there would be problems arising because of a shortage of other regional assets, but it is clear that there were other kinds of problems emerging which were material to the functioning of the territorial knowledge pool. Third strand activity does sit uneasily alongside teaching and research activities at a micro-scale, in the way that there is tension within individuals caused by the efforts involved in balancing teaching and research work loads. These small problems in a number of cases caused larger problems. Moreover, it is also clear that the interactions between the different parties in the process was not always constructive. In some cases, where research groups became start-ups, then they could be neutral, but in other cases, where they recruited staff from one another, that could cause severe problems which were not a positive labour market effect.
6.4.1 Problems in the creation of territorial assets through spin-outs

There were a series of problems faced in developing territorial assets, involving different combinations of the various actors involved in the territorial knowledge pool. Firstly, there were issues with attempting to create new intermediary institutions, particularly when internal mechanisms came into conflict with external mechanisms. There had clearly been some conflict between one of the centres of excellence and the university around the Strategy for Success. So whilst the presence of two organisations might appear as providing redundancy and institutional thickness, it could be argued that it inhibited the development of a successful nanotechnology centre in Newcastle. INEX was heavily dependent on convincing central funding agencies (HEFCE and DTI) that it was a plausible project, but the fact that the RDA were pursuing their own centre of excellence, which INEX sat outside, made it more difficult for INEX to prove its plausibility. Although INEX did succeed in attracting funding, the conflict between the intermediary organisations was clearly a problem for building regional capacity.

The second problem was that the university commercialisation system relied heavily on the presence of the particular members of the business development team, rather than there being some process through which companies and inquiries moved. This meant that progress from the company’s perspective was not always either smooth or rational. One company director described it rather poetically as:-

“there are good intentions in the university, but the effector arm of the university arm is flawed … nothing happens, the committee speaks but there is nothing to administer the committee’s wishes. I’m not dealing with anybody ... the directive is from the intellectual property committee to draw up a contract, but that isn’t being implemented, and … that’s because there is no vehicle for implementing the intellectual property committee’s commands. So they speak into the wind”.

The third problem was that there tended to be a divergence in understanding the nature of the relationship between the university and spin-off company, between the various parties around what it meant to be a spin-off of the university, particularly around the issue of informal exchanges of assets, and properly pricing those exchanges. The stake a university holds in a spin-off is in recognition of its past investment in intellectual
property, and so university staff argued that this ought not to lead the university to treat the company preferentially in any way, and to ensure that public money was not subsidising private profits and creating a false market. This created conflicts between USO managers and business development staff which undermined the trust in the relationships. USO managers appeared to think that the success of spin-offs was a direct benefit for the university, so they should be given favourable treatment because they had already contributed to the university, and so had an ‘entitlement’ to preferential treatment. Conversely, business development staff were concerned that although there were benefits for the university, USO founders did not realise that the university shareholding was recognition of the granting of university property rather than a statement of future behaviour. There were then incentives for misunderstanding which had the potential to build mistrust between the partners.

In many cases, the consequence of this was that business development process involved a series of hurdles to ensure that USOs were dealt with properly. From the point of view of the USO founders, this appeared to create a continual stream of hurdles to academic entrepreneurs; issues such as charging for space, access to car parking, and ownership of library cards were regarded by the interviewees from all sides as being both contentious, but also badly handled by the university, in particular in terms of the negative feelings they generated from the USO towards the university. It could be that this is a kind of adolescent angst from USOs in the North East being forced by an absence of other property opportunities to remain too long in the university ‘nest’, but regardless of its cause, it was a problem for the universities, and led entrepreneurs to try to avoid having to deal with the university over such minor issues.

Fourthly, there were a series of issues that because the USOs were formed from unusual sets of resources, in particular involving research staff who had not always been involved in a commercial environment, some of the firms behaved in peculiar ways. One spin-off company, for example, was criticised by a number of interviewees for failing to behave like a ‘real’ firm in developing a finished product, rather than an almost-completed idea. There was a perception across those interviewed that although academics were frequently good at generating ideas, as a group they tended to be much less capable at turning those ideas into something usable and protectable that a BDM could try to sell. The issue of
profit also caused problems; where companies were run to make profits, then this created friction and mistrust between university and company, because the university felt it needed to ensure that the firm did not spirit away its’ property. Where the companies were not run to make personal profits, but were run to bring funds back into professors’ laboratories (for example), then there was the risk that the consultancy ‘tail’ could wag the academic ‘dog’; there were at least two cases of professors having to do loss-making or unproductive consultancy work to fund the staff within their USOs, which then clearly has an opportunity cost for the university.

The final problem concerned the relationships between SMEs, USOs and universities. In the naïve model, they are assumed to operate unproblematically, but it was clear that there were issues which hindered effective co-operation, which did not all derive from the peripheral position of the region. Certainly, the third party small firms did have difficulties in persuading collaborators of their size and significance, and because Newcastle University tried to license only to large firms, local SMEs did not benefit from easy access to technologies that they could not easily obtain from external suppliers. The other issue was that there was clearly a movement of resources between the various groups in ways that were not always positive. Although two spin-offs benefited from the BDMs working for them in a formal capacity, this clearly reduced the BDM team’s overall capacity to increase deal flow. There were stories that some spin-offs, although not those interviewed, had absconded with university IP or developed unfavourable deals (cf. chapter 7). There were also issues with spin-offs and other firms suffering from their relationships with the university, not always intentionally, but because the university as a large employer was able to offer certain things, such as promotion or doctoral training, that small firms cannot easily afford. Although at a meso-scale, this could be regarded as a set of ‘untraded interdependencies’ to those firms and university teams suffering the loss of key staff, there was no overall positive effect because of the etiolated state of the scientific labour market in the North East of England.

6.4.2 Solutions and learning activities in the Newcastle techno-economic network

These problems were not insurmountable, but they did reduce the overall scope of the benefit which spin-out companies were able to bring to the region. Certainly, the
intuitive notion of the university creating swarms of these new businesses which went boldly out into the region and transformed the technological basis was ill-informed. It is clear from this that the knowledge-pool in the region such as was created by the spin-off activity was extremely dependent on the continuing effort of the university, and required a great deal of energy to produce the results. When that effort was expended, then there would be big successes like Novocastra, which produced a rash of activities in its’ wake that seemed to be a genuine improvement in what the region could offer to external agents, as well as extending the scope of the regional research base within the university (as demonstrated by high RAE ratings for the Pathology department).

Part of the continuing effort is indicated by the high degree of reliance of the activities at the time of the research on the business development team within the university. The idea of a regional knowledge pool is suggestive of a range of companies involved with a variety of academics, and although that situation does exist around Newcastle University, the USO activity existed to one side of this broad thrust. The Business Development Managers did have a lot of knowledge about their own sections and speciality areas, and had a dense network of relationships with external firms, which they used in introducing firms to the university spin-off activity area. Involvement by third party firms with spin-off activities was likewise a lot more energy intensive than merely giving in an industrial research contract to a research team in the university.

This suggests that the knowledge pool around USOs is quite tightly bounded, with a very strict set of rules for access to that pool, and relatively limited replicability and reusability of the assets. This at first seems to suggest that spin-offs have a relatively limited impact on their regional environment. However, as we have seen, the spin-offs around Newcastle were actively putting resources back into the university, including cash, knowledge and staff, which were in some cases being exploited by other firms. Consequently, although the operation of the knowledge pool is not as straightforward as the naïve model suggests, and depends heavily on the accessibility of all the knowledge within the university, not merely that ‘between’ university and USO, there are examples of USOs contributing to the regional environment.
So what does this revised, segmented and bounded territorial knowledge pool look like in the case of Newcastle University? In effect, that means there are two territorial knowledge pools. One of these is largely within the university, and is that used in establishing new spin-off firms. However, there is a second area where spin-offs bring resources back into the university, these are invested in the research groups, hard infrastructure, and business development activities, and these activities then benefit local companies. This second knowledge pool is much more loosely bounded and is much more easily exploited by other firms in the region, so INEX was host eight firms who were not nanotechnology-spin-offs, other firms were working with research groups whose professors had funded those groups with spin-off funded research, and regional companies also benefited from the ideas and contacts of the business development officers. We attempt to represent this in figure 5 below, which shows that indirect access to the knowledge pool is the more significant potential impact on the regional economy, namely that the USOs create resources which other elements of the university ‘render’ to make them more easily appropriable by other regional firms.

*Figure 6 The disparate nature of the apparent relationship between USOs and the territorial knowledge pool around Newcastle University*
Of course, what figure 5 shows is a set of archetypal research relationships around the university and the USOs at the time that the research was undertaken. The key issue for this research is the extent to which they have become more general territorial assets, more generally repeatable and reusable by other innovators without necessarily incurring the initial start-up costs. In the case of Newcastle, the high effort involved with the spin-offs means that it is problematic to regard the direct benefits of the USOs to represent a territorial knowledge pool; there is little direct free-riding that can be done by other firms on the basis of Newcastle University’s experience with its spin-outs. The key locus for the knowledge lies in these intermediary institutions which appear to push the economic benefits of the spin-outs and generalise them. The institutions are not solely the consequence of spin-off activity, and in the majority of the cases, the spin-outs are more dependent on the institution than vice versa. But the spin-outs appear to have contributed assets which have facilitated making those activities better at supporting regional activities, and possibly therefore to have densified the regional techno-economic network.

6.5 The nature of the territorial knowledge pool: towards more explicit mechanisms

The fundamental message from this chapter is that spin-offs can contribute to building a knowledge-based economy in a peripheral region, namely Newcastle. Of course, there are questions remaining about the scope, stickiness and sustainability of the particular economic activities, but the spin-offs contributed to the development of enlarged activity networks. These networks contributed to making some local firms more competitive, at least as far as improving their performance in the innovation process. It is possible to see knowledge generated through university research activities being implemented in local firms, providing them with external innovation resources, thereby improving their local innovation environment. What this chapter has not been thus far able to establish is the broader significance of these changes in improving the political-economic situation of the region, in making it more powerful in its relationships with other places, and making itself more of a place to be to perform particular types of knowledge economy activities.

It appears that the territorial assets which materialise are in three main forms; firstly are the solid infrastructure which provide access points into the university, USOs have been
part of the business case for INEX, and the reorganisation of the campus is creating space for spin-outs as a way of ‘bringing the city into the university’. The second are the new institutional arrangements within the university to provide better access for regional firms to knowledge held within the university, which can in turn be subdivided into the ‘routine’ and the ‘special’ access points. The routine access points are what are traditionally thought of as boundary spanning functions, things that help bring academics and firms, with their very different world-views, needs and demands together around particular collaboration activities. The special access points during the research was effectively the business development managers, who enrolled businesses into the university in ways that contributed to the university’s core mission. There were far fewer firms who had this really close relationship with the university, but some of those firms were spin-offs, particularly those which had had an amicable spin-out process. The third set of assets were the relationships that they had with other individuals who could also provide resources for small firms, and who were held in the region by their connection to the region. This third class of contribution remained the most basic, the least territorialised, and the most ‘tacit’, whilst the sold infrastructure and routine boundary-spanning functions were the most regularised and codified of the activities.

One way in which in the case of Newcastle University substantially deviated from the conceptual framework we established was in the sequencing of events, and the subsequent direction of resource flows. In the basic model, there was the assumption that the first process was spinning out the companies, and that this then led to new relationships which represented a densification of the techno-economic network. In the light of the various findings presented in that chapter, that particular perspective feels somewhat naïve. Indeed, in many cases, because spin-offs was the ‘new’ activity, and researchers had been engaged in technology transfer and other kinds of outreach activities previously, they benefited in spinning out companies from these past relationships, so the direction of flow was from the past experience into the spin-out competition. In the research council business plan competitions, for example, problems, mentors and moral support were drawn in each case from companies with which the university (BDMs and academics) already had an existing research relationship.
The other interesting point relating to the direction of the flow of knowledge is that there was not a simple flow from the university into third party firms and the spin-offs. In a number of examples, the firms were in some ways more sophisticated than the universities themselves, and took their findings back to the university, to ask for help in understanding the problems they faced as part of developing a commercial solution to those problems. In giving the problems to the university, this expanded the university’s domains of research; a number of academics used their students to explore the generalities of these problems and consolidate them into a more formal research stream. Thus, the development of new activities within the university was predicated on flows from the third party and spin-off companies. As one professor, also a director of a spin-off, noted:-

“The company will pose a question to me, as research director, ‘that represents a 30% loss of productivity over the entire year, what can you do about it?’ And the answer has turned out to be very, very interesting … There are two things. Firstly, how can you devise solutions, and I tend to go to the DTI and ask for funding to explore whether we could devise such a method … arguing that this would increase productivity by 30%, increase profit, lead to growth, and then so many more people would be employed, We’ll try and do that with them usually as the first thing I do. … Then you go to the scientific literature and you ask, ‘is there any scientific or any knowledge or mechanisms for measuring [what controls productivity]?’ … Finally, you can then devise a programme of pure research to try and get at that mechanism.

“My understanding of the mechanism of what is going on follows the realisation that it’s important, not the other way round… It’s not the accepted paradigm for university research, universities like to think that doing blue skies research spins out into commercially viable processes. My experience is that you find something that works but you don’t know why it works, finding out how and why it works gives you new scientific information, and that can then lead into new things, which is why it is a dynamical relationship”.

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Newcastle University have taken a particular approach to its spin-out activities which has given what one BDM refers to as a Rolls-Royce system, but which fits into Clarysse et al.’s (2003) classification as supportive and to Pirnay et al.’s (2003) schematic as codified/academic. Thus, the overall scope of the activity has deliberately been relatively limited, with small numbers of proposals coming forward, and the university emphasis being on identifying the appropriate pathways for exploitation. Much of this activity is contained within the university itself, negotiations between academic founders, business development staff and senior managers. However, this has created a flow of resources into the university which have enabled it the better to fulfil its’ regional role, supporting the development and population of a range of its’ regional engagement activities. Of course, some companies – particularly the research group start-ups – have gone out into the wider economy and left a territorial footprint. However, this contribution appears to be less significant, in terms of the number of interactions involved with regional industry, than the contribution to making the culture of the university more open to regional engagement. It is to this issue of the university’s regional mission, and making the university more accessible as an innovation asset to regional partners, that this report now turns.
7 University spin-outs opening up the university

In the previous chapter, we considered how the spin-outs affected the routine of the operation of the territorial knowledge pool in the region. In 6.5, we noted that one issue which determined the territorial effect was the porosity of the knowledge pool to outside agents. There were examples historically in the university where despite repeated efforts, third party firms had not been able to access particular university resources (cf. Benneworth & Dawley, 2005). Likewise, in this current research some spin-offs felt that following the spin-off process, they were unfairly, or at least unhelpfully treated by the university. In this section, we look at how the process of promoting spin-outs at an institutional level has contributed to making the university more accessible as a knowledge resource, in order to be able to say more meaningful things about the territorial scope of the knowledge assets within the university. In order to do that, we look at the impact of a shift from a culture (that we could perhaps typify as ‘benign neglect and prioritising licensing deals’ to ‘actively promoting spin-offs’) has changed culture and practises within the university. To do this, we consider the changes outlined in 5.3 and 5.4, which set out how the university had sought to reorganise its strategic orientation towards commercialisation, and how these changes affected the routines, practises and cultures of those involved in those activities.

In the literature, we noted that there were a range of knowledge communities literatures, such as community of practise and networks of practise that could conceivably be of use in conceptualising this process. In the analysis of this chapter, we extent the concept to consider a more general Newcastle University Commercialisation community (of practise) extending beyond the formal ‘team’ community of the business development director. We extend this to include the ongoing role of spin-outs in shaping the community of practise, in affecting the policy framework and strategic orientation, and in opening up the university to outside users. We begin by giving a basic narrative for the evolution of the business development directorate as a ‘community of practise’ in the period immediately preceding the research, and identify some of the key routines, beliefs and practises of community members which emerged in the course of the fieldwork. We then turn to look at two of the main struggles within the community precipitated by
USOs, how crisis has precipitated changes in those behaviours and mores, and then finally turn to consider whether these changes, associated with spin-outs, have had a beneficial or a negative territorial effect, in terms of the accessibility of knowledge resources within the university to outside actors.

7.1 The Business Development Directorate as a community of practice

As noted above, the Business Development Directorate was something new that was quite deliberately created as part of a wider attempt to change the culture of the university, and to begin to mainstream some of the entrepreneurial and commercialisation processes which had been developed in the late 1990s. These (almost certainly unfair) old conceptions of the university as “risk averse”, a “barrier to innovation”, and “poorly managed” appeared to be used by key actors throughout the institutional change process as a reference to try to ‘ground’ what was being done, and create a broader rationale for the changes. The context for the period of change was extremely difficult for the university; the restructuring and associated redundancy programme made many of those in business development feel that they were being asked to take on new roles which exposed them to people who had a negative perception of the BDD as part of a more general negative perception of the institutional reorganisation through which Newcastle University was then going.

Because the creation of the BDD was an attempt to rework the culture of the university, in this section, we take three different perspectives of the change process outlined above, how the university was prepared to accept the BDD, how the BDD was created, and how links were developed to use BDD as an exemplar to support other changes in the wider culture in the university.

7.1.1 Changing the old culture of the university: creating a space for ‘business development’

The first element of clearing a space in the university culture came through an apparent discursive dismantling of the “old regime”, and formally defining business development
as something that the university did\textsuperscript{25}. Part of this came about under the previous Vice Chancellor, creating a team with the capacity to bid for and win funding to pay for structural change in the university. Thus, the Business Development Managers, who were to become a key component of the BDD community, were appointed on the back of a funding stream applied for by the Regional Development Office during the Wright/Hamnett regime. Alongside the HERO bid (which delivered the BDMs) other elements of the old ‘risk averse’ regime were discursively dismantled, that is to say particular new policies and decisions were implemented in parallel with public statements from senior managers that these changes represented a change in university culture. One example of this is that the university mission statement was extended to include a formal regional development mission, and the university also actively took credit for a number of very successful spin-outs, including Mindware (qv).

With the departure of Wright as Vice Chancellor, it appears that the university continued this idea of discursive dismantling of the ‘old regime’ by deliberately appointing someone to lead a process of vigorous change. In appointing Professor Edwards, the appointment committee chose someone that had experience of their highly successful high growth own spin-off firm. However, even before the arrival of Edwards and the more or less synchronous arrival of the BDMs, it is important to note that the core of what might be considered a new regime had been built up starting with the ‘Regional Development Triumverate’ (cf. 5.3) around the Regional Development Office. Senior members of the RDO, for example, were available to meet with the new Vice Chancellor before his arrival as part of the induction process, and they articulated a clear position for the role of business development and regional engagement in the university, which informed the Vice Chancellor’s own deliberations and strategy development on taking up his position. However, because of the desire of people to dismantle the old regime, interviewees certainly stressed the change elements of the story rather more than the

\textsuperscript{25} Although it is important to state that in truth what happened was better depicted as closer to a consolidation or mainstreaming. It is important not to over-state the idea that the old regime was that of Professor Wright – as we say in the next section, important changes were initiated during the 1990s.
continuity. This had the effect of making it artificially appear that the arrival of the new VC was the key event which determined the shift in university culture.

There was during this period a parallel process of tangibly dismantling the old regime, and a key element of this was a problematisation of the old university management discourse. The previous university management system had been rather informal and bottom-up; a number of interviewees made reference to the ‘Monday Morning Meeting’ of deans and the senior management team as the key decision making forum in the university before the introduction of the new governance arrangements. What the university called its business plan was in reality a collected set of plans for the services and academic departments, and commercialisation activity operated on a case-wise business. Because of its’ informality, such a system was very difficult to formally dismantle; it was replaced with new activities, and the new activities, and the associated pain of change, were legitimated by problematising what had previously gone on as unsuitable for a university with Newcastle’s aspirations, that is to say as a research intensive Russell Group university with a strong orientation towards academic entrepreneurship.

What is interesting, is that it was the past that was problematised in the community discourse, rather than any particular period or person, and indeed there was some disagreement within the BDD group as to when the problem started and was solved. So one interviewee did identify the problem as being part of the old regime in which the Vice Chancellor was unable to force the academic governance structures (in particular Senate) to accept the need for particular activities in this new third stream outside the core mission of teaching and learning with which Senate members were comfortable:

“There are many examples of commercial opportunities that were brought by particular members of the academic community to the vice chancellor and the bursar, for investment - spin-outs for example – which ended up being turned down as incompatible … the Vice Chancellor even then had the perspicacity to

26 Of course, this is a synthetic disagreement we have created by juxtaposing contradictory quotations from the three month interview period; the research did not involve creating situations where different interviewees could actually disagree with one another.
identify that there was an emerging agenda around commercialisation … but it was not his leadership style to force it onto the wider university community”27.

A member of the university who had been in the university since before the arrival of the BDMs noted that it was with his arrival that things had begun to change, that is to say that his appointment by the Vice Chancellor was a key part of setting in train the events that led to the appointment of the BDMs, and hence the change in the university’s attitude:-

“My perception is spinning out businesses into the regional economy, or indeed anywhere, was one of the more conservative parts of the university’s, umm approaches”.

One of the more recent arrivals observed that as late as 2000, there were still problems:-

“Most of the spin-outs that were being talked about that time, or had been developed or were formed, were not being aggressively developed as companies. They were quite nice vehicles with quite nice technology, but no one had said, ‘how do we get this to be the biggest and the fastest growing’?”

Another long-term staff member saw that the problems had been running for a long time:-

“Of course, back in those days, it was very risk averse, as I’m sure I have told you before, umm, a lot of people were dead against the idea of any sort of spin out at all, the thrust was to be licensing”

One of the business development managers agreed with this diagnosis, and indeed argued that the risk aversion had continued during their period of tenure:-

“First of all, the university was scared by the idea of having a bunch of people walking round representing the university, without very close academic ‘management’. It was very, umm, risk-averse, it still is risk averse, admittedly less than it used to be, but it’s terribly risk averse”

27 This is actually a composite from two quotations – there was a second meeting with one interviewee to discuss the findings, and the interviewee indicated that what appears above was a more articulate way of setting out their beliefs on the situation.
In the quotations above, it is interesting that all the interviewees paused significantly (umm-ed) before describing their problematisation (e.g. “umm, risk averse”) which gave the impression that this was not necessarily an accepted view of the whole group, but their reading of the situation. This may also refer to the fact that it was in the past, and they were uncertain of precisely the details which justified why they thought it was risk averse (see 7.2.1 below). Alongside the conceptual dismantling of the old regime, and more particularly, problematising it within the discourse of an entrepreneurial university there was a process of constructing a new set of institutions and attracting new actors to solve the problem of the old arrangement, and make the university more fit for its purpose as articulated in its mission. This, business development managers were recruited, a new VC was appointed with entrepreneurial experience, NUVentures was subordinated to Equity Committee, and the Bursar was given a line manager (the Registrar). A target of 12 spin-offs per year was set for spin-offs, with the understanding they had to be proper companies rather than just shell companies.

It is important not to overstate the stability of the new commercialisation approach or its disconnection from what had been achieved already by the time of the arrival of the new Vice Chancellor. The old arrangements were slowly dismantled from within by the Regional Development team, who noted in the course of the interviews that they had been given huge latitude to build up a third, entrepreneurial mission by Professor Wright. The old arrangements were gradually replaced with a different set of arrangements, and the new situation was never fully stabilised; thus, the new arrangements were heavily dependent on the particular individuals involved at the core of the team, and a lot of effort was expended by the university in attempting to regularise commercialisation routines (cf. 7.1.3 below). The key members of the BDM team from a spin-off perspective were in a continual state of flux; as entrepreneurs themselves, they were continually appraising new opportunities which were potentially of interest to them as entrepreneurs as well as service providers. Thus, one BDM left in late 2003 to take over as MD of one spin-out; another spin-out company bought out the time of another member of the team, and a third member was absent from the team for one year as the consequence of two consecutive secondments. This instability meant that commercialisation and spin-out activities were
not necessarily something which were fully embedded into the university, and as we see in 7.3.1, had difficulties in working back to change the overall university culture.

7.1.2 Dealing with the new environment: creating new work routines

Having created a clamour for a set of institutions to make the university more commercial, by problematising past activities, and having subsequently started to establish those institutions and activities, the second element of the community involved creating a set of working practices and routines for the various members of the teams. The first issue was that the Business Development Managers were arriving in a relatively new environment and had to fill the institutional space which had been vacated for them. There seems consensus amongst the BDMs that they were given relatively free reign in the first period (2000/1-2003) as part of an attempt to let them infuse the university with their entrepreneurial potential. With the arrival of Douglas Robertson, attempts were made to regularise the activity, so the BDMs were moved into permanent contracts, they were formally welded into a single team with the TTOs and attempts were made to routinise the services they were delivering. One interviewee noted a significant discrepancy between what he expected and what he found his workload to be. Expecting one third sales, one third marketing and one third multi disciplinary working across platforms and faculties, what he got was 20% sales, 5% marketing, 25% cross- and multi-disciplinary work, and then the rest, a bit less than half, has been sorting out how the university does the business interface.

This is indicative of the fact that much of the work of the BDMs was in trying to create institutional solutions to problems; the BDMs as people were not a solution, but an intermediary form on the way to a more permanent, possibly more regular, professional and routine set of business interaction solutions. An allied problem was the fact that the business development team members were themselves extremely entrepreneurial individuals, and their presence within the university was never going to be either permanent or stable. Thus, although the university could offer permanent contracts to the BDMs, they were unable to offer them the exposure to risk that involvement with a company created. It is interesting that since the research was undertaken, at least three of the BDMs have subsequently involved themselves with spin-offs, and two BDMs are
themselves directors of a new company which is not a spin-off, but is using the university to prove a concept prior to seeking venture funding.

The second issue was the unification of the two disparate groups (the HERO-BAC BDMs and the TTO people) into a single team providing differentiated services. The risk of creating space for a business development group within the university was that it would end up stigmatising all those involved in the delivery of services under the old arrangement, and the arrival of the ‘clean pair of hands’ in 2003 was associated with a departure of some of those managing the old arrangements. There was a degree of luck that the two teams, Business Development and Technology Transfer, had already begun to work together, in part because of the convoluted management arrangements for the North East Centre for Scientific Enterprise (qv), but also because of the resource constraints the group remained under. A number of interviewees noted that the core business development team were continually under-resourced, that meant that they had to share out their workload continually to ensure that any kind of progress was made. An argument could be made that even though the university managers had agreed the terms for the funding for the HERO posts, there was concern in the university of creating too many free agents, who were inherently risky and difficult to manage. This argument seems supported by the fact that although Business Development Directorate did grow rapidly, the numbers involved in those ‘lone wolf’ business development activities, the core business development team at the time of the research, did not grow anywhere near as rapidly, whilst those providing more standardised services did.

The third element was the way they attempted to promote academic entrepreneurship. One interviewee likened the situation to “Eastern Europe in 1992” upon their arrival in 2001; there were no formal market or commercial mechanisms, but everyone was excited about the potential opportunities that existed as a consequence of those changes. The problem was that the pathways to market for academic ideas was very different between different technological sectors and departments, and so it was difficult to produce a single market pathway. Some of the BDMs developed their own specific models and concepts to try and structure diversity within commercialisation activities, developing such concepts as were known as the “High Volume Pipe” or the “Digital Development Zone”. The business development team members also segmented individual academics into
different groups depending on the propensity for and openness to entrepreneurship, again attempting to make sense of an extremely diverse and complex environment. There were some high profile successes, and in their own terms, by a process of experimentation and internal discussion, the BDMs were able to build a shared sense of what they were seeking to do, and develop some formal routines to solve the particular commercialisation problems the university faced.

7.1.3 Reshaping the institutional configuration: generalising entrepreneurship

The prevailing management discourse within the university at the time of the research, changing the university culture because it was insufficiently entrepreneurial, influenced and led to the creation of the business development team. However, the business development team were a service within the university, and a central part of the aim of the new culture was that entrepreneurship was to be encouraged within all academic schools, to meet faculty targets for third strand income generation. The BDMs were introduced as a project, to revolutionise the university culture, identify problems, barriers and ultimately solutions. However, they were never conceived of as a permanent solution; as the original HERO-BAC bid argues, they were part of a cultural change within the university which will

“establish processes that will change the culture throughout the academic and administrative staff of the University. This will encourage a move away from individuals and small groups liaising independently with businesses to an environment where contact with the wealth-creating sector permeates the greater critical mass of staff” (HEROBAC bid, 1999, p. 7).

This was realised in the activity of the BDMs, who were somewhat time limited in the post because of their entrepreneurial interests elsewhere. Where the BDMs and TTOs were least time limited was when their own entrepreneurial impulses could be co-ordinated within the university establishment, and their own experiences and strengths as entrepreneurs could be harnessed to carry academic proto-entrepreneurs towards the market. There was a change in the nature of the work that was being done in the team; after the initial flurry of activity there was a shift towards more routine activity which did not need or indeed interest those at the level (ALC 5) of the BDMs. There were thus two
drivers for routinisation of technology transfer activity, the onward movement of the BDMs and the solidification of particular activity strands which could be delivered by more junior staff, at which point there could be said to exist a ‘system’ for technology transfer and commercialisation rather than people active in technology transfer. This was also driven by the reorganisation within the universities, and in the HEIF 2 bid, the decision was taken to move the BDMs back to the faculties, and to appoint new staff at lower levels (4 at ALC 3, 3 at ALC 2) to work alongside (fewer) new strategic business development staff.

At the time of the research, it was difficult to identify tangible changes that the HEROBAC staff had had on the overall culture of the university. Certainly, the university was managed in a more entrepreneurial way, and entrepreneurship was prioritised to a greater extent within the institutional plan. There was an increase in the number of spin-off firms, and there was a set of activities promoting entrepreneurship, such as the creation of the Research Beehive, and the running of seminars on various aspects of entrepreneurship. But the evidence was not equivocal that it was the change of regime that had improved performance; many of the results that were seen were a consequence of previous activities, not least because of the time that some proposals took to get through Equity Committee. In order to understand the nature, significance and extent of the cultural change, then, it is necessary to look more closely at the functioning of the community.

7.2 Some key features of the community: repertoire, engagement, exercise

In the community of practise literature, Wenger stresses that there are a range of things that give a community a degree of cohesion, a repertoire of shared knowledge, engagement between the team members, and common goals and activities. Although the various members we are discussing in this section were formally joined into a single team in 2003, it is interesting to consider some of the informal activities and mechanisms that contributed to the life of the community. In the interviews with the core technology transfer group, there were a number of stories that were told by community members that seemed to play that kind of community-building and learning role, events which members
had not been involved in but which allowed them to draw inferences about the way they organised their working lives, and which hence became materially embedded within the life of the community.

7.2.1 Why the university was risk averse: the ‘Manchester software company’

Another alternative explanation for the risk aversion of the previous regime arose repeatedly in the interviews with the wider BDM team, which was that some bad event during former period had ‘scarred the psyches’ of those involved in technology transfer activities, and that had become transferred through to those involved currently in technology transfer. Very few of those in the current business development team were actually present at Newcastle at the time of the problem, but the problem had acquired status as a ‘myth’, which provided a very neat rationalisation of why the university was so risk averse. One member of staff argued that there was a confidentiality argument in place covering the precise details of the problem which is why no one was clear about the precise details.

The root of the myth was that in the past the university had invested in one particular spin-out company that had in turn developed a product and licensed software to a third firm; the software had failed, and the firm sued the university rather than the spin-off, which had no real assets. This was seen to have left a permanent impression on those involved in technology transfer.

"Decades ago, literally, well, I’m told it was in the NUVentures era, anyway ... this is one of the university’s skeletons in the cupboard. The university licensed some IP to a software company, which span out of the university and was a completely separate legal entity. It went wrong. There was a bug in the software, it caused ... some consequential damages. Now the company was a limited company, and there was probably no reason whatsoever for the university to have rolled over. The university were not a subsidiary, we were a minor shareholder. However, they went for us and not the company because we had some money, in the end the university paid out hundreds of thousands of pounds in liability, for no good reason. But it’s something that’s remained … ever since, which is the idea that every spin-out you create is a potential liability on the university.”
One metaphor that emerged during the interviews was on ‘burned fingers’, that particular senior members of staff had ‘burned their fingers on the ‘Manchester software company’ problem, and so avoided all risks of any form. It certainly was a plausible explanation for a range of problems which the community had to address. However, it was more than a plausible interpretation of events, its ambiguity allowed it to acquire a life of its own as a story; one interviewee even referred to it as an “urban myth”, and noted that he had heard two versions of the story, one where the university lost £60,000, and another where the university had lost £600,000. As one interviewee explained, who had also been in the university for a long period of time (a decade):-

“I think it was the legacy of a number of people having burned fingers on one or two spin-outs which hadn’t been undertaken particularly cleverly. There was one in particular, and I never got to the bottom of it, but I think it was a software spinout, where the bugs hadn’t been ironed out, and I think in the end cost the university six figures to make good the damages it had done. These burned fingers were exhibited whenever there were serious proposals to bring out another spin-off”.

The myth showed a great deal of the properties expected of key stories within communities, that they provide a conceptual lens to interpret a particular situation, but that they are also continually reflected and updated by their life within the community. Thus one more much more recent member of staff articulated the myth in the following way, again, with uncertainties and ambiguities reflecting the ‘lost’ nature of the origin of the story.

“Then, I don’t know what happened at Newcastle, but there was, I think, an issue maybe with some of the support for some of the spin-out activity, which was less than, umm, commercially tight, and I think the university got put off risk in a big way.”

Our argument is that this story became an important ‘myth’ within the university technology transfer community. Even those who had no direct connection to the period knew that there was this shadow over the university’s previous commercialisation activity, at least at some point in the past. However, this myth also had implications for
opening up the university to outside interests, as the meaning of the myth was that the university was not approachable for small firms because of the risk of being sued should a collaborative activity fail. As one spin-off manager themselves observed, this problem had tainted university experiences of commercialisation in ways that had very real implications for their willingness to get involved in further activities.

“The university’s attitude was that they were scared of being involved in a commercial company, they had had their fingers burned a year or two before. I don’t know how out in the open this is these days, but at the time it was something they did not like talking about. They had a spin-off company had created some product, and the university had created a holding company in order to own the spin out, or at least to in order to create the spin-out company. The spin-out company ended up getting sued, and the people suing them just bypassed this whole legal apparatus of an independent spin-off, and went straight after the university, and got a relatively large sum off the university. So the university were terrified of any commercial link which could come back and bite them”.

This was a myth that was in every day circulation within the business development team; we were not specifically probing for this story, but it was something which the business development people regularly brought up themselves, to the point where they were not sure who they had told it to. As one business development manager related…

“Now I believe I told you about the story in which in the past, the university rolled over and gave some money even though it didn’t need to. Did I tell you about that? [Interviewer: No, I don’t think so] If not you, then someone else.”

7.2.2 The risks of risk aversion: Mindware software

Another important common piece of knowledge within the core team surrounded the spinning off of Mindware, a company which emerged from the Computer Science department in the late 1990s, and had managed to sell itself to a larger development company for $13.5m within three months of the launch. The university had deferred deciding on whether to license the IP to the company for what was arguably an unreasonably long length of time, and Equity Committee apparently decided to allow the
firm to use the IP freely. Recognising the high potential for a lawsuit against the company, which was developing risk tolerant software for failure sensitive applications, the university did not take equity in the company, because the potential rewards were seen to outweigh the risks. Consequently, the university did not get a share from the sale of the company, and this could potentially have generated £1m of free cash. The value of the story to the community came in the way that the story neatly codified what the problem with the risk aversion of the university was, giving tangible costs to that risk aversion in the Manchester Software Company story, and creating motivations to improve the situation. The mythological status of the story was neatly encapsulated by one member of the broader team who told a story in which competing versions of events were present in the same narrative, in which every fact the speaker presents was in some way mythologised: (four wrong facts are highlighted in bold)-

“The classic one was the one, I’m trying to think of its name, that was in Bluetooth technology, which was spun out and eventually sold, I think, to [a global computer firm], for - I think - €38m, and then set up down the Quayside. At one point it had twenty - no, ninety! - people working for it. The university had refused to invest in [the company]”

This story was not uncommon in the various staff members, even those who had been there at the time the process was taking place. Interestingly in the quotation above, many of the ‘facts’ in the case are ambiguous, and the speaker creates a link between the particular story, and one of the subsequent activities undertaken by the university, that of creating a fund to invest in spin-outs. Even one of those staff members who had been involved in the activity agreed that the university system had represented a barrier, and risk aversion was to blame for the subsequent opportunity cost of not taking the shares in the company.

“the university was very, very nervous about the whole idea, so they tried to get it spun out without the university officially involved, effectively through the back door of the university. Basically, the result was that the university didn’t take any equity, because it was seen that if they got equity they could accrue risks and the liabilities”
There was an interesting transmission mechanism of this story within the community, in that one of the new BDMs, arriving after the case of Mindware, actually went to speak with the MD of Mindware as part of his induction into the role. What he inferred from the whole case was that the risk aversion because of the Manchester Software Company experience had undermined the university’s willingness to take a stake. He also emphasised the ambiguity and flexibility within these stories by being uncertain as to whether the original sale price was €5m or £5m, and for what price the new purchaser was itself eventually bought out. Each of the speakers used this story in a very different way:-

- the senior manager emphasising that **cultural change had to happen**,  
- one BDM argued that **licensing deals were a better** way to commercialise technology (and had subsequently pursued a number of such deals).  
- another member of the core team regarded **Equity Committee as an improvement** on the previous process (NUVentures) because it was in part a response to the Mindware ‘failure’, and  
- One academic entrepreneur had a misconstrued version of events, overvaluing the significance of the failure; “Not taking a share in [Mindware] cost the University tens of millions”, but that arguably **motivated them to be more entrepreneurial**.

In combination, these various stories show that these common understandings with different interpretations came together as a ‘myth’, a story with the power to act as a potent rallying symbol for the idea that something needed to be done within the university. It is this ‘idea that something needed to be done’ which was critical in mobilising a coalition for change in the university, and overcoming the natural resistance of the academic community which had hindered the crystallisation of the distinct actions of the senior management into an entrepreneurial university culture.

**7.2.3 Business Development Managers as a ‘group apart’**

A third story which emerged very strongly in the core group, but also in the senior managers, was that the Business Development Managers were ‘a group apart’, that they were something new, and would play a transforming role in changing the university culture. They were appointed to the most senior pay scale for administrative staff.
(ALC5), and were appointed in a way that made them very close to the senior management in the university. They were variously regarded by interviewees as being “tradable people with a high market value”, “a critical resource for delivering the university’s regional agenda”, “a fairly forceful set of characters” and “free agents … to work with whoever they want.” Although the funding bid that went into HEFCE stressed that the intention was that these people would perform against a broad spectrum of activities, the particular element of activity in the bid which impacted on the spin-offs was the work of the business development managers. The story was that their role was transformatory, to change the way that the university did business, to get good ideas and encourage academics to bring those ideas forward to the new formal institution, Equity Committee. The outline of the story as told by members of the broader BDM community was that they went and did that, and then like heroes of cowboy films, when their job was done, they moved on, taking their entrepreneurial instincts to new pastures. This onwards movement was a consequence of once the interesting problems were solved, they were increasingly encountering bothersome and bureaucratic difficulties, and were partly frustrated, and now they were starting to hand over their work to other more junior staff.

BDMs noted that they were continually very busy, and that they were used as a ‘free resource’ rather than a ‘free spirit’. One complained that much of their time was taken up in dealing with external partners, not least in helping the regional development agency with whichever part of their strategy was the most urgent. They felt they were trying to develop university/business networks, but systemic network building was continually being interrupted by the needs of responding to immediate requests, and also under-resourcing within the business development group. However, the way this featured in the way the story was told was that it was presented as a challenge to be overcome rather than a barrier to achievement. By solving this barrier, the BDMs were solving the cultural problem with the university that had led to the risk aversion, and so preventing the recurrence of the Mindware mistake.

“And then of course what happened was we unearthed a whole can of worms, really, ... there was people saying they hadn't seen anybody from technology transfer for five years, and ‘we've got this project and that project’, ‘help us with
this, help us with that’. So almost immediately we were just swamped with things to do, and it was a bit of a challenge really.”

One of those aforementioned challenges was the integration of the two formal structures (regional office and business development office) into one, and the story that was told by several members of the community in that area related to NECSE, the North East Centre for Scientific Enterprise. The project was led by Durham who sought to learn from the experience of Newcastle University, who were seen to be best practise in university liaison. The impact on Newcastle was that the technology transfer apparatus of the university had to provide staff to work with Durham University. There were not enough staff in either the TTO or the HERO-BAC team, and the demands of NECSE placed incredible time pressures on both groups, that led to the forging of a common shared identity within the group. One BDM said that the team that emerged from this process styled themselves the “dysfunctional team meeting”, a play on the idea of a cross-functional team meeting. That BDM related how that this process of balancing work informally between the BDMs, a challenge that had to be addressed, had the positive consequence of building a stronger business development and technology transfer team

“It also meant that he spent more time working with us and realised that we weren’t a bunch of idiots, and that we could be trusted, so it worked out that we ended up with these things called the cross functional, or as I think it became known, the dysfunctional, team meetings”.

The view of their managers confirmed that they enjoyed this special status within the university, able to go out and pursue a range of different projects. This meant that they were highly valued by their management, which was demonstrated by the conversion to permanent contracts despite the lack of a long-term funding source for them.

“They were a key part of the thinking that we needed, some, some flagship projects. Certainly, once we embarked on that course, the BDMs became invaluable, in helping us to configure them on, a basis that we felt was appropriate, both in public sector terms, and also in commercial terms. Frankly, for instance, if you take Genetics Knowledge Park, that bid that would have
looked anything like as good as it did if a business development manager had not been involved”.

There was also a feeling that their positions had evolved over their time in the university, and they had reached the limit of what they could reasonably achieve within the university context. Whilst they had built good regional networks of contacts, arranged seminars and networking meetings, and steered USO proposals through Equity Committee, there seemed to be a shared sense among the BDMs that their position was evolving in a way on which they were not overly keen. There was a common feeling in the BDD as a whole that there was a need to develop systems for USO exploitation, and that the BDMs had been successful in raising the profile of the ideas of spinning of businesses within the university. However, there was some uncertainty in the team about whether or not they would continue as central actors into the future. This reflected both an orientation within management that more routine workers and fewer visionaries were needed to deliver the new services being developed. There was also uncertainty as to whether university management were uneasy that the BDMs were not directly under their control; as ‘free agents’, they were involved in all kinds of activities, and the technology transfer staff seemed to think this made management ambivalent to them. On the one hand, they were recognised as valuable agents for change, but as partly external actors, there was some desire to try to take tighter management control over the way elements of their functions were performed. This was suggested by moving the BDMs out to the faculties, reducing the extent to which they were autonomous voices, and increasing their parity with other faculty service providers.

7.2.4 Concluding discussion: key stories in the technology transfer community

The essence of the stories within the community that were related in the interviews tend to present a mythological version of their role as ‘technology transfer’. There was a barrier, the university’s risk aversion, and it caused problems, the loss of £1m around Mindware, and they (the BDMs) collectively were the solution. They were changing the university culture, making it more entrepreneurial, taking forward particular projects and developing new systems to generalise their activity. In a sense, this story has parallels with the Magnificent Seven, where a despot rules over a kingdom, levying exorbitant
taxes, and a group of mysterious strangers arrive to free the citizens from their bondage, leaving in place a more just and productive system of government. And like that story, the business development group story embodies the idea that once this change had been achieved, so academics in the university would be freer to go about the business of enriching themselves, their departments, the university and the region through entrepreneurial activities, as they did in the Novocastra days.

It is a good narrative to describe the changes, and there are stories and evidence emerging of the ‘freed’ academics better able to establish businesses. One team member cited Orla, Xcellsyz and Arrow as examples of companies formed under the new arrangements that were likely to benefit the university in the future in the same way that Novocastra had done in the past (£6m, 2 further spin-outs and a spin-in). However, there remain a number of steps to take before it can be claimed unambiguously that the formation of the business development group represents a positive territorial outcome. In order to do this, we extend the analysis to look at how more temporary members of the community, the entrepreneurs who draw on the university as a resource to promote innovation, engage with the core business development group.

7.3 The role of spin-out companies in the evolution of the commercialisation community

Traditional explanations of the role of technology transfer offices based on a linear model of technology transfer regard such offices as negotiating licenses for discrete pieces of intellectual property with external companies seeking to exploit the activity. More nuanced models recognise that this model is very different to providing services to support the creation of new firms from university ideas. In particular, there is a recognition that the creation of a new firm involved, in the case of a USO as much as any other firm, the assembly of a package of resources, and part of those resources, including the knowledge resources, may not be readily and freely available at the outset. There is no clean break between being an academic and then an entrepreneur, and for a period, individuals may fulfil dual roles, in which they engage regularly with technology transfer officers or the Liaison Office. In that sense, because of this regular engagement of entrepreneurs with the technology transfer activities, those entrepreneurs could
temporarily participate in the commercialisation community within the university. This implies that part of the assets that the university offers to the new entrepreneurs are embodied within this community, but likewise would suggest that those temporary entrepreneurs play a role in the life and the evolution of the community. In this section, we turn to look at how the spin-offs we interviewed did in fact interact with the core technology transfer team, and whether the BDMs and the much vaunted cultural change was creating such territorial assets which facilitated the spin-off process.

7.3.1 The heuristic for temporary participation in the community

The basic model for the operation of a community of practise around academic spin-offs is that there are a core of commercialisation staff, and then others temporarily participate in the community. However, because they are involving themselves in spin-offs, by participating in that community, they move away, and leave, that community. Despite that fact, they are temporary participants and can leave a mark on the operation and behaviour of the community. The typical heuristic might be that a graduate student comes to work in a research group, then through the course of the doctoral research has an interesting discovery, which they seek to commercialise. In the course of their Ph.D., they move from being outside the community, to peripheral, as interested entrepreneurs. At the time the decision is taken to commercialise, those people then become quite central in the community, as the business of the commercialisation staff involves managing these people as they progress through the spin-out. Once the company has successfully been formed, and academics have a formal relationship with the new business, the entrepreneurs now move away from, and ultimately, outside the community.

This framework did describe the activities of a number of the companies which formed, in which one of the main reasons behind the company was to provide employment for the post-doctoral worker. There were only three companies which closely fitted this process, in which the academic remained within the university, at one remove from the firm, whilst the post-doc assumed much of the responsibility for the management of the company. There were two other firms which formed in which post-docs were directly recruited into management positions. There were other cases where well-formed research
groups started up directly in business, and other arrangements where in one case another university took the lead for the firm formation.

With all these diverse practises and relationships, it suggests that it is hard to disentangle the role of the spin-offs on the core community of practise. However, there are clearly three direct mechanisms through which spin-outs exerted an influence on the operation of the community of practise. The first is that the spin-outs were a shared set of resource, experiences and common understandings that the business development managers had in delivering their job. Although each firm was led through the process by a dominant BDM, other BDMs had experiences of the companies, and the issues they raised for university commercialisation. In part this was because of the pressure the whole team found themselves under – they were forced to work with companies on a ‘first come, first served’ principle rather than having any kind of sectoral or skill specialisation. Thus all the BDMs interviewed interpreted their actions and their consequences in the light of the university’s portfolio of companies. Each of the BDMs and managers interviewed had an understanding of the particular set of companies; in some cases, like the Mindware or Novocastra ‘stories’ outlined above, they were particularly significant for their own roles. In other cases, they encapsulated other messages, such as three of those interviewed highlighted the risks of spending a lot of time developing companies that academics did not take seriously as money-making vehicles, but just ran as so-called lifestyle businesses.

The second is that the spin-out companies represented a set of tangible problems that had been solved, and which defined in turn a set of capacities for the technology transfer community in the university. In seeking to develop more generic mechanisms, each of the BDMs interviewed had come up with quite different mechanisms as a response to the different challenges of their particular disciplinary background, and in particular, in response to the difficulties they had faced with the previous companies they had been working with. One of the BDMs, for example, classified academics in four classes depending on their willingness to engage with commercialisation activities. That classification was based on particular individuals, and they then had developed an informal strategy based on the classification which was in turn based on the observation of commercially-minded (and non-commercially minded) academics:-
“The university splits into three groups. Firstly, those people who are the usual suspects who are busy doing entrepreneurial activity … [names two people] … Secondly, you’ve got those people that are interested, and they are people who see it as an alternative to their current career to a certain extent and are looking to do something a bit different … ‘let’s try a little bit of third strand to spice things up a little bit’ … [names two people]. Then you have in my opinion 30% of people who are peering over the top of the brow of the ramparts, thinking, I’d like to play but I’m not certain I whether or not I want to be involved’. As we speak, they are the current targets for what we are currently trying to do … [when prompted names one person]…

“The first class, what you are mainly doing is you are slowing them down, in order to prevent them from making poor decisions, giving them what you consider to be good advice, and hopefully to guide them to good decisions … The second group, the ones who are involved but not running away, they need close support; they have lots of questions, they are academics and have inquiring minds, they want to know everything there is about the situation, so a lot of it is to do with explaining how processes work, maybe getting some research work done for them, some market research for them. With the final group, what it involves is education, and making sure that they feel as though they can take the next step, put their toe in the water and get involved, although I do seem to be mixing my metaphors slightly!”.

The third is that it was clear that the assumption that the temporary members of the community are the academics and entrepreneurs is not true. In three of the 14 cases, for example, the academics had been senior managers in the business in quite a hands-on way for a period of time, far longer than the HERO coordinators had been at the university. There is the question of the extent to which they had been participants in the community, but as the three had made deals over periods of time exceeding a decade, it is clear that there was a long-term element to the relationships with staff formerly in the TTO. The other issue was that the commercialisation staff members were also themselves temporary; we have already seen that one BDM formally moved on to work for one of the spin-outs, whilst another BDM manager bought out a lot of their time using
spin-out funds. Thus, although the heuristic assumes that the movement in the community is of academics and researchers, and it is the BDMs who are the permanent staff at the core of the community, in the case of Newcastle, that is not necessarily true. It is not clear however that these long term academic entrepreneurs within the university leave a formal imprint on the commercialisation culture of the core BDM teams; they were problematised in a number of cases by university administrators and managers, although in other cases they were consulted and enrolled into the university commercialisation culture. At the time for example that the BDMs were being introduced, there was an informal working group within the university dealing with commercialisation issues, and at least one of the spin-off MDs was present on that body, and so fed back their experience into the managerial attitude towards commercialisation28.

7.3.2 The contribution of spin-offs to the community key features

We have already begun to sketch out some of the key attributes of the current commercialisation community, in terms of its members, some of the key ways they define themselves and their environment through stories, and in terms of the dynamics within the community itself. Thus far, the contribution of ‘spin-offs’ has been considered entirely passively, namely in the way that ideas of, experiences of and stories about spin-offs were used by the core team. However, we argue above that academics and others involved in spin-offs can also play a more active role in the community, leaving a more permanent imprint on the community, and ultimately on the attitude of the university towards commercialisation.

One element of the contribution came in the way that the spin-out academics worked with the core business development teams to help them solve their problems, the more formal element of the co-evolutionary model we outline above. In some cases, spin-off managers did feel that the BDMs consulted with them, but fundamentally were involved in enacting the university’s wishes. However, in a number of other cases, there were

28 Although there was some scepticism in a number of those interviewed about the impact of that committee.
closer relationships that contributed to the shared knowledge resource. In some cases, these came about through involvement in Research Council Business Plan competitions (3) and SMART award bids (4). One of the spin-off managers interviewed noted that the appointment of the BDMs made him much happier to form the spin-off, despite the poor treatment they had received previously; that formed the basis for a year-long involvement between the two in trying to negotiate and shape the formal bureaucracy of the spin-out process, particularly Equity Committee and the Heads of Agreement for using university staff to perform consultancy work. Only in two of the fourteen cases had relationships between the university and the spin-off team degenerated to the state where there was no common learning process; even in one of the three cases where a large research group left the university, the spin-off team and BDM were working together to create ‘work-arounds’ against the perceived weaknesses of the university system, which focused on a complex and informal compromise which was not ever fully written down. One of the BDMs described the process of setting up a spin-off as a real learning experience because of the problems which had to be solved jointly between them.

Secondly, there was the role of the spin-offs in extending the community beyond the formal scope of the university. We have already seen that in the majority of the cases (11/14), the spin-off process involved developing a distinct team related to the lead professor to form the kernel of the company employees. In some cases, the spin-off process involved bringing in outside mentors and consultants, changing the dynamics of the experience of the individual professor within the community. In three of the 14 cases, this external expertise came in through the business plan competitions in which the professors had been involved. In two of those, the companies had remained relatively small and had materially changed direction in response to the advice of their mentors, whilst in the most successful case, the core decisions were taken by a core group of the BDM and academic. Likewise, with the two spin-in companies, where successful corporate executives moved into spin-off companies, this created tensions between the new managers, the professors and the BDMs, with the two spin-ins being reasonably successful in their own terms but not really creating a significant high growth new company.
A second component within this was of people who were involved in spin-off activity without ever being employees of the university, but who had some association with the university. Obviously, Richard Maudsley was involved as Chair for Equity Committee, but the interviews revealed that there were individuals that were involved in various ways with particular spin-outs, in non-exec roles with the spin-outs, for example. There was also no strong evidence that the third party firms were a strong influence on the commercialisation community. Although there was a set of firms with whom spin-offs and the university were working, there was not really the sense that they were contributing to much more than representing a set of ‘problems’ to be solved by business development actors. With one third party firm, for example, the firm had had a long set of dealings with the university, and so some of the solutions which the university had devised – such as the Biosciences Exploitation Platform – were a response to that firm’s relationship with the university. Tellingly, however, when the individual responsible for the relationships with the firm moved on, the relationship reverted back to a much more formal set of relationships.

This suggests that there remain problems within the university community in effectively building external linkages to learn from external commercialisation experiences from individuals outside the university. Although the BDMs had a lot of commercial expertise, they brought this within the university by becoming employees of the university. This suggests that the university organisational boundary is perhaps more a more significant barrier to the exchange of commercialisation knowledge than might have been expected. However, there are mechanisms for introducing such external expertise into the university commercialisation community, albeit not necessarily by direct external mentoring of potential academic entrepreneurs, rather by bringing individuals into university ‘family’. Although we did not specifically explore what makes the university regard individuals as elements of the wider ‘family’, which makes them more able to work in the commercialisation community, it does seem to involve meeting with senior managers in formal capacities, then being invited to serve on bodies like Council or Court.

A final element to note is that the spin-offs themselves participated in some of the myths of the commercialisation community, sustaining and reinventing those stories in making
sense of their own experiences. In 7.2.1 above, we relate how one spin-off manager used the ‘Manchester software company’ myth to make sense of their treatment by the university, which they felt was otherwise inexplicable. There was a feeling that successes led to others attempting to succeed, as was the case with Mindware:

“I remember Phil Harley saying after Mindware was bought for $13m, it was amazing how many people were ringing up his office, explaining what wonderful technologies they have, that also must be worth lots and lots of money. So there are certain events which can trigger people on the ground to start thinking. From my recollection of the way that one company evolved was that a particular professor went from saying ‘what I do is pure research, you know, five years away from commercialisation, blah, blah, blah’, and then the next minute he was the Technical Director of a spin-out company.”

7.3.3 The limits of the ‘Magnificent Seven’

In this section, we have explored the broader participation in the commercialisation community outside the kernel of key actors whose main jobs relate to commercialisation and spin-off activity around the university. What has become clear is that the community is more complex than purely comprising the ‘Magnificent Seven’, the seven staff members in the core business development community. This is augmented as a core group by some of the university senior management, not least the Deputy Vice Chancellor (ultimately responsible for the university’s corporate regional engagement), as well as some of the academic entrepreneurs within the university. There were at the time of the research at least one senior manager within the University, Professor Malcolm Young, Dean of SAgE faculty (qv) who was also involved with a spin-off company (not interviewed in this project). Some academic entrepreneurs are a key part of the group, shaping the development of the routines, particularly attempts to develop general models for commercialisation, as well as the more intangible aspects of the community, the myths and stories of the group.

Around this core group, there was a set of peripheral actors linked to this core group, but much less active in shaping the community, they were affected by the community, and their attributes enrolled by the core members. There were also two key extra-peripheral
groups involved with, but unable to really participate in the life of the community, those firms which fully left the university, and also the attempts made to introduce business expertise into the university by business mentoring, particularly for the business plan competitions; the barriers they faced were also faced by spin-offs who brought in external managers who came into contact with the core community. Figure 3 is an attempt to represent this diagrammatically, although clearly it is a cut through at some point; individuals have multiple identities within the group, and also themselves move about as their roles and interests in commercialisation shift.

Figure 7 A conceptual core/ periphery/ outside map of the university commercialisation community of practise

What this diagram is useful for is in returning to the question of the porosity of the university boundaries, and how the territorial knowledge pool functions to make particular assets more accessible to firms particular in need of them. The first point we would wish to make, illustrated rather than demonstrated by figure 3, is that the university is not of itself an ivory tower, and other external actors are involved in its commercialisation and spin-off activities. What is interesting about their involvement is
that it is all to some degree “formalised” through a variety of mechanisms and instruments. We have already highlighted the role of the University’s board of oversight, Council, in introducing external agents to the university, who then assume particular jobs within the community, such as the Equity Committee chair, or someone acting as a non-exec for particular university spin-offs. We have also highlighted the role of spin-off companies themselves, in creating the myths (Novocastra, Mindware), perpetuating the stories in rationalising their own experiences. Third party firms who are working with the university already on non spin-off commercialisation activity become involved tangentially in the commercialisation activity. These boundary spanning activities are all mediated processes, that is to say that potential collaborators are identified, relationships built with them, and then consolidated until they are part of the university ‘family’, and then are able to assume a range of functional roles providing particular innovation and entrepreneurship services which leverage and valorise university knowledge.

This idea of accessing the university community through a mediated process contrasts very neatly with the experiences of those who do not have similar intermediated access to the university. In the case of the firms who left the university in a ‘total’ way (i.e. whole research group departure), this departure process seems to create a barrier with participation with the community. The links that remain tend to be functional and bilateral, about dealing with left-over issues such as floor space charges or intellectual property, rather than the firm involving itself more actively in the life of the community. The second group, the external mentors, also seemed to have difficulties in accessing the community, excepting of course the person that they were mentoring; this created difficulties when that advice was at odds with the core commercialisation community staff, and meant that the university as a whole was not learning from the commercialisation experiences of external staff, except when they were hired in some capacity and brought formally within the university as employees. This suggests that the most relevant barrier to the commercialisation community is not formally around the university, but around what we have called the ‘university external family’, the university, and the external agents with which it deals with on an informal basis.

From the perspective of understanding access to the territorial knowledge pool, what is then of interest is the linkages and mechanisms by which individuals move into this
external family. In the case of the external stakeholders, we have seen that there are often pre-existing relationships with the university in which the university believes that the individual has something to offer to a particular role, such as in Council. These individuals are then given the opportunity to involve themselves in other particular areas which may give them a general role in the commercialisation community, which may also produce tangible outcomes in terms of providing assets for spin-outs. For the third party firms, we have already seen in chapter 6 that it is other contacts that tends to drive benefits for spin-offs, and so the introduction process to the university is in significant collaborative research projects and ongoing research relationships with the university, which leave them involved in particular spinout activities. Thirdly, spin-offs which retain some link to the university also participate in the community, through the activities of the particular entrepreneurial professors and their dealings with the core business development community. These are all very complex developments by individuals, and not directly amenable to simple analysis, because they are predicated on a range of desires by each party, both functional (such as for resources and knowledge) and ceremonial (e.g. prestige, friendship, intellectual challenge).

7.4 Towards a network of practise: the extended community in the territorial knowledge pool

USOs have clearly played an important role in the evolution of the entrepreneurial culture of Newcastle University. As it was not been possible to interview the previous Vice Chancellor, it is important not to be unfair to his intentions, and it is clear that he laid in place many of the foundations which came together to produce the change in the university’s culture. The problem appears to be was that despite a pursuing a set of regional development activities, the university as a corporate body had an attitude that was cautious and risk averse. There have been a number of changes, and in the minds of those talking about them, there appears to be a clear distinction between the problematic past and the improved contemporary period. That does conflate a number of contradictory facts into a rather simplistic narrative, and it should of course be stressed that each person seemed to tell a story in which there was a simple transition point. We stress that this is quite distant from the reality emerging in the broader context of this
project, which involved the evolution of a commercialisation community of practise within the context of three or four different policy regimes which changed the overall direction of commercialisation practises within the university over a much longer period, arguably at least twenty years.

But it remains the case that the impact of spin-outs directly on the culture and accessibility of the university has been very limited; we could characterise even today the spin-off community and its associated benefits and resources as a very exclusive ‘country club’, with extremely limited access, very high levels of service, and very little direct relevance to the wider economy. In asking whether or not spin-offs have played a very important role in directly opening up the university to outside influences, it is clear that this is not the case; if anything, spin-offs have been predicated upon restricting involvement in the wider university governance system to a limited number of trusted university family who have elsewhere proved their bona fides as amicae academiae. This sounds a very critical judgement to make of the university service, but in the particular context of the North East of England, it could be that this ‘country club’ is less a ‘cathedral in the desert’ and more the beginning of a wider territorial upgrading programme, creating other actors who then are responsible for creating more general territorial benefits.

To explain why some degree of aloofness and separation may be necessary for the commercialisation community, it is necessary to set out a conceptual model of the community. The process model for Newcastle University’s commercialisation activity hinges on there being a core of business development managers, who have developed repertoires of routines and stories about their activities, who are central to the process whereby knowledge resources are opened up to outsiders who lack the resources to do that themselves (i.e. typically small firms). This core group also involves from time to time academic entrepreneurs and senior managers in using spin-offs to further their own interests. In assembling sensible companies to exploit university technologies, there is a wider group on which the commercialisation community draws, encompassing third party firms, external stakeholders and USO managers. These external agents have to be brought into a position where the university ‘trusts’ them to act in the best interests of the university. What we have found is that these actors have been engaged with through a
mediated process in which the university ‘finds’ them, then introduces them into the university governance system, where they are themselves able to influence, and ultimately improve, commercialisation activity.

One possible explanation for this could be in terms of the external environment for innovation and entrepreneurship, which as we have already seen in the North East, is an extremely harsh environment, and the commercialisation community has the capacity to provide an extremely valuable service to a select group of firms. Some of the evidence suggests that the reason for drawing hard boundaries between those who are trusted to get involved with spin-outs, and those who are not, is because of risks to the university of undermining the progress already made. Building the community has certainly not been an easy process; it has involved a range of overlapping and mutually reinforcing events very a long term period, arguably two decades, to the point where there has been a clear systemic change in the university. These have included changes in senior management, the creation of new roles over a ten year period (Regional Development Office, then the HERO team), bidding for funding from external sources (HERO, HEFCE restructuring).

The activity that they have produced does not necessarily easily sit within the university as a centre of teaching and research, as has been demonstrated by the prior abandonment of the Newcastle Technical Centre and NUVentures Ltd. However, the situation is somewhat more straightforward than in Twente, where the university professoriat has extraordinary powers to frustrate initiatives of the senior management.

However, the same risks exist within Newcastle as were evident within Twente (cf. Chapter 7, Working Paper 2), albeit at a lower level. The changes have had to be pursued sometimes in the case of extensive opposition from the academic community. Embedding that activity within the mainstream of the university has involved building a successful community which is clearly central to the university’s mission, to the point that no one can argue that spin-offs or licensing deals are working counter to the supposedly core missions of teaching and research. It therefore seems intuitive that part of the reason for the separation around the boundary of the external family could be to prevent elements of the very delicate eco-system being removed from the university. This would potentially precipitate a collapse of the community, and with it the university’s
capacity to spin-out companies, as well as the university’s ability to offer a high value, but very narrowly defined, territorial innovation and entrepreneurship asset.

The extent to which this regional ‘crown jewel’ can be regarded as a territorial innovation asset is problematic. Clearly, having a university with a capacity to spin-out a handful of companies each year is not intrinsically transformatory for the regional economy. However, this capacity is useful, and its’ sequestration and separation within a tightly bounded university family has territorial value, if those spin-off firms themselves have wider territorial impacts, and improve the position of the North East within a broader political economy in the way that external actors regard the region. We have already seen that a number of territorial assets did solidify within the community, and then largely move out of them to become part of more general territorial service bundles offered by the university, INEX and BEP sitting alongside Knowledge House and the Stephenson Centre (cf. Klofsten et al., 2000). These are distinct from the spin-off services and community in having quite a low threshold for engagement with by outside partners. It is thus in the emergence of these generic service bundles that the most ‘territorialised’ innovation assets are created, whereas by contrast, the services that are drawn upon within the community are indeed what one BDM repeatedly called “Rolls Royce deals”, significant for the university in cash terms but not necessarily in terms of regional development.

In the broader densification conceptual framework we set out above, we highlight a number of further mechanisms in which these spin-offs can have such impacts. The spin-offs and associated activities within the university may contribute to building particular niche sets of critical mass in the region, making Newcastle and the North East the ‘place to do something’, if not as impressive as being ‘the place to be’ like Cambridge, it at least resembles an improvement. The spin-offs may also build their own territorial networks, so that other regional companies benefit from the effort expended by the university in its exclusive spin-off system, albeit at one remove. The general issues associated with these two specific examples complete the analysis of the contribution that the spin-offs can potentially make to the system, and comprise the following two chapters of this report.
8 University spin-outs as active technology transfer

A third way in which the literature outlined in Chapter 2 suggests that USOs improve their local innovation environment is through the direct provision of innovation resources to other innovative SMEs. There have already in the previous two chapters been a number of examples of this kind of mechanism working in practise. We have already seen one example of a spin-off working with a corporate spin-off collaboratively on an R&D joint venture facilitated with a SMART award. A second example has been a university spin-off working with an already innovative fine chemicals company as part of their strategic response to the challenges of nanotechnology. In chapter 2, we suggested that the basic concept for this process was that the USOs would take ‘ideas’ out from the university, apply their ‘entrepreneurship’ to them, therefore making them available to local businesses, and thereby help to improve those firms productivity through the innovation process.

The argument is that the USOs in the model could do this more effectively than universities because as companies they had to be closely aligned and responsive to their customers’ needs. A heuristic for this process is given in the example where some of the consultancy companies were working to help local companies keep ahead of the challenges of competitive global markets, such as the threats (and of course opportunities) of nanotechnology for the chemicals industry. However, we have already seen in the two previous chapters that the naïve mechanisms we envisaged in chapter 2 do not work smoothly or straightforwardly. In this chapter, we therefore begin to unpick some of the complexity surrounding the contribution made by Newcastle University USOs to technology transfer – and hence to the innovation and competitiveness capacity of firms - in the North East of England.

8.1 Introduction

In a sense, that the naïve model does not function straightforwardly is unsurprising, because spin-offs are frequently small companies themselves. As we have noted, they have their own problems and limitations as new start-up firms, compounded by their reliance on resources at least partly held in the university. As one observer noted
“I think one of the problems we get with the university businesses is because the people running them don’t have the business experience, and often are not good at articulating what they are doing in commercial terms, they end up, the whole thing ends up being very half hearted.”

In reality, the third-party companies in the study that were best able to work with USOs were the ones that could compensate for the fact that the USOs did not always have a directly commercial idea, often by themselves being established firms with their own technology transfer activities and technology absorption capacity. It is perhaps then unsurprising that the there is an exchange – rather than transfer – of knowledge between the USO and third party firm; at best the exchange is more or less equal, like Muller & Zenker’s notion of co-evolved knowledge. Some USOs in the region had been able to establish themselves as independent companies who could co-operate with other companies in R&D activities. However, at worst, the third-party firm may have to expend significant effort to transfer knowledge into the firm and/ or university in order to get a particular problem solved or absorb the knowledge held in the USO.

In the specific case of Newcastle University, the issue is further occluded by importance of the dual role played by the academic professors, who were both articulating the problems faced by the USOs (as Research Director, for example) and then solving them within the university research team. This does not always have to be the case, as is seen in the University of Twente, where there are far fewer entrepreneurial professors (cf. Working Paper 2, chapter 6). In the case of Newcastle University, when a third-party firm deals with a professor, it is difficult to be certain which role the professor is enacting; although there may be flows of resources, we have already seen that in some cases there is a cross-subsidy between the formal company and research group elements which the professor jointly undertakes. With some consultancy work, for example, it was clear that one purpose of operating through a USO arrangement was to avoid heavy university overheads whilst still accessing the professional expertise of the professor (rather than the consultancy expertise of a professional manager). All these issues serve to cloud the mechanisms by which USOs from Newcastle University translate their knowledge - as actors independent from universities - into the North Eastern economy.
In this chapter, we attempt to address this by looking at the different roles that spin-offs can play in working directly with SMEs to promote regional innovation. We then consider whether there is evidence that the various activities associated with this are becoming generalised into a territorial learning competency. We envisage a variety of mechanisms through which this could potentially happen; USOs can work directly with other innovating firms to help them solve the problems they face in their innovation processes. USOs might also be involved collaboratively in co-evolutionary innovation activities, and they might also represent demanding customers for other regional firms, thereby representing a vertex of the Porterian ‘diamond’ (*qv*).

USOs can also work indirectly, and strategically, to help create the kinds of general collaborative activities which benefit other similar firms in the region, including both formal institutions such as cluster groupings or speciality groups, or informally, networking meetings and activities. They can also work to ‘seed’ new regional activities, creating sequences of innovation outside the university, but also increasingly outside the scope of their organisational boundary, which can in turn reinforce the overall regional innovation system. Finally, they can have a wider, cultural effect on what could be termed (after Lundvall, 1998), the regional ‘style’ of innovation, helping to make the region a place where particular high technology activities are done, and thereby increasing its attractiveness to outside investors who further reinforce the status of the territory.

USOs may not always play a lead role in the issues that are dealt with these analyses. The story of the rise of Silicon Valley, for example, is often told with reference to the role played by Fairchild Semiconductors, which was a spin-off of Shockley Laboratories, itself a daughter of the AT&T telecoms firm, rather than Hewlett Packard, which was a spin-off of Stanford University. Certainly, Fairchild Semi did ultimately produce a large number of spin-off companies, which contributed to the development of the high technology complex in the Santa Clara Valley. The university subsequently adjusted itself to the emergent technology base, to increase the role they played in the regional environment. The literature is ultimately clear; even if this point frequently remains unemphasised – that USOs do not have to lead the activities, they can still play a role in shaping them (*cf.* Kenney & Burg, 2000). In this chapter, we look at each of these areas
in turn, and then turn to consider whether they can, in toto, be considered as an improvement in the regional innovation system.

8.2 Formal technology transfer between spin-offs and other local firms

In chapter 6, we indicated that USOs were involved in a range of relationships with local companies which in turn often created, or supported, links between the firm and the university. Alongside these indirect and intermediated linkages, there were a range of direct relationships between the USOs and other firms, which were not directly dependent on the university as the source of the advantage, and these in turn became other sources of advantage in the regional economy. However, the clarity of this point is blurred by the fact that as we have seen, in 11 of the 14 cases under examination, the entrepreneurial academic had a dual role. This made it hard to distinguish whether the third party firm relationship was really with the university or the USO. However, there were other important types of relationship between USOs and other third party companies which potentially were affecting the overall innovative capacity of the North East.

8.2.1 Direct technology transfer from USOs into local companies

In terms of the formal technology transfer between USO and other companies, there were relatively few direct examples of where this had been done successfully, without drawing directly on the skills sets of the entrepreneurial professors. As we showed in chapter 6, the academic professors were an important source of the knowledge held within the regional knowledge pool. Most of the direct technology transfer was being done by the USOs who were directly involved in consultancy work (3 of the 14) and employed professional managers who were involved in the delivery of consultancy. They had their own technologies or expertises, and they embodied it into the solutions they sold on to others, who could then in turn use it to improve the quality of their product. More generally, there were a limited set of substantial examples of technology transfer between USOs and regional companies.

In one case, a scientific analysis company provided data analysis to a software firm who needed concise and well-written analyses to provide a database within the software package they sold. The third party firm in this case was a software firm who sold a
product which helped large pharmaceutical firms to co-ordinate the performance of identical laboratory experiments on different sites. This was something which was vital for ensuring the comparability of data in large clinical drugs trials, and hence potentially had a potentially multi-billion dollar market. The software programme provided ongoing prompts for the researchers to take particular actions as the experiments progressed: the role of the data provided by the USO was to explain what the interim results meant, and to shape further cues for the researcher, to ensure the experiment was performed to the highest level, before the software package centrally collated the results. The high quality of the material provided by the USO increased the overall quality and the success of the product, dependent on its’ capacity to standardise activity as its key competitive edge. On the basis of this successful first collaboration, they were in discussion with the USO to take out a more general license for the database system which would allow their product to be functional in a wider range of markets.

Likewise, there were regional fine chemicals companies who had undertaken process development work drawing on USOs, and used this to improve their productivity levels, embodying the consultants’ expertise in higher overall output levels. However, only five of the firms were working this way, selling their expertise to other local companies in a way that made sense to be described as ‘technology transfer’. The apparent advantage to the clients in working with USOs rather than trying to license the technology directly from the university themselves was that the USOs were much more flexible than the university. For the clients, who tended to themselves be relatively small firms, they could demand and enforce milestones and deliverables from the USOs. They could do this in ways not possible within the university environment where client firms were often relatively small with respect to the university, and much commercial work was done by staff also funded by long-term research and teaching contracts.

The result was that the USOs could then potentially became dependent on those clients in the way that a research group, underpinned by core teaching and research funds, would never. This had the inadvertent effect that the USOs themselves then had to deal with the problems that emerged in dealing with the university departments, persuading occasional commercial resources (RAs and professors) to do this work, when failure so to do would primarily punish the USO (cf. 8.2.2). Certainly, it is not true to say that Newcastle
University spin-offs were an unproblematic pathway into universities for firms who lacked a capacity to engage with the business development structure.

A final example was the case of Mindware, who were involved with an international standards body, developing a key standard for electronic commerce. As a spin-off of this they had been able to help other (local) companies deal with the standards as well as selling a piece of software which embodies those standards. Their development of standards was interlinked with their connections back to the existing research base in the university. It is not clear how important these links were to firms directly; there is a risk of assuming that there were connections between both relationship sets, in particular in assuming that the third party firms wanted to work with Mindware to be able to more easily access technologies held in the university. There is some evidence that Mindware had built up its own knowledges independently from the university which were also valued by third party firms.

These examples suggest that there is relatively little technology transfer directly from universities to firms in the manner of ‘forcing’ their technologies into existing firms to help raise the quality of the technological base in the region. However, as we have argued, the fact that spin-offs are not transferring university technology is not a problem if they have built up unique knowledges which can be combined with knowledge in other regional companies to solve their innovation problems. There is clearly a problem that USOs are themselves small firms, and this makes it more difficult for them to directly transfer technology into other companies. To make a tangible direct difference, they would have to grow into large companies, but this has not really happened for the companies in the research.

8.2.2 Collaborative interaction involving university spin-offs

A second area where the USOs contributed to the firms in a positive way was in collaborative interaction and problem-solving. This was, in reality, much more common than the formal technology-push transfer relationships dealt with in 8.2.1. As with the case of university/ firm interactions, this often involved the transfer of significant amounts of firms’ expertise into the USO, often in ways that were not directly rewarded. One interesting example of the complexities involved in this collaborative process was
that there was a USO which formed as a consequence of the university paying a third party firm to develop a software tool for it. The university then realised that there was value in the software tool, and the USO was subsequently set up as a joint venture between the firm and the university. This neatly exemplifies the USO as a knowledge pool item, in the co-innovation process depicted on page 16. The third party had shares in the USO firm, and was using it as a vehicle to sell on its’ IP (the software) alongside the university selling on its IP (the content).

Other firms engaged university expertise by bringing professors into new spin-off companies; one construction company set up a company jointly with a professor to sell on the professor’s expertise in a targeted way. This *modus operandi* was more successful than the professor’s previous foray into academic entrepreneurship. The professor’s previous spin-off had been unsuccessful, because it had been set up and organised to try to direct prime consultancy to the professor, and deliver the rest using a full-time manager within the firm. The manager’s role was to operate a base-load of consultancy work and pass on lucrative elements back to the university and professors. This raised the dual risk that not enough work for the professional consultant would lead to losses that the professor had to cover, or the professor would have to do lots of extra work if too much work was taken on to ensure the consultant’s costs were covered. As one such professional manager noted:-

“I did have one difficulty last year, one contract they gave me, and it threw up these problems. When you are building a business by subcontracting, the biggest hole is when you have nobody to do the work. And in one bad deal we did, unfortunately, when we decided to do a piece of work, we estimated how long it would take and we recruited a post doc, who had just finished his Ph.D. and was writing up and so wanted some income. Unfortunately he didn’t finish the work, because the work proved more difficult than it looked and then we couldn’t replace him because there was nobody else available. Contract work is a good story when it works, but it can also have its downsides, and the downside of this one wasn’t helped because we charged for something and then we didn’t get the result we hoped. But I guess the embarrassment was then not being able to find anyone else.”
Certainly, dual funded staff (lecturers and post-graduates) were much less freely available to respond to the changing requirements of particular consultancy contracts, but this appears to be more a function of staff largely being dependent on delivering long term teaching and research outcomes than the existence of USOs as organisational forms. However, it is not clear that this would apply to research groups on fully reliant on delivering research contracts, unless they were dominated by large contracts that made them regard links with small firms as insubstantial. Activities like the RCID and EDC (qvs) which had remained within the university were providing the kinds of advice mechanisms to high technology start-up firms that consultancy spin-offs were also providing. In the case of the three consultancy-type companies that span themselves out, it was clear that they did not spin themselves out to improve their value to clients; it was instead a reaction to the changing environments within university faculties. Consequently, care must be taken in ascribing the success of the technology transfer activity to the particular organisational form, the “USO”.

There were also examples where USOs and firms had connections in ways that were not directly linked to the innovation process, but which seemed to be reinforcing their competitive strength and innovative capacity by building critical mass in the area. One clear example is that there were a number of chemical, biologicals and biotechnology firms in the North East, including spin-offs, who interacted with each other. There was evidence in some cases that the USOs were involved in bringing new technologies and ideas into those firms, accompanied by a parallel movement of knowledge back into the spin-offs. The issue of whether this set of activities constituted a ‘critical mass’ will be looked at in some more detail in section 8.4. A second example, not directly provided by the study, but raised in Benneworth & Hodgson (2004) is in the renewable energy sector, where universities had been involved in the formation of a number of the key regional companies, including Soil Machine Dynamics and The Engineering Business Ltd (which was a spin-off of SMD). As established large engineering firms, they had been involved with a number of local second-tier suppliers, and had worked to bring them into the field of offshore renewable energy, which in the North Sea context, requires remarkably rugged construction (cf. Chapman et al., 2004). A final example is that one of the firms
had engaged a local firm as a distributor for its’ products and technologies, so that company benefited from additional products and services.

There was also the involvement of USOs around networks of contacts, particularly those involving staff from the former British Gas Engineering Research Station and On-Line Inspection Services (now closed cf. Benneworth, 2003). This is perhaps unsurprising, given that the Research Station had employed at one point two hundred R&D engineers working in the broad field of gas pipelines. One of the BDMs at Newcastle University had himself worked at OLIS in the late 1980s, and had a series of acquaintances with other people also from British Gas who were involved in USOs and third party firms. One of the third party firms working with one of the USOs was a spin-off from British Gas. That firm had also built strong linkages with another regional research-intensive firm, whose research director had subsequently gone to work for a second USO as a lead consultant. One of his initial base load retainers came from a former OLIS employee who had moved to a large engineering consultancy. The consultant also used the British Gas spin-off as one of four case studies in his Executive MBA. The problem that this vignette raises was that the USOs seemed mainly to be exploiting existing contacts, rather than developing and renewing the particular network. The Gas network, for example, was under threat from the fact that many of the ERS/OLIS staff were approaching retirement, and the USOs and indeed the gas spin-offs themselves were not creating new entrepreneurial engineers who could deepen and sustain the network.

8.2.3 Technology transfer between USOs and regional innovators

Arguably the most significant issues to emerge in 8.2 were firstly the fact that the USOs were not always the active party in the advantage they provided to the firm, and secondly that there was very little evidence of them forcing new technologies to upgrade existing businesses. A number of the spin-offs reported that they were working with companies who liked the idea of the cachet of working with a ‘university company’, which implies that the third party firms were using that USO characteristic to improve their own market position independently of the technology transfer process. Despite the fact that the university does not allow its spin-offs to brand themselves with university trademarks, the spin-offs did become a route to access particular university-based resources, in this case,
prestige for people who would not necessarily have a direct link into the university. Because the university was primarily interested in large collaborative research projects with blue-chip partners, this made it harder for smaller companies, the archetypal “Scrotum Manufacturing” (qv) averred to by a senior university manager in chapter 5, to work with the university outside the formal structure of outreach activities like EDC or RCID. Consequently, working with USOs provided a basis upon which these companies could access university technologies, given that the university regarded them as too small and unsophisticated to have a ‘proper’ university relationship, namely a licensing deal.

The companies that were in this class were very small, sole traders or real micro-businesses employing a handful of FTEs. As we have already argued in this section, there was a great deal of technology transfer from the client companies into the USO, and so although we have described the firms as ‘unsophisticated’, this relates only to the very poor treatment they experienced at the hands of university governance structures very poorly oriented towards their needs. They often had unique or specialised domain knowledges which were vital to the development of new ideas, and which could also in turn stimulate new research, as in the case of the spin-off which emerged from a commercial relationship with a firm. One such collaboration led to a publication in a journal in the client’s disciplinary field (business studies) which was entirely different to the background (life sciences) of the academic collaborator.

Given that there were 14 spin-off companies interviewed, there were relatively few third-party links that the spin-offs themselves believed were significant to them in terms of their own innovation processes. This seems to suggest overall that spin-offs in the North East are not playing a strong direct role in getting new technologies into regional businesses. They are providing some consultancy services for firms that are already sufficiently technologically sophisticated to articulate a set of demands. The relationships exist because of the present of the firm, but it does not seem to be directly upgrading the technological basis of the region.

In particular, it is not clear how this technology transfer process would operate in the absence of the spin-offs as organisational forms, were the staff to have remained active as a consultancy unit within the department. This raises the question, to what extent the
particular organisational form ‘spin-off’ is responsible for the technology transfer? The commercial opportunities provided by the companies seem to provide the entrepreneurial professors with opportunities to learn about how to work with companies, and working with companies seems to stimulate new research areas for the professors (cf. 6.2.2) They are an opportunity for smaller firms – too small to effectively attract the university’s attention – to work with the university, but this does not demonstrate that spin-offs are a better way of organising this interaction than outreach activities such as EDC or RCID.

The spin-offs have a role, but it does not appear to be the direct and totalising change envisaged by theory, nor is that role unique and unchallenged within the university environment. In terms of getting technology into companies, USOs and consultancy departments in the university appear more or less interchangeable. Of course you could make a neo-Thatcherite argument that a truly Schumpeterian entrepreneur would benefit from being outside the university, that the university prevents the realisation of certain beneficial outcomes that USOs could provide. In the next two sections, we therefore turn to look at these indirect, transformative/ Schumpeterian impacts of USOs, before finally asking whether all this activity adds up to building niche strengths in innovation in domain-specific areas in the North East of England.

8.3 Creating collaborative institutions and activities in the North East

A second area where USOs potentially have the capacity to improve the innovation environment for other companies is in shaping the regional institutional environment in ways that create more assets, not only for themselves but for other companies. In her famous Ph.D. thesis, “Sleeping with the enemy”, writing about the Twente Innovative Medical Products (TIMP) network (or cluster group), Rosalind Klein-Woolthuis (1999) noted that university spin-offs were central to the cluster group, and the contacts built during their shared time at university was central to the trust ‘asset’ on which the group was founded. In a later and possibly more reflective analysis (2004), she argued that although Twente had many of these clusters organisation groups, they tended to remain semi-detached from the region, and did not hang together to improve the overall regional innovation system. There is some evidence in the North East that USOs are involved with such collaborative institutions and activities; likewise, there is less convincing
evidence that they are ‘hanging well together’ in ways that is creating more generalised territorial advantages beyond the micro-scale networks.

8.3.1 Direct involvement in establishing new entrepreneurial networks.

One area where USOs can feature in explanations of assets building in support of innovation is as key actors in the kinds of networks that contribute to a place’s institutional thickness or richness. There are a variety of roles that USOs can play: arranging these by the significance for regional networks, these roles vary from initiating those networks, through supporting and contributing to them, to finally them merely drawing somewhat parasitically on the networks inasmuch as they offer assets of interest to the USOs. The first point to make is that none of the USOs had been involved in initiating particular regional network activities; this contrasts with the comparator research in Twente, where there were many examples of USOs getting involved in initiating collective activities to jointly address common problems with the innovation environment (cf. Working Paper 2, p. 8.3.1, p. 176). One example, from Twente, that illustrates the comparative weakness of the situation in the North East was that a group of local companies in Twente had been facing the retirement of a professor with whom they had all collaborated in their own R&D, having variously funded research programmes and studentships, and recruiting masters’ students. The University of Twente had simultaneously decided to use the retirement as an opportunity to cut costs by making that post redundant. At the behest of one spin-off, the firms mobilised to assemble finances, and hired a new professor, within the framework of the “Stichting Mechatronica Valley, Twente” (The Twente Mechatronics Valley Foundation)\(^\text{29}\) (Working paper 2, p. 182).

The most obvious contribution that the USOs had made to networks which supported regional innovation and entrepreneurship assets was as part of the evolving and emerging venture capital market in the region. Policy analyses have regularly revealed that weak venture capital markets in the North East of England contribute to the poor environment

\(^{29}\) <Stichting Mechatronica Valley Twente> <<<http://www.mechatronicavalley.nl/>> <Accessed 14th March 2005>
for entrepreneurship in the region, and recently, the UK Ministries of Finance (HM Treasury) and Trade and Industry (DTI) have created regional venture capital funds to try to address this finance gap. Spin-offs have been part of this process, primarily as users rather than as ‘shapers’, including using the new (publicly funded) regional seed capital fund. In tandem with that, there has been an apparent improvement in the venture market in the region, in particular with the private local venture capital funds (such as Northern Enterprise Ltd) getting more involved in financing local high-technology investments.

It is possible to make an argument that because after they emerged from the Equity Committee process, they were then sensible high technology investment opportunities, and so USOs had contributed to improving access to finance in the North East. This argument would then continue that that had in turn removed a general constraint to innovation faced by all high-technology start-up firms in the region, by encouraging the creation of a venture capital market. How does the evidence sit with this narrative? In total, eight of the 14 companies interviewed had brought in external finance, whilst six had not (including those three companies which had been formed within the university).

There was a recognition in the North East that USOs had a problem in attracting venture finance, because research projects tended to stop some way short of producing the kinds of proven concept with protectable IP in which venture capitalists were willing to invest. As one interviewee noted,

“Spin-out companies tend to have exciting technology, and tend to address new leads and new opportunities in the market place, and those are not best funded on a very small scale with a very small mindset. You are almost better to walk away or do it properly, and that’s not what we do in the North East, we sort of do a half cocked job of everything, which sounds terribly rude. All the people involved are trying to do the right thing, it’s just that the environment constrains them to not be able to.”

Figure 7 below gives a diagrammatic representation of how the North East’s RDA-supported venture fund conceptualised the problems faced by USOs in exploiting their technologies for the benefit of the region. Figure 7 was printed by Northstar (qv) which provides investment funds to both USO and other high-technology start up firms.
Although no firms in the study had accessed Northstar funds by the time of the primary research, by 2005, one third party firm had accessed those venture funds, and at least one firm was to later benefit from the proof of concept fund. It could then be that in some way, spin-offs have had a conceptual ‘demonstration’ effect for regional policy-makers, to show that high technology firms can succeed in the North East. In turn, their problems in attracting venture capital have spurred regional policy-makers to take action to develop the kinds of instruments which so far have been able to help one innovative third-party firm, as well as other firms with no direct link to USOs.

*Figure 8 The gaps faced by university companies in seeking finance to exploit research findings in the North East of England*

Three of the USOs had obtained investment from corporate venture capital firms, two from private businesses, and two from business angels. One of the firms was particularly interesting, because it was a spin-off with three academic parents, which had located in Newcastle rather than near to either of the other parent institutions. The other two parents, one from the south of England and the other from Spain, had helped it raise investment from the City of London and Spanish venture capitalists. In this case, the university helped to bring investment funds into the region through the spin-out activity. There was some indirect evidence that past successes with spin-offs were conditioning investors to be more confident that the North East was a place in which high technology
firms could succeed and be sold on at a profit. However, to some extent, USOs were beneficiaries rather than initiators or causes of this situation.

It is of course more contentious to argue that this is an improvement in the overall environment for finance, but figure 7 appears to be evidence that there is a recognition that policy makers had begun to recognise that there is a gap for all firms in the region, on the grounds that there were viable investment opportunities which were having difficulties in attracting funding. In turn, this might make it one step towards changing all investors’ attitudes to investing in the North East of England, something which is important given the strong herd instinct of venture capitalists identified by other writers. It was observed that the process of investing in USOs through things like the USO seedcorn fund was creating unique knowledges which were more general knowledge assets for the region:

“There isn’t enough money in the North East, but in that case, wouldn’t it be better syndicating. There must be venture capital organisations in London who are trying to find good opportunities to spend money who would benefit from the depth of knowledge and research that someone like the particular North Eastern funds have.”

It would of course be interesting to see if those external investors who came in syndicated alongside the lead local investors were in turn having their attitudes towards investing in the North East changed, but answering such a question is outwith the scope of this particular research project. Of course, the evidence above is not compelling that there has been a change in the venture capital market precipitated by USOs and activities, but there are some indications that USOs are part of a more general development of regional venture capital in ways that is beneficial to regional SMEs.

8.3.2 Contributing to institutional thickness: USOs, academic entrepreneurs and the knowledge economy.

We have already questioned whether USOs are vital to technology transfer, and wish to identify potential areas where spin-offs could use their entrepreneurial orientation to set up activities not possible within the confines of a university. A second issue is that USO
founders were not getting involved in supporting and sustaining existing networks, something sometimes referred to in the UK as “public life”. USO staff had not developed strong public lives in ways that had created and reinforcing these new knowledge networks. In his 2001 memoirs, Herbert Loebl, a renowned North Eastern entrepreneur, noted that the activities he achieved through his public life were arguably more important than the company he had helped to found in improving the economic potential of the North East; he had worked on a group for ECOFIN, at the time the special advisory group to the European Council of Ministers, and had been involved with the development of the Structural Funds, from which considerable resources were later to flow to the North East.

Looking at two other examples of entrepreneurs who have also engaged in similar public lives, it can be seen that one feature of them is that the managers there build up a set of public positions in tandem with the growth and success of their particular company\(^{30}\). Chris Thompson, managing director of Express Group, was on the Regional Innovation Steering Group 2002-3, he was a board member of the local Training and Enterprise Council, was involved with the establishment of the Manufacturing Challenge network group, and at the time of the research was on the board of the regional seed capital fund, Northstar (qv). Mark I’Anson established Integrated Micro Products in the late 1980s, which was bought up by Sun in 1996. Before the buy-out, he had already developed a series of public life engagements interests, in particular because of IMP’s status as a rare high technology business in the former Steel town of Consett. He had become involved with the Derwentside Industrial Development Association, as well as the British Steel Corporation which provided finance to new business ventures in old steel areas. On the basis of this, and his successful stewardship of a venture capital funded company through the NASDAQ to buyout, he became regarded as an ‘investor friendly’ non-executive director for local firms, including one spin-off company. As their web-site observes :-

\(^{30}\) These two examples are taken from past experience to illustrate the general ‘public life’ issue in the North East, rather than being derived from interviews in this or any other CURDS project. It was brought to our attention later on in the drafting process that both the individuals named are involved in research projects within IPP, but this information was deduced from readily available documents in the public domain and on the internet.
“After graduating from Cambridge University, Mark began his career in computing as a research fellow at the Open University. Leaving academia Mark and a colleague further developed these ideas and founded Integrated Micro Products. Over 15 years Mark grew this to a several hundred person business, floated it on the US NASDAQ stock exchange and was ultimately acquired by Sun Microsystems. Within Sun Mark was responsible for the Telco Platforms Group and provided leadership in Sun's telecoms and Internet strategy development. Since leaving Sun he has continued to develop his business career and is Chairman of Nexpress Group Ltd, a computer remarketing company and ESB Ltd, a developer of business applications for mobile devices. He is also a non-executive director of Non-Linear Dynamics, a leading developer of proteomics software. Mark is also involved in a number of business development organisations. He chairs the Derwentside Industrial Development Agency, a local business start-up and support agency, and is a director of The Alchemists (Northern) Ltd, which is a government backed body charged with maximizing the potential of the North-East's highest growth businesses.”

The one academic entrepreneur who seemed to have made the leap from being an academic entrepreneur to a ‘spin-off guru’ was Professor Christopher Edwards, the Newcastle University Vice Chancellor, who had experience of working with venture capitalists. Because he had successfully managed investments in his company, and had very successfully and managed to produce a return for his investors, this meant that he enjoyed a network of contacts in the world of finance upon which he could draw. He was also a board member of ONE, the regional development agency for the North East of England, (in an *ad hominem* capacity, not representing the university) as well as the Regional Science and Industry Council. It was not unusual for university senior managers to be involved in those kinds of regional activities, particularly in Newcastle University where regional engagement was, at the time of the research, managed by a very senior individual, the Deputy Vice Chancellor. One senior manager not interviewed as part of the project, Professor Malcolm Young, Provost of the Science and Agriculture faculty, also had a spin-off company, Enrotis, and he became involved at the start of 2005 with developing a science case with the City Council and RDA for the “Newcastle Science City” submission from the region to the Treasury (*cf.* Chapter 9).

By comparison, the principals from those spin-outs which sold up (Mindware, Novocastra) had not built up such personal portfolios of other appointments on the basis of their experiences in charge of USOs, upon which to capitalise after the sale. Admittedly, the Mindware team became concerned with running the development
laboratory for its new owners then restarting the business, inevitably leaving them little
time free to devote to part time public life activity. The Novo castra principals reinvested
their funds in areas of research of interest to them. Almost none of the spin-offs had
employees who were building up the kinds of curriculum vitae during their time running
the spin-off which included participation in regional activities. There was one example
of such activity from one academic entrepreneur, who was invited by the UK Minister of
Science, Lord Sainsbury, to sit on a stakeholder committee for the development of the
European Framework Programmes. However, this particular activity seemed to derive
much more from his role as a senior academic than as someone involved in the
commercialisation of university research.

Three complementary explanations emerged in the course of the interviews for this low
participation rate in the kinds of organisational, activities and networks which could have
improved the regional innovation system. The first, and most intuitive explanation for
this, was that being an entrepreneurial academic meant that the individuals had no time to
do anything but cope with their academic workload and business demands. As one
academic entrepreneur noted, the demands of the job meant that there was less time
available for core academic tasks, much less for engaging in the development of new
regional collaborative activities.

“Running a spin-off is terribly time consuming, so it means that, although I don’t
do much for the firm when I’m here in the university, I’ve always got plenty of
other things to do. This means that I don’t do any of the academic kind of things
which I was formerly doing at home. I am spending all my time running this
business. Well, of course, I’ve got one hobby, singing, and I haven’t stopped that,
but what has stopped is the academic work I previously have done at home”.

Besides a lack of time, there was a second complementary explanation for the lack of
reported participation in public life. We have already noted that one of the characteristics
of USO activity around Newcastle University was the idea of the ‘academic professor’,
one individual jointly managing a set of research activities which spanned the firm and
research group. For the two non-university entrepreneurs outlined above, public life
provided a means to build external networks which allowed the individual to condition
their local environment in ways which was directly beneficial to themselves as part of
creating broader regional assets. Clearly, these local networks were less important for
academic entrepreneurs than local entrepreneurs, because as professors managing
research groups, they were dependent on building status and position in global and
international peer networks through which to access continuing research funding for their
peer reviewed research activities.

They also provided a complementary set of activities in the case of pure entrepreneurs,
providing a change from the routine of particular business roles. In the case of the USOs,
the mix of being a professor and entrepreneur together provided a balance of interests for
individuals which entrepreneurs sought to achieve through involving themselves in the
public life of other companies. One individual was clearly very keen on both halves of
being an ‘academic entrepreneurship’, the practical side of developing and using
techniques along with the academic discipline of writing about those new techniques.
That might perhaps explain why there was no necessity for individuals involved in USOs
to actively seek the varied other challenges of public life.

“I have always been a keen writer, and I’d published quite successfully out of my
Ph.D., thesis, and even when I’d been working overseas, I’d published a couple of
things on stuff I had done while I was working there. I just loved writing, and I
loved developing new techniques. Overseas, necessity was the mother of
invention, and I had been developing these fieldwork-based techniques, and so I
thought, ‘bugger it, I’ll publish it, why not?’ So I was still publishing abroad, and
I got in the habit with my Ph.D. and I never really stopped. And that helped get
me the job, I’m sure, but then I found the same skill that makes me a good writer
of papers also makes me a good writer of proposals. It’s probably been my key
skill, I’m not really an experimental scientist … I love it, it’s like playing Cluedo,
but better, it’s like outdoor Cluedo, you know.”

The third explanation was that the companies were themselves relatively insignificant,
and they did not require individuals to solve ‘big problems’ – such as arranging external
finance – which were in demand elsewhere such as managing a NASDAQ-quoted
company. It has already been noted that there was a perception that academics in the
North East did not try to ambitiously assemble finance packages to properly capitalise spin-out companies, so entrepreneurial professors were not building up reputations as effective commercial managers which might have led to invitations to involve themselves in other activities in the region. Of course, this was not true for a number of the firms who had managed to raise venture finance, and it is possible that in the future, their experiences with venture capital might make them “venture capital investor-friendly” individuals who could mentor and support other local start-ups, as had the two cases of regional entrepreneurs already outlined.

8.3.3 Concluding discussion

The main mechanisms for regional improvement in this section appears to suggest that where there is an academic entrepreneur model of entrepreneurship for USOs in a region, then not all the assets that the academics build up around them pursuing their goals are either locally available or locally valued/valuable. This suggests in turn that the USO activity is less beneficial for the region than might be expected. One issue is of course the sheer workload of the academic entrepreneurs, but there also seems to be a suggestion that personal characteristics of some of the entrepreneurs, in particular a lack of vision to properly capitalise their spin-offs, means that the USOs do not have a Schumpeterian capacity to transform their regional environments. As was previously noted, one interviewee argued that “all the people involved are trying to do the right thing, it’s just that the environment constraints them to not be able to”.

But that is perhaps a little unfair on the academic entrepreneurs. There are clear examples of where university spin-offs have raised finance and transferred technology under particular sets of conditions, and at the same time, USOs have been built up as real fast-growing high technology firms, independent from the university. The different types of company seem to correspond to some degree to the type of knowledge flows, with consultancy activities actively pushing technology into existing businesses, and the high technology start-up firms involved in building up venture capital and other entrepreneurial-type networks. The former evidence seems to suggest that promoting USOs where there is an academic entrepreneur model in dominance, as there is in the case of Newcastle University, will not lead to the development of cluster activities and
organisations\textsuperscript{31}. It is possible to conceive of university spin-offs in the North East that would in the future build strong regional networks to support their own success, or whose managers would become ‘gurus’, but none of those companies or activities had been found so far in this particular study.

### 8.4 USOs as initiators of new regional sequences of innovation

A third contribution which USOs could make to their regional economies is if they become strong centres of regional growth, as in the aforementioned case of Fairchild in Silicon Valley. It is possible for firms outside such core regions to also become such centres of growth, as we already found with the firm Joyce-Loebl in the North East; although it created over forty spin-off firms, three of its daughter companies were also strong centres of further growth moving forward into new technological fields (Benneworth, 2004c). The university has a number of such high technology spin-outs, and it is conceivable that they might have likewise become strong growth nodes for the regional economy. However, in chapter 6 we have seen that only two Newcastle University spin-offs have produced daughter companies, and only one of those was included in the research (the other being Soil Machine Dynamics and its daughter, The Engineering Business; cf. Benneworth & Hodgson, 2004).

It is of course arguable that there has not been the time elapsed for new strong growth nodes which had the time to demonstrate their strength by producing significant numbers of spin-off companies. With Joyce-Loebl, the real spin-off activity was concentrated between 20 and 30 years after the firm itself was founded. Likewise, Musson (2005) observed that the real stimulus for spin-outs from Ferranti in Manchester was when the company went bankrupt decades after its original founding. By contrast, the oldest spin-out company in the sample, Seabait, is only 19 years old. However, there may be other elements of new growth nodes already evident, particularly in terms of how the spin-offs are interacting with the growth prospects of existing sectors, and the role of

\textsuperscript{31} Anecdotaly, there was a start-up from Newcastle Business School which did not follow the academic entrepreneurship route, and that company is currently on the board of the Service Network, a group promoting collaborative interaction between knowledge intensive business services in the North East of England.
USOs in configuring institutional support for new sectors in ways that support economic growth.

Because there is no clear proof that USOs have been initiators of new sequences of regional development in terms of creating daughter companies, in this section we focus on two smaller areas where there is some evidence that new economic growth nodes are being created, which involve university spin-off activity. One area where university spin-offs could potentially have a significant impact on the region is in supporting processes of regional adaptation and renewal in existing strong industries under competitive pressure. Although regional economic development narratives regularly decontextualise the emergence of new sectors from the places in which they emerge, technological change as a driver of economic development brings about its consequences as much through changes to existing activities as through creating new sectors from nothing. Economic decline is in part a consequence of a failure of regional firms to adapt to new market conditions and opportunities, an issue which emerges strongly in the history of the North East set out in Chapter 4. Consequently, spin-off companies provide one mechanism to avoid renewal by facilitating the adaptation process.

The problem underlying such an analysis is that adaptation is inevitably incomplete and ongoing, making it very difficult to evaluate the extent, significance and value of particular changes. We therefore look at a diverse range of activities to try to gain different perspectives on the impacts of USOs on this adaptation process and finally attempt to bring them together in a coherent narrative about the role of USOs in facilitating technological adaptation in a particular sector. In this section we look at two examples of how USOs have been involved, firstly with supporting the emergence of the biotechnology sector in the region, and secondly, with the formation of the INEX centre as a dedicated resource for promoting nanotechnology R&D exploitation in the region.

8.4.1 The role of USOs in creating a new regional growth sequence in biotechnology

In this section, we look at the role of spin-outs in facilitating the adaptation of the chemicals and pharmaceutical sector in the region. The North East has long had a very strong chemicals sector, home at one time to the giant firm ICI (Greco, 2003), and supported by a pharmaceutical industry built on inwards investment. This has come at a
time that traditional bulk chemicals and generic pharmaceutical manufacturing across advanced manufacturing economies is being squeezed by low cost Far East Asian manufacturing. New product innovation in pharmaceuticals is dependent on securing the approval for new chemical entities (NCEs or drugs) by regulatory bodies, principally the American Food and Drugs Administration. The purpose of the trial is to demonstrate that the drugs is safe, and produces the desired therapeutic effects without disproportionate side-effects. Drugs companies are compensated for long term investment required to secure approval with a temporary monopoly – a patent – which permits only the manufacturer to sell the drug for a fixed time period. The key competitive driver for pharmaceutical companies in advanced economies is in exploiting these monopolies, putting a premium on bringing products to market more quickly. Biotechnology allows more and better drugs to be developed and trialled faster, thereby allowing a much longer period of super-profit taking in the patent-protected period. These rich rewards for accelerating drug discovery and cutting time to market has also encouraged companies that have not traditionally had a strong orientation towards chemicals and pharmaceuticals to move into exploiting biotechnology and pharmaceutical markets. The biotechnology ‘revolution’ has encouraged increasing numbers of these companies in the region to build competitive advantages around biotechnology broadly defined (Benneworth, 2004b); in the North East, regional software firms have emerged with expertises in bioinformatics.

Biotechnology is an industry that has emerged in the UK as a consequence of long term public sector investment in agriculture and biotechnology, primarily in the South East (Blair, 1991; Wicksteed, 2000). However, there has also been a lot of regional support for the development of a biotechnology sector in the North East, albeit from the regional development agency rather than from national scientific funding councils. ONE identified as early as 1999 that there was something worthy of the name of a ‘biotechnology cluster’ in the region; although attempts to form a regional biotechnology association had been unsuccessful in the early 1990s, by the late 1990s, an industry leadership group, named “Biosci North” had been launched to promote the sector in the region. In 2001, the American-based Chemical Speciality journal listed its top twenty global innovators in Speciality Chemicals, and three of the twenty had an R&D base
which relied heavily on assets in the North East of England (Thomas Swan, Avecia, Rhodia Chirex). ONE’s and Biosci North’s interests subsequently converged in 2003 with the creation of CELS, the North Eastern Centre of Excellence in the Life Sciences, as part of the “Strategy for Success”.

The main criticism that has been levelled at regional development agencies is that in moving towards cluster-based concepts of economic success, they have all adopted similar high-technology clusters with little regional specificity (such as life sciences or nanotechnology). Benneworth & Whitehurst (2002) identified that all English regions had identified some form of biotechnology cluster for their region in their (1999) Regional Economic Strategies. This called into question the meaningfulness of particular supposed biotechnology clusters; to try to establish the significance of the biotechnology sector in the region, we firstly disaggregate it into a set of elements which seem to suggest that there has been a positive development of some kind in the region.

The first element in establishing the viability of the sector in the region has been the development of a stable institutional framework to promote and leverage public sector investment in a way that makes the region a ‘place to do biotechnology’. Within that, CELS, the public sector organisation attempting to promote biotechnology in the North East, were quite clear that USOs had only a peripheral role to play in building a strong biotechnology sector in the region. CELS’ focus at the time of the research was in trying to attract a private pharmaceutical R&D investment or create a large regional institution that would give the region some kind of critical mass and global profile in a niche area of biotechnology. As one of the then-employees of CELS noted:-

“I think it’s fair to say that we have got a sense that if we want to achieve our goals and our mission and achieve the Strategy for Success goals and mission you are not going to do it by helping a score, a hundred, two hundred SMEs alone. You can help them and that’s part of it but I think to get to become a global player in a Biotech market we’ve got to scale up. That’s why things like centres and institutes and initiatives come in to play.”
8.4.1.1 USOs and the BioNE\textsuperscript{2}T network of excellence

Newcastle University has historically long been interested in supporting biotechnology, especially R&D. As one of the first recent moves within Newcastle University’s approach to regional engagement after the “Manchester software company” failure (\textit{qv}) Newcastle University bid for, and won, DTI funding for a so-called Bioscience Exploitation Platform company, Bioscience Partnership Ltd. This was formed in 1998, with the intention of jointly commercialising research from Newcastle University, the University of East Anglia and the Babraham Institute. When Newcastle University were bidding for funding for their BDMs under the HERO-BAC programme, life sciences was identified as one of the university’s strengths, and a business development manager in the field of life sciences was duly appointed to lead that area. The EPSRC funded a 2 year networking and collaboration project within the university, BIONET, which was subsequently adopted and extended by CELS under the title “BioNE\textsuperscript{2}T”. One of the business development managers appointed in 2000/01 was involved in creating the BioNE\textsuperscript{2}T organisation as a means of collectively mobilising biotechnology actors in the region. The BioNE\textsuperscript{2}T organisation was principally an academic networking organisation, consolidating regional strengths and attempting to make the North East ‘a place to be’ for particular speciality biotechnology research.

An very practical example of the geographical re-imagining that this process has subsequently involved was in the title of a paper given by Dr Miodrag Stojkovic at a BioNE\textsuperscript{2}T Stem Cells event. Dr. Stojkovic was the first UK academic to be granted a license to undertake human stem cell cloning, and headed a research group which apparently had a great deal of commercial potential because of its unique and unreproducible skills in dealing with the practical problems of therapeutic cloning. The paper was entitled “Human embryonic stem cells: Made in Newcastle-upon-Tyne”, and was presented to the “Regional Progress in Stem Cell Biology” working group, 7\textsuperscript{th} February 2005. The significance of the paper title lies in the fact that it is in this case an academic performing the act of geographical imagining, making the case that the uniqueness of their knowledges made Newcastle a place where cloning was done, almost an obligatory “point of passage” for therapeutic cloning.
But what is the role of USOs in BioNE\(^2\)T in this process of reimagining Newcastle as a Biotechnology City, if indeed any? As related though the interviews BioNE\(^2\)T was conceived of as an academic network, to do for the academics what Biosci North had been intended to do for the firms in the region. None of the USOs interviewed mentioned BioNE\(^2\)T as something with which they were involved, with the exception of Orla, but this was clearly because their CEO had been involved - in his previous employment at the university - in establishing the organisation. However, there was some engagement between BioNE\(^2\)T and the USOs. BioNE\(^2\)T and CELS had between them between them provided some funding for Ph.D. studentships in academic research groups, who could arrange both university funded stipends along with industrial support. The requirement for two additional sources of funding meant that an ‘academic entrepreneur’ was an ideal provider of both those assets; through the academic entrepreneur there are connections back to the university to access departmental and faculty studentships, and through the company there is the opportunity to access industrial partnerships. In the last round of awards before this report was drafted, there were a total of four studentships offered, of which two involved sponsorships from spin-offs from Newcastle University, and whose academic supervision was provided by members of the academic entrepreneur’s research group. Of these two, one was sponsored by Novocastra and one by Xcellsyz, (Novocastra had also had one similar studentship in the previous funding round). The studentships involved some degree of cofinance and network building between the university, firm and BioNE\(^2\)T, as the funding rubric made clear.

“The student will be expected to have a placement within the company for a period of between 6 and 18 months. It is anticipated that ownership of intellectual property rights will be negotiated between the University, Industry and CELS. The student will be required to produce a progress report, every six months for CELS and the industrial partner. BioNE\(^t\) can provide assistance in establishing industrial links.” 32

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The cofinance needed to be of the order of £4,500 from CELS, £4-6,00 from the industrial partner, and £11,000 from the university for each year of the project. In return for this, there was intended to be considerable quite a lot of interaction between USO, student, university and CELS (hosts of BioNE\textsuperscript{2}T). Although the USOs were not leading the development of the network, they were involved in the life of the BioNE\textsuperscript{2}T network, such as in this case, by contributing tens of thousands of pounds to training new research-active post-docs for which they would not expect to see the full benefit.

8.4.1.2 USOs as symbols of a plausible North East bioscience industry.

USOs were also enrolled in a symbolic way by a variety of actors who wanted to make the point that the region was a place to do particular versions of biotechnology. The regional newspaper group published a special report on pharmaceutical and chemicals in the North East on Spring 2005, and they enrolled USOs to argue that the North East was an acknowledged centre of excellence in pharmaceuticals and chemicals, and they argued that “there are many world class speciality and fine chemical companies based around the North East ... the region is home to leading edge biotechnology companies such as Novocastra, Xcellsyz, Angel Biotechnology and Nonlinear Dynamics” (North East Vision, 2005, p. 37). This discursive enrolling is made by a number of organisations who are each trying to legitimate the concept that the North East is a place to do biotechnology.

One of the regional bodies for whom that legitimation was a significant concern was the Centre of Excellence for Life Sciences (CELS, \textit{qv}), to establish its own legitimacy rather than merely being another regional “me-too” cluster organisation \textit{pace} the Benneworth & Whitehurst critique. In seeking to establish itself as a Centre of Excellence, CELS needed to establish that there was a rational technological and scientific basis for a strong regional biotechnology industry. There is evidence that CELS enrolled the USOs into this process, despite the fact that they realised that USOs would not of themselves transform the regional industry.

One way this was done was in assembling all the companies involved in biotechnology into a single list to suggest a ‘critical mass’ of regional activity. By early 2005, as this report was being prepared, of the fifty firms in the region identified by BioNE\textsuperscript{2}T in their
regional company directory, 15 of them were university spin-outs, and around half of the USOs came from Newcastle University, the vast majority of the rest coming from Durham University. This represents a considerable increase on the levels of activity reported on earlier analysis work done on the biotechnology cluster in the region. The DTI Biotechnology cluster mapping working group (1999) identified 18 biotechnology firms in the North East, and the Angle Technology report, (2001) identified 25 firms, as active in biotechnology in the North East of England (cf. Benneworth, 2004b). The full breakdown of companies and their origins, identified by BioNE\textsuperscript{2}T, is given in table 5 below:-

\textit{Table 5 Regional biotechnology firms listed by BioNE\textsuperscript{2}T, by firm origin, March 2005}

<table>
<thead>
<tr>
<th>Origin of firm</th>
<th>Number</th>
<th>Origin of firm</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>University Spin-offs companies</td>
<td>15</td>
<td>Inwards investment</td>
<td>10</td>
</tr>
<tr>
<td>\textit{Newcastle University USOs}</td>
<td>8</td>
<td>Unknown origin</td>
<td>2</td>
</tr>
<tr>
<td>\textit{Other university USOs}</td>
<td>7</td>
<td>High technology start-ups</td>
<td>6</td>
</tr>
<tr>
<td>Corporate spin-offs</td>
<td>12</td>
<td>Not in North East (inc 1 NU USO)</td>
<td>4</td>
</tr>
<tr>
<td>\textit{Joyce Loebl spin-offs}</td>
<td>4</td>
<td>Hospital spin-out</td>
<td>1</td>
</tr>
</tbody>
</table>

Source: \url{http://www.bionetatcels.com/}, authors’ own calculations

USOs have been similarly enrolled into the political process of ‘making a place for biotechnology’ in the region, one such place being the International Centre for Life (ICfL). ICfL was a controversial project developed by the Tyne and Wear Development Corporation to create a flagship high-technology biotechnology activity in the region around the fields of genetic engineering and gene sciences. The idea emerged in the mid 1990s, out of a criticism that Newcastle University was not doing enough to commercialise its research and to support biotechnology companies in the region. The original Centre for Life concept envisaged bringing together the university’s research capacities around Human Genetics, along with regional companies, and a theme park focusing on the public understanding of the science (PUS) of human genetic. The Centre was able to attract one high-profile regional biotechnology firm, Applied Imaging onto the precinct campus. The idea was to use the PUS theme-park to underwrite the
incubator units. Newcastle University bid for and won an £8m Joint Infrastructure Fund (JIF) bid to integrate a number of research teams into the multi-disciplinary Institute for Human Genetics with a fully equipped and state-of-the-art laboratory.

Despite these early successes, the project was not unproblematic, not least because it was difficult to balance the implicit cross-subsidising within the project. In particular, there were problems in attracting other biotechnology firms, and throughout its existence it was criticised for providing expensive office space rather than meeting the needs of regional R&D and laboratory based firms. Biosci North, for example, took office space there, as subsequently did CELS, and indeed the RDA. In response to this criticism, senior managers at the ICfL did put effort into attracting USOs to fill their incubator unit; currently, at the time of writing, of their seven commercial tenants, four are Newcastle University spin-offs (although only two of those are in the life science field). The significance of the Centre for Life is in part as a consequence of the ways it has shaped the attitudes of external parties to biosciences in the region, and this is dealt with in more detail in Chapter 9.

8.4.1.3 The emergence of high science content biotechnology innovation

A third area is that there is evidence that the quality of the industry in the region is improving, in terms of the development of a high-technology sector with strong involvement in particular NCE pipelines. In previous research (cf. Benneworth, 2004b) we had identified that there was already a strong biotechnology cluster around what we termed in that paper “Low Science Content Biotechnology Innovation” (LSCBI), drawing on expertise in associated domains outside the drug discovery pipeline, principally chemical engineering and computer software. At the time that the research for that paper was undertaken, there was arguably only one High Science Content Biotechnology Innovation (HSCBI) firm in the North East, Sanofi Laboratories. One distinction between LSCBI and HSCBI relates to its’ position in the pharmaceutical product pipeline, a ten-plus year process which takes ideas from basic science to approved new chemical entity. HSCBI firms occupy positions within the pipeline, from basic biochemical research through to drug discovery, clinical trials performance all the way through to the approval of new drugs by drugs regulators. By contrast, LSCBI firms
either support the pipeline (such as laboratory→ factory engineering upscaling services) or take discrete pieces of biotechnology knowledge and bring them quickly to market (like paternity testing kits or innovative clinical and diagnostic supplies). The regions which have had the highest profile and most visible biotechnology industries have tended to be dominated by HSCBI, such as Cambridge or Silicon Valley, and the North East has suffered from a perception that it is technologically backwards in comparison to such areas.\(^3^3\)

However, looking at the regional firms cited by BioNE\(^2\)T and reproduced in table 5 above, it does appear that there is beginning to be the emergence of the kinds of HSCBI that characterise successful high growth regions, and that USOs are a key part of this. Four of the eight Newcastle University spin-offs who were also listed within the BioNE\(^2\)T organisation were involved in HSCBI, as direct contributors to the drugs pipeline. There is only one other firm in the BioNE\(^2\)T list in the North East who is actively involved in the drugs discovery pipeline, although a significant proportion of other firms are involved in innovation in pharmaceutical manufacturing. There is also one Newcastle University spin-out, Arrow Therapeutics, which is not based in the region, but which is also involved in the pipeline, which helps again to make the case that Newcastle University is a place where medical scientists are producing ‘good biotechnology’. This science in turn makes good ventures from a funding perspective - meaning that in practise that those ventures feed directly into clinical drugs chains. Because the university has a medical school in which its departments are highly research rated and internationally renowned, it is not hard for the university to raise further finance for the commercialisation of particular ideas.

8.4.1.4 Producing a regional dynamic: how this all hangs together

The final element by which USOs contributed to the growth sequence, and the adaptation of chemicals and bulk pharmaceuticals into knowledge-intensive high value added

\(^{3^3}\) However, the successful sale of Novocastra, the purchase of Joyce-Loebl by Applied Imaging to access their imaging technologies, and the successful listing of Non-Linear Dynamics demonstrate that this LSCBI can be extremely lucrative and contribute extensively to building a strong regional technology base for the sector (cf. Benneworth, 2002).
products was through the direct interactions between USOs and other regional companies highlighted in 8.2. In part through the work of CELS and BioNE\textsuperscript{2}T in promoting networking, but also as a consequence of longer term relationships, there were some interactions between regional companies in ways that added to the total activity in the region. There were regional supply chains around the pharmaceutical sector, so spin-offs were selling particular high value inputs to pharmaceutical and fine chemicals companies. In one case they were doing this as part of the development of a new product by a fine chemicals company, supporting their regional innovation process.

There were also other interactions between them that helped to consolidate the sector; the board of Orla is an interesting example of how different activities can come together to produce tangible outcomes, which address the specific North Eastern problem of a sparse entrepreneurial environment. All this information is drawn from the website of Orla, (http://www.orlaproteins.com/) The scientific founder (the entrepreneurial professor) and the first manager were joined on the board of directors by three other people:-

- one had been involved with Newcastle University through the previous Biosciences Exploitation Platform programme (qv),

- one was a shareholder representative for the venture capitalist investors, who had been brought in as co-funders for a science council exploitation award, and

- the third was an employee of a company which had been bought out by a large biotechnology firm who also bought out a regional biotechnology firm that span out of an existing North Eastern fine chemicals company.

This assembly of a team of mutually-known contacts would not be unusual in a narrative of successful biotechnology activities in Cambridge or Maryland USA (cf. Benneworth, 2004b). The point is that board has been brought together in a less successful region, in which there is a sparse entrepreneurial environment, characterised by the absence of the kinds of people who are able to convince potential investors that they are a sound investment proposition. This board drew together contacts from a range of activities in which the university and USOs were involved, including the BEP, the BBSRC business plan competition and BioNE\textsuperscript{2}T. These activities may be more or less responsible for the actual outcome – but that should not detract from the significant consequence that the
barrier of peripherality was overcome. A strong management team was assembled which managed to attract significant amounts of venture finance to allow for aggressive growth and building a market leading company (albeit in a specialised niche). The key question here is to what extent is that actually an improvement in the innovation and entrepreneurship environment, that is to what extent are the benefits on which Orla (and other companies have drawn) more generally available.

Having presented a diversity of activities, this raises the more general question of to what extent does these activities come together to represent an improvement in the regional situation, generalising the availability of entrepreneurship assets and creating a more dynamic and self-sustaining set of activities in biotechnology. In figure 8 below, we have attempted to bring some of the elements together to suggest that there has clearly been an adaptation around biosciences at a micro-level, and that universities have been a part of this. In figure 8 we show the development of linkages between three elements in the biotechnology sector in the region. When the last research was undertaken (c. 1999), these three elements, as with the whole regional sector, was highly fragmented. Since then, a range of linkages, both traded and untraded, have built up; this is in part a consequence of public sector support which has involved universities and their spin-off companies.

Starting from three companies, Thomas Swan, Novocastra and ACS Dobfar, the growth impulse has come into contact with further Newcastle University commercialisation activities, and has in turn gone on to produce a ‘blossom’ of activity. It is impossible to clearly state what is a consequence of which activity, not least because one of the antecedent companies was itself a university spin-off. What figure 8 also does rather neatly is to begin to link up what was emerging around the ‘commercialisation community of practise’ in 7.3.3 with the improvements to the regional innovation environment, albeit at a micro-scale. The various activities which have emerged and solidified all correspond to elements within the university extended family. The university commercialisation community identified in figure 8 corresponds with the extended university commercialisation family identified in figure 6, and therefore this helps to build a connection between the internal improvements made to the commercialisation practises of Newcastle University, and their corresponding
consequences for the regional economy and the adaptation of the pharmaceutical industry in the region.
Figure 9 The role of spin-offs in supporting a regional innovation sequence around biotechnology
8.4.2 Producing the infrastructure for an innovation sequence: the case of INEX

Another area where the university has been involved in trying to develop critical mass around the university, and exploit it for regional benefit, is in the field of nanotechnology. We have already noted in 5.4 that one important facet of the university’s commercialisation activity at the time of the research was the Institute for Nanotechnology Exploitation. The case of INEX is an interesting example of how an infrastructure can be built up to create a sequence of investments which support the emergence of a new industry. Markusen (1999) is particularly critical that analyses of the emergence of high technology complexes around Boston and Silicon Valley fail to indicate the importance of public investment to the emergence of those sectors. Thus, an institution which attracts significant government R&D investment to the region could potentially be supportive in the future of the emergence of nanotechnology companies as nanotechnology moves into the mainstream of the economic structure.

The nanotechnology sector has emerged as a discipline with the convergence of the phenomenon with which the sciences of chemistry and physics could deal; as physics became interested in dealing with ever smaller objects, increasingly at the ‘nano’ scale, so super-molecular chemistry, as chemists developed new substances such as Buckminsterfullerene, also became interested in those objects with sizes of the order of $10^{-9}$ m (one nanometer or nm). Wide scale research was enabled with the invention of scanning tunnelling microscopes in 1981, which used a magnetic needle to scan the surface of materials producing analyses of the surface with a resolution in nanometers. As with the impact of the electron microscopy on biotechnology (Rasmussen, 1999), the development of the STM as a research tool enabled a huge amount of research activity to take place which had previously been constrained by the lack of effective vision systems at the nano-scale. Although Professor Richard Feynman is usually credited as founding father of the concept, the field really started to take off with the diffusion of scanning tunnelling microscopy in the 1980s; a cluster of significant milestones emerged in the late 1980s as the idea of nanotechnology became increasingly more feasible and as a practical and ultimately commercialisable field:

- Dr. Eric Drexler published his influential book, Engines of Creation (1986),
• IBM research engineer Don Eigler produced a photo of the company name written in Xenon atoms on a supercooled Nickel plate (a ‘letter size’ of 6 nm), (1989)

• The journal Nanotechnology was launched (1991).

Nanotechnology has the potential to act as a disruptive technology, to precipitate an economic paradigm shift, but there are also a range of nearer to market opportunities. Whilst much of the initial impulse for the discipline came out of a desire to allow continuing miniaturisation and increasing computing power in accordance with the so-called “Moore’s Law”, there are a huge range of other markets potentially affected by nanotechnology, in recognition of its power as a disruptive technology. In 2003, for example, the largest investor in nanotechnology was the cosmetics company L’Oreal, ahead of the more intuitively high technology companies such as IBM, Eastman Kodak and BASF (Niosi & Reid, 2004). However, much nanotechnology remains a long way from market and dependent on the pace at which complementary technologies are developing.

The commercial sector therefore is therefore polarised into small companies attempting to exploit small pieces of near to market nanotechnology, alongside global corporations seeking to shape technology development to ensure that their core businesses – and profitability - are not undermined by disruptive paradigm shifts. As part of this dependence of competitive nanotechnology on the public science base, governments are investing heavily in nanotechnology programmes to promote their own competitiveness. In 2004, China invested $1bn (c.£600m) in nanotechnology, and the US-federally funded National Nanotechnology Institute invested $3.7m (£1.9bn) in the field out of total global nanotechnology R&D investment of $6m (£3.2bn) (Niosi & Reid, 2004). The EU have made around £1bn available for nanotechnology R&D through their Framework programmes, and the DTI have made £90m available over 6 years to support commercialisation of nanotechnology (so-called applied research).

Newcastle University has made a serious and sustained attempt to involve themselves in the pursuit and valourisation of nanotechnology, culminating in the establishment of the Institute for Nanotechnology Exploitation (INEX), which as we have noted, provided a set of physical infrastructures to the university and for spin-off companies.
However, the creation of INEX was also a significant process; it was assembled from unusual funding sources, because it was a major capital investment, and involved integrating Research Council, DTI Innovation, European and Regional Development Agency funds. The driver for the creation of the centre was the appointment of Professor Ken Snowdon in 1996 to a development chair in nanotechnology by Professor Andrew Hamnett, a Pro Vice Chancellor who, as a chemist who had built his own scanning tunnelling microscope for his research activities, was well aware of the potential for nanotechnology to have a profound impact across a range of disciplines. The appointment was made in the Department of Physics, specifically with the brief to build a research community with linkages across cognate researchers in physics, chemistry and other departments with an interest in nano-scale research. On the basis of his early work, a funding bid was prepared for the Joint Infrastructure Fund in 1998, a central government fund developed to support large investment projects in universities. Although the bid was not successful, it demonstrated to senior managers in the university that there was a growing university expertise in nanotechnology, and this convinced the university to invest more funds in developing the activity, initially as a research activity.

By 1999, One NorthEast, the RDA for the North East, had come into existence, and one of their first investments was to provide funds for Newcastle University to develop a nanotechnology laboratory, in recognition of its’ potential importance to the regional economy as a disruptive technology. This provided the first investment, which was then supplemented in early 2001 with funding under the University Innovation Centre fund. This was provided from the DTI for universities and identified commercial partners to work to exploit particular research strengths; nanotechnology at Newcastle University partnered with BAE Systems to establish a UIC in nanotechnology. These funds then provided resources to match European Structural Funds because of the clear relationship between nanotechnology and innovation promotion and cluster development. The funds were spent on redeveloping one building, the Herschell Building, as a nanotechnology centre complete with laboratory and manufacturing capacity, office units and incubator space, thereby providing the infrastructure for a research centre in nanotechnology.

This was initially completely managed by Professor Snowdon, although after the research work had been completed, the research centre, the scientific arm called,
Institute for Nanoscale Science and Technology (INSAT), was split off from INEX to be separately managed from the exploitation activities. In August 2004, after the completion of this research, a further £3m of DTI funding was announced for INEX, from the government’s “micro and nanotechnology manufacturing initiative”. It is important to emphasise at this point that the creation of INEX was not funded purely on the basis of scientific excellence, but on the grounds that good science in parallel with a sound commercialisation infrastructure would lead to improved economic outcomes of clear national benefit (the DTI interest being the national economic benefit). The UIC project and the nanotechnology manufacturing initiative were both clearly awarded to promote exploitation rather than basic research; ONE provided early funding because there was the potential for that research to have an economic impact. By making the case that Newcastle University was “well positioned” to exploit its’ nanotechnology research base, funding was won for the development of this large nanotechnology research centre within the university fabric.

The North East as a region only became firmly interested in nanotechnology as a region in the wake of the Arthur D. Little report in 2001, although there was some debate about the extent to which ADL was merely a means of giving independent imprimatur to a previously decided-upon set of fields. The consultants’ report to the RDA recognised that the investment thus far in INEX made it a potential focus for economic growth, despite the fact that up to that point, there had been relatively few commercial outputs from the public investment. There was a hiatus between the publication of the ADL report and the formal pre-launch activities for the “Strategy for Success”, which emerged early in 2003. By that point it had been decided that there would be five free standing “Centres of Excellence”, one of which would be in the field of nanotechnology. The relationship with the existing University Innovation Centre within INEX (which also included some activities within Durham University) was by this point somewhat unclear; as figure 2 shows, the idea was that the nanotechnology centre would form a bridge between the research base and funding opportunities for emerging activities, immediately creating an overlap with the idea of EXploitation as articulated in the INEX mission.

This led to problems when the nanotechnology centre of excellence was formed in 2003. The centre, called Cenamaps, faced the dual problem of lacking either a physical infrastructure or financial resources to invest in university-based research.
Durham University had invested their UIC funds in a new nanotechnology building and clean rooms on the Science Park site, and consequently the two university activities dominated the available nanotechnology activities in the region. Given the clear overlap between what other centres of excellence were doing in terms of commercialisation, and what INEX was doing in nanotechnology exploitation, there were clearly potential for a lot of problems and wasted resources were Cenamps to duplicate what INEX had been established to do. In particular, the risk of running two parallel institutions was that Cenamps would undermine any claims to excellence in commercialisation to be made by Newcastle University. This was clearly very risky for INEX, because as we have seen, the potential for Newcastle University’s excellent valourisation infrastructure to produce economic rewards from nanotechnology formed a key driving force behind the support that INEX had already received. However, these were resolved with Cenamps choosing to adopt a subtly different approach to its’ task to the other “Centres of Excellence” who themselves had more tangible assets to offer34.

Having done that, the Institute (INEX) as a concrete phenomenon (was) then transformed into a ‘model’ for exploitation of academic research. This transformation process through which INEX became ‘exemplified’ was driven in particular through the way that a Danish researcher, Jakob Vestegaard, compared INEX with a Copenhagen business park (Vestegaard, 2003), and later with Swedish and Finnish experiences. The model was elusive, but hinged on performing research in ways that promoted exploitation from the start, rather than after the research had completed. This view was also echoed by one member of the Business Development Directorate, although he had arrived at that view independently of the success of INEX.

“If you take a market oriented approach, you will tend to focus on the endpoint of the research process and pick things up when they are produced. Whereas my view of the world is that you have to actually work with the research teams through a fairly long process of equipping them, umm, to think about their research with the blinkers off, at the point they are starting their

34 A project manager was appointed from the Advanced Materials Research Institute, the University of Northumbria node of the UIC project, and clear divisions of labour were established between the various elements, attempting to build them into a single commercialisation network for nanotechnology opportunities in the North East of England.
research and at the point they are doing it. And not thinking you do the research and then you pick up whatever comes out of the end as an exploitable product and see if you can shift it.”

The Vestegaard explanation also resonated with the way that the Deputy Vice Chancellor explained the so-called ‘Newcastle model’ for commercialisation. Goddard is involved with the Organisation for Economic Co-operation and Development, a multi-national organisation representing the advanced economies, whose projects are autonomous from government, but which represents a key conceptual space within new managerial and governance practises are development. The concept of the Newcastle model, validated through INEX, has been used in recent discussions around the impact of higher education on regional development. In a range of his presentations to academic and practitioner groups, such as in his presentation in 2004 to the European Regional Knowledge Based Innovation Network, the case of INEX was raised repeatedly, the point made that it had been validated by Vestegaard, and in turn used to support the idea of a Newcastle model.

“The Newcastle Model (after Vestegaard) The vision is not to transfer certain research results with particular commercial potential from the university to the regional economy, rather it is to make the university itself an active player in the regional economy. A fundamental difference between this and the traditional model is that the latter is tailored to help commercialise research, whereas the Newcastle model seeks to build an institution that is capable of producing commercialisable research. The traditional model is tailored to help new entrepreneurs commercialise research-based technologies, while the Newcastle model seeks to make entrepreneurs of students and commercialisable technologies of research” (Goddard, 2004)

The idea has been to use the infrastructure to support new entrepreneurs in the field of nanotechnology, recognising that new nanotechnology companies are likely to be high-science content organisations, some of whom will indeed have near-to-market applications. The heuristic for how these companies were intended to form around INEX was as the consequence of a Ph.D. process which encompassed both scientific and commercial developments, also recognising the need for commercialisation to be an integral part of the research process. The model for research process was therefore that there would be a piece of commercial research which would be managed by a
Ph.D. student and involve a number of master’s students. All student progression would involve the development of theses which would solve the technical problems but also contribute to the development of a business to exploit the idea. This was represented in one particular INEX brochure as a new model for doctoral research in which academic research was performed in a team, but a key part of the qualification also involved a business development activity which was intended to lead to new spin-outs. At the time the research was undertaken, this model, shown in figure 9 below had not been operating for long, so there were no spin-offs that had been formed, although there was one which one interviewee claimed might subsequently be forming.

*Figure 10 The INEX model of nanotechnology exploitation through high-level research*

Indeed, since the research was completed, one such company was successfully formed. Molecular ID Systems was formed by a research team who had been led by a Newcastle post-doctoral researcher who had been recruited from Ireland, and developed two blood test devices, one to provide hospital bedside diagnosis of bacterial infections as well a second for the detection of rogue bacterial contaminants for security scanning systems. The firm was formed out of a team who won a business planning competition held internally within Newcastle University. The victorious team subsequently proceeded to the regional finals for university student business plans, where the team won an award for the best Science and Technology proposal. The process was particularly interesting because one of the Masters students involved in the team was an American, Michael Sinkula, who had a background in investing in nanotechnology. He co-authored in 2003 what was to
become a widely cited article on the commercialisation of nanotechnology in *Nature Biotechnology*, Paull *et al.* (2003). He had come to Newcastle University to write his Master’s thesis on DNA analytic techniques. After the Master’s research, Michael returned to the US to continue working in the venture capital industry having established the company in the North East of England. The process also demonstrates the mutual overlap, enrolment and interaction between the various assets being created; several members of the team to establish Molecular ID Systems were also identified by BioNE²T as being active in the field.

As with the case of biotechnology in the region, it is very difficult to establish from these anecdotes that something of significance has been created; each of the various elements outlined above suggests that progress has been made. However, because there has not been a rash of spin-out companies from INEX, it is much harder to claim that INEX has made a tangible improvement to regional innovation networks. What can be said is that with respect to the position a decade ago, the infrastructure for the exploitation of nanotechnology in the North East and Newcastle University is very much improved. This infrastructure has been actively built by bidding a collaborative community of researchers performing excellent nanotechnology research, but emphasis has always been placed on the imminent economic value – and on occasion, the realisation – of that research. One of the pathways to realise that potential value is through the formation of spin-out companies, and the commercialisable research in INSAT and INEX has led to the formation of at least one company, Molecular ID Systems, as well as a number of other spin-offs around Durham University related to the UIC.

There does appear to be genuine external recognition that what is going on in Newcastle University is truly world-class in the research field of nanotechnology, even if there is not a great deal of commercial nanotechnology R&D in the region. There seem to be the foundations of a stronger innovation and commercialisation system coming together, and even better, with the development of so-called “bio-nano”, the kinds of things that Molecular ID Systems are involved with, assets are building between a growing biotechnology sector, and the nascent nanotechnology activities. There appears to be a mutual reinforcement between the two fields, mainly at a fairly basic level; biotechnology firms are located in the INEX incubator suite, and BioNE²T is helping nanotechnology as well as biotechnology academics and
firms with their networking activities. Over the course of the research, nanotechnology around Newcastle University appears to have taken a set of steps forward, and spin-off firms have been an element of the forward steps.

As with biotechnology, and with supporting technology transfer more generally, USOs have been beneficiaries rather than shapers of that success; INEX promised that it could commercialise and create spin-offs in 1998, and was believed by ONE in 1999 and the DTI in 2001. The spin-offs we interviewed had moved to INEX in 2003, and the first true INEX spin-off, following Vestegaard’s ‘Newcastle model’ came in 2004. Each of these suggests that there has been a step forward in densifying the system, each bringing the reality of the North East as a place to do nanotechnology a step closer. Of course, the situation has not been fully stabilised with the North East unambiguously established as “the place to do nanotechnology”.

It is important to recognise that real progress has been made in promoting commercialisation in nanotechnology, even if that has not led to the rash of nanotechnology companies that have been seen in other places. By comparison, MESA+ at University of Twente, in the comparator study, had produced spin-offs which had themselves produced further spin-offs. However, in reality, although MESA+ was only created in 1998, its antecedent institute (MESA) was created in 1992. Consequently, the comparator seems to suggest that INEX might now be on the cusp of producing new sequences of innovation, although that would require further evidence to substantiate that hypothesis.

8.4.3 Concluding discussion

One of the key features about the contribution of USOs to regional innovation activities in the North East is how comparatively reactive the USOs have been. In all the cases shown, the USOs have mainly been recipients and beneficiaries of the advantages rather than creating new knowledge assets which have regional economic development benefits. However, we have already argued that USOs and universities do not have to initiate activity themselves to be significant, rather what is important is the way they orient themselves towards new activities as well as supporting the renewal of more mature industrial sectors. In both the areas, the pharmaceutical renewal sequence, and the creation of activity in nanotechnology, USOs have played a role in supporting the development of knowledge based activities, although not
necessarily in ways that would have been anticipated from the literature review. The first implication is that in a peripheral region like the North East of England, the high-cost commercialisation activities within the university have become points of stability which attract the attention of investors in ways that attract the kinds of investment that produce a broader sequence of innovation. The second implication, arising from this ‘attractiveness’ quality, is that USOs have a symbolic value in the UK science political-economy, as evidence of university competence at commercialisation, which can in turn act as the trigger for large scale scientific investments that can act to promote regional economic development.

The first area where the broader network picture begins to emerge is in the importance of stability in the university commercialisation activity. In 7.3.3, we observed that the university used the idea of a close family of relationships to create a set of links with trusted external partners that allowed certain difficult things to be achieved. This was specifically in response to the fact that particular things could not easily or routinely be achieved in the North East, but instead required a great deal of effort, and incubation, within a sheltered environment. In this section, in 8.4.1, we have seen the benefits of this sequestration in terms of providing a space of stability, and the important role of USOs of regulating access to the trusted university family space. In this section we showed how particular regional development assets have built up drawing on stable assets in this space; this has compensated for the instability and sparseness of the surrounding entrepreneurial environment. It is these regional development assets, the successful and diversifying regional companies, not the USOs directly, which have had the broader economic development effect, contributing to a renewal of pharmaceuticals and chemicals in the region, rather than a decline or ‘adjustment’, in the language of Chapman et al., and created a field of biotechnology innovation assets. Diverse activities outside the university have been mediated into the university, and as we saw in 7.3.3, the USOs have been a critical route for firms to participate in this broader family. Although in figure 5 we describe the contribution to the regional knowledge pool as ‘disparate’, bringing together the model for the operation of the commercialisation community of practise and the biotechnology renewal sequence, we argue that this has contributed to something more systemic than figure 5 suggests. In figure 11, we combine the two diagrams 7 and 9 to demonstrate how this suggests that the idea of a point of stability might operate.
university has created a relatively closed system in which innovation and entrepreneurship can be pursued, this has allowed a blossom of spin-off and associated activities which have upgraded the position of the region within the wider biotechnology production system from a low-science content to having some high-science content activity. Looking at the same networks through the two lenses allows the mutual reinforcement of the two outcomes to be seen, and to highlight some of the necessary robustness required in a peripheral industrial region.
Figure 11  The role of the university external family in incubating and stabilising the sequence of innovation at Newcastle University
The second area is with building a new activity on the basis of a number of individually insignificant elements that are brought together to create a significant and convincing case for attracting external resources, and the attraction of those external resources in turn fulfils the original belief in the significance of those activities. These could be regarded as ‘multi-agent projects’, that is that a range of agents pool their resources, and produce something that could not be achieved by the individual actors acting alone. It is probably worth highlighting at this point one key asset offered by the university, and that is the stability that is conferred on these activities because of the way Newcastle University has established itself as at one remove from the rather hostile environment for innovation in the region.

This idea of a ‘multi-agent project’ is a way of describing what was to become the INEX centre, because a number of elements came together, actively integrated and enrolled by management, but with the promise of producing significant economic benefits because of the competency of the university in research valourisation; one element of that commercialisation was past success in producing spin-outs, as well as working with industrial partners. It also describes what both CELS and the ICfL have been attempting to do in positioning the North East as a place where good science can ‘become’ dynamic companies that are worthwhile investment propositions, leveraging outside investment. Both CELS and ICfL are using successful USOs to give legitimacy to their arguments, even where those spin-offs have not necessarily followed the track that those organisations are suggesting as the ‘North East biotech model’. Both of those organisations are in turn are reimagining the region to try to win further Government funds to provide investment funds to support the process of remaking the North East in a material as well as imagined way.

Of course, in this section we have not dealt explicitly with what is arguably the critical element of making the region a place to be, that is altering the perceptions that external actors have of the region, and the value they place on assets in the region. Winning government grants suggests that progress has been made from the situation averred to by Heim (1987) in the 1950s where Whitehall civil servants felt profoundly that a respectable scientist could never be asked to live in the North. Moreover, the fact that there is some evidence of industrial renewal suggests that some external actors do regard what is going on in the region as relevant and important. In the case of biotechnology, there have been a large number of corporate spin-outs from existing
companies; since this was indicated in Benneworth (2004), further spin-offs have been formed from existing chemicals and pharmaceuticals activities, Onyx Scientific spinning out from Rhodia Chirex, Angel from ACS Dobfar and Aesica as a buy-out of BASF.

The Aesica buy-out is the activities which were originally the Boots pharmacists’ second manufacturing plant besides Nottingham; ACS Dobfar were a long time ago a Glaxo’s second penicillin plant besides Ulverston. In both those cases, although they have been surplus to the needs of one firm, they have been bought and have retained their knowledge skills, and have led to future spin-offs. The Chirex site was sold by Sterling Organics to Sanofi, who sold it to managers, who in turn sold it to Rhodia. Following that sale, Rhodia invested and turned the plant around, whilst two groups of managers formed new pharmaceuticals businesses in the region, one being Onyx Scientific and other formed from two bankrupt businesses, WP Promotion and Eldon Laboratories. The retention of such activities suggests that there is a real stickiness to activity in the region, around knowledge-intensive manufacturing optimisation; innovation is essential to the routine manufacturing operations, and that is why periodically new businesses emerge out of these supposedly routine activities. This in turn suggests that there are valuable local knowledges in the pharmaceutical and biotechnology sectors in the region, and external actors value what can be done in the North East. This issue of stickiness, and the external perception of the region, is something that we will return to in chapter 9.

8.5 Newcastle’s USOs and the regional ‘style’ of innovation in the North East of England

The various elements outlined in the three previous sections suggest that there has been an influence on the way that USOs have directly influenced regional businesses and their capacity to innovate. USOs have been involved in some cases in providing unique knowledges, and in providing consultancy and innovation services drawing on the university knowledge base to firms who are too insignificant for the university to prioritise working with. However, generally speaking USOs were not the active party in those relationships, and there was very little evidence that they actively pushed new technologies into existing firms and upgraded the regional technology base. In part, this seems due to the predominance of the academic entrepreneur model of a
professor running a research group and USO; the spin-offs are very tightly focused on particular research or innovation activities and do not react well to outside opportunities, such as companies approaching them for assistance. So is it possible to develop a broader narrative explaining the significance and the extent of the contribution of USOs to the regional style innovation? Have they acted as vectors for entrepreneurial DNA, infusing the regional economy with a new vibrancy leading to a rash of new activities? The problem in such analysis is that the answer is not clear-cut; although we have noted above that some influence has been limited, there is evidence that some more systemic and environmental/cultural changes have take place which could yet prove to be part of a more comprehensive transformation.

One disappointment certainly is that academic entrepreneurs have not become serial entrepreneurs of the kind who do leave a significant regional effect. A number of regional entrepreneurs have in recent years reinvested proceeds from the sales of their companies in building up a second set of business empires, in areas related to the original business,. Outside this study, research in the North East has highlighted the existence of a cadre of regional entrepreneurs who have built up groups of related businesses, such as the Express Group or Tanfield Group of engineering companies. None of the academic entrepreneurs have produced companies that have been sold, and used the proceeds and the knowledge of financial markets to produce a second iteration of companies. However, it is important not to decry that a number of the spin-offs are significant businesses, whilst others have apparent significant future growth potential. There does seem to have been a change in the university commercialisation strategy in which there may be high growth businesses which emerge at a greater remove from the university than with the academic entrepreneur model, and so which do produce people who ultimately become serial entrepreneurs.

One argument that can be made with biotechnology and pharmaceuticals is that USOs have reacted to what is already a fairly dynamic environment, although one which is under appreciated because it is dominated by LSCBI, in process engineering and manufacturing optimisation. In that sense, just as the USOs have piggy-backed on networks created by others, be it British Gas, BioNE2T, CELS and regional venture funding organisations, they can be said to reflect the North East’s style of innovation as much as changing it. However, just as USOs participating in some of those networks has brought regional benefits, so USOs contributing to a regional style of
innovation is part of a process of updating activities and ensuring that the region does
not become too old fashioned. It is of course necessary to make the point that four of
the biotechnology USOs interviewed were entirely innovative in terms of the North
Eastern style of innovation in being active within the drugs discovery pipeline,
something which was very rare in the region, and this may potentially offer new
opportunities for new combinations of old, mature manufacturing knowledges and
high-technology bio-science innovation.

A key question to answer is whether the clusters of activity in nanotechnology and
biotechnology that are taking place within the university family space are large
enough to be considered significant influences on the regional style of innovation.
What we can say is that the way that Newcastle University has built its
commercialisation activity, as a high-intensity, “Rolls Royce” service, does seem to
meet the particular needs of a peripheral environment, where the poor external
environment militates against an open and freely available system of innovation.
Instead, the university has segmented some of its innovation activities within the
university family, and created a parallel set of institutions to provide low selectivity
and easy access innovation assets (around the Stephenson Centre and the formal
outreach activities of RCID and the Engineering Design Centre).

We have so far built a model of the territorial knowledge pool between universities
and spin-offs; figure 5 shows the range of activities and assets which have solidified
in the region and been drawn on by third party firms. We have also built a model of
the internal commercialisation activities within the university, compensating for a
harsh and corrosive external environment by creating a space around the university
populated by trusted innovators and in which unstable activities can be slowly settled
and realised (figure 7). We have in this chapter demonstrated that the stability offered
by the university external family space has in turn been drawn on as an asset in
pulling together various disparate activities into a convincing and coherent narrative
of technological success in which the North East is reimagined as a place where these
high technology activities can take place, and where they produce valuable economic
rewards (figure 9). The three sub-systems do therefore appear to be cohering into a
sub-system which is delivering competitive advantage for the region. The remaining
determinant on the success and the significance of what has taken place in the North
East is the way that USOs have been involved in reconfiguring the attitudes of
external actors to the region, and hence the power enjoyed by actors within the region as owners of desirable and exclusive assets. It is to this external dimension that this report finally turns.
9 University spin-outs as partners in improving external political relations

In the previous three chapters, although there have been positive outcomes produced by university/USO/firm interactions, there has yet to be the demonstration that this has improved the region’s situation within a particular political-economic framework. The North East is a peripheral region, and the economic problems it faces are at least partly relational; although the region suffers from having a sparse entrepreneurial environment, it also suffers because the environment is not as good – i.e. it is sparser – than other places. Consequently, the final element of the USO improvement model we offered in chapter 2 was that one potential benefit from USOs would be if they improved the relative positioning and status of the region. One framework for examining this is the so-called global production network, in which regions’ respective status is determined by their relationships with other regions with whom they have productive relationships. A heuristic model for GPN relationships is shown below in figure 12.

Figure 12

![Diagram of global production network]

In previous sections, we have raised at various points the idea of the North East being made into the “place to do” particular activities (cf. 7.5, 8.4). We argued implicitly that things like enduring innovation-rich manufacturing in the pharmaceutical sector and the emergence of high-science content biotechnology innovation over the last five years implied that there had been an improvement in the relative status of the region. From being a “place to escape” during the plant closures from the 1970s onwards, now the North East appears to have become a “place to go” for some companies, entrepreneurs, innovators and academics in a number of niche activities. We have seen that USOs and their achievements have been actively enrolled by regional actors, particularly RDAs, but also to a lesser extent, by the University (cf. figure 4) in making the case that these “multi-agent projects” are themselves successful.

In this research, we could (had we had more money) conceivably have spoken with a wide range of external actors to see how effective the USOs had been in reshaping the way that those actors viewed the North East, and how that had changed the way they valued the region as a place to do particular things. Because of the relatively small scale of the research project, it was not possible to do this, so in this chapter, we focus on one very particular set of relationships that have potentially been remade through the USO activity for which evidence was generated through the North Eastern based interviews. We look at how particular examples of successful science in the region have been used to address a particular problem the region faces, its position within the political-economy of science and technology in the UK. This is notionally aspatial, although government policy has recently shifted to emphasising the economic benefit of that research for “UK plc” in a spatially indifferent manner. This in turn implies the promotion of research excellence wherever that excellence is located.

This seemingly neutral discourse serves to hide the fact that the UK’s geography of science and technology has been actively created by decades of differentiated investment which have systematically privileged the south and east of the country (Buswell & Lewis, 1970; Heim, 1985; Charles & Benneworth, 2001). Indeed, the Golden Triangle of London/ Oxford/ Cambridge is home to a large proportion of national R&D spend, and this pattern is continually reinforced through central government investment. A policy that rewards what it assumes is ‘natural’ excellence therefore risks perpetuating this historically produced pattern of unevenness. Associated with the uneven distribution of activity is a spatial discourse of that
activity held by policy-makers, articulated in such spatial concepts as “Oxbridge”, the “Big Four”\(^{35}\) or the “Golden Triangle”. The UK’s scientific pre-eminence is in some way assumed to be a natural consequence of research being concentrated in those four institutions, and that this in turn shapes the allocation of resources in ways that artificially reinforces the presumed naturally state. The problem is an inter-related assumption equating (rather than merely associating) concentration with excellence, and therefore seeking to promote excellence by promoting concentration. The corollary is that science spending which takes place with a spatial bias is a waste of resources and undermines the strength of the national science base, disregarding the reality that excellence does to some extent follow funding.

Consequently, overcoming the subaltern position of the North East in the political economy of science and technology involves activity at a variety of conceptual levels, building local sources of excellence and the appropriate funding in tandem with challenging the spatial discourses of the Big Four, Oxbridge and the Golden Triangle. In this chapter we therefore look at how USOs have been involved in this process of changing the position of the North East in the UK’s political economy of science and technology. Of course, although national/ regional relationships are important, there are other scales which are equally important to defining the ‘position’ of a region; even away from global networks of academic prestige and commercial funding, within Europe, the European scale (mediated through the Framework programmes) is very important for providing flagship investment funding to leading scientific institutions. Moreover, in the UK, a new scale for science has recently emerged, the idea of the “North of England”, the three regions of the North East, North West and Yorkshire and the Humber. Each of these scales envisages a role for science in the North East, and improving the position of the region involves upgrading the position of the region at each of these scales at both the material as well as the discursive level (van Duinen, 2004).

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35 Oxford, Cambridge, University College London, Imperial College London who account for a significant share of the UK’s expenditure on science and technology. Interestingly, the creation of the New Manchester University (from Manchester and UMIST) has created an institution that receives more from the funding council than any of those big four, and the Open University also receives more HEFCE grant. However, in research terms, UK university research is dominated by those four institutions, and they also receive special treatment through things like the creation of the Cambridge MIT Institute in Cambridge University.
9.1 The political economy of science and technology policy in the UK

It is common in analyses of the UK science and technology political economy to argue that there are strong – almost irresistible - centralising tendencies within this particular system (cf. Charles & Benneworth, 2001). Although it is a convincing narrative, and is particularly useful for explaining science and technology investments and policies in the UK in the last two decades, our argument is rather that the centralising tendencies are merely temporarily dominant over a countervailing set of tendencies towards decentralisation. In this chapter, we are trying to understand how a region can improve its position within the political economy; the narrative of “irresistible centralisation” performs an act of rescaling on different actors, making the national policy-makers seem ‘big’ and centralising ‘inevitable’, whilst crushing any and all efforts by actors in the North East to improve their positions and improve the aggregate regional situation (Amin & Palan, 2001).

Although centralisation is currently in vogue, it is possible to see that there have been other periods in which decentralisation held sway, or at least that other activities encourage a more equal pattern of public R&D expenditure. Moreover, it is possible further to argue that the national political economy of science and technology is actually comprised of a mix of centralising and decentralising tendencies which co-exist as a consequence of the professed spatial indifference of policy-makers. These exist in a balance which determines the overall strength of the centralising tendency of the system of the day, but they do shift over time; although centralisation has held sway for the last twenty years, there are other features of the national political economy, not least the relatively uniform distribution of higher education, that militates against centralisation. In order to bridge the gap from ‘small’ spin-offs, to a ‘large’ political-economy, and explore how the small affects the large, we now disaggregate the two sets of tendencies, and identify some of the key levers that exist by which regional actors could renegotiate their position within the policy of science and technology and thereby improve the overall position of the North East of England.

9.1.1 The divergent tendencies of the S&T political economy

Although a strong developmental state never emerged in the UK akin those in Germany or the United States, the UK government has nonetheless been an important
investor in, and hence shaper of, national research and development expenditure (Keck 1993; Freeman, 1995). In many ways, the Government has historically invested in ways that spread research activities across the country. Nationalised industries and utilities were huge investors in R&D, and for decades, the UK Atomic Energy Authority was the country’s most R&D active body, public or private; telecoms, broadcasting, electricity, gas and water research were all undertaken by large publicly owned corporations and as their research activity grew in the 20th century, it diffused over the country. The North East in its time had state-owned research centres in the gas, water and electricity fields (although they were all closed after privatisation). Although almost all of these activities have subsequently been privatised and in many cases dismantled, it does demonstrate that there is not a simple centralising tendency in science and technology allocations.

One of the great decentralising characteristics of UK science and technology is the geography of the higher education sector, in which the relatively even distribution of institutions - justified through providing universal access to higher level teaching - meant that research and development investment has long been spread out beyond the core areas of England. The establishment of the University Grants Committee in the 1920s channelled public funds into universities in ways that invested both in teaching and research capacity, one leg of the so-called ‘dual system’. With all English regions at that time having established universities, Fawcett (1919) was able to remark that the English university system was remarkable for its regional characteristics. He cited the inter-relations between the Faculty of Metallurgy at Sheffield University, and the metalwork sector in South Yorkshire that so caught Alfred Marshall’s eye in the 1890s. It is important not to regard this as merely a historical phenomenon, associated with the creation of the later Civic Universities (such as Bristol) in the 1900s, or the Robbins-era expansion universities of the 1960s. This process has continued to the present day, firstly with the 1992 Higher Education Act, giving parity between polytechnics and universities.

Although many of these so-called new universities concentrated on their teaching activities, others made a successful transition into research institutions, most notably Bradford, Brighton, Sheffield Hallam and De Montford universities. This process continued into the 21st century with the upgrading of a number of HE colleges into “University Colleges” along a pathway leading ultimately to full university status,
most recently achieved by Gloucestershire (2002) University for the Arts, London (Sept 2003) and Bolton University (Jan 2005). As table 6 below shows, higher education spending is the most equally spread of the elements of R&D expenditure, and the North East actually outperforms the national average in terms of its HERD in GDP level.

Table 6 Share of R&D expenditure in GDP, by major component and region, 2002

<table>
<thead>
<tr>
<th>Share of R&amp;D expenditure in GDP</th>
<th>Business</th>
<th>Government</th>
<th>Higher Edc</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>North East</td>
<td>0.43%</td>
<td>0.02%</td>
<td>0.54%</td>
<td>0.99%</td>
</tr>
<tr>
<td>North West and Merseyside</td>
<td>1.78%</td>
<td>0.07%</td>
<td>0.38%</td>
<td>2.24%</td>
</tr>
<tr>
<td>Yorkshire and the Humber</td>
<td>0.54%</td>
<td>0.09%</td>
<td>0.52%</td>
<td>1.16%</td>
</tr>
<tr>
<td>East Midlands</td>
<td>1.80%</td>
<td>0.11%</td>
<td>0.40%</td>
<td>2.31%</td>
</tr>
<tr>
<td>West Midlands</td>
<td>0.95%</td>
<td>0.07%</td>
<td>0.30%</td>
<td>1.32%</td>
</tr>
<tr>
<td>Eastern</td>
<td>3.01%</td>
<td>0.31%</td>
<td>0.44%</td>
<td>3.77%</td>
</tr>
<tr>
<td>London</td>
<td>0.65%</td>
<td>0.16%</td>
<td>0.72%</td>
<td>1.53%</td>
</tr>
<tr>
<td>South East</td>
<td>2.21%</td>
<td>0.31%</td>
<td>0.41%</td>
<td>2.93%</td>
</tr>
<tr>
<td>South West</td>
<td>1.84%</td>
<td>0.33%</td>
<td>0.28%</td>
<td>2.45%</td>
</tr>
<tr>
<td>England</td>
<td>1.57%</td>
<td>0.19%</td>
<td>0.46%</td>
<td>2.21%</td>
</tr>
<tr>
<td>Wales</td>
<td>0.52%</td>
<td>0.12%</td>
<td>0.51%</td>
<td>1.15%</td>
</tr>
<tr>
<td>Scotland</td>
<td>0.88%</td>
<td>0.33%</td>
<td>0.80%</td>
<td>2.00%</td>
</tr>
<tr>
<td>Northern Ireland</td>
<td>0.73%</td>
<td>0.07%</td>
<td>0.41%</td>
<td>1.21%</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>1.45%</td>
<td>0.19%</td>
<td>0.49%</td>
<td>2.13%</td>
</tr>
<tr>
<td>Standard Deviations of distribution</td>
<td>1.87</td>
<td>1.99</td>
<td>1.05</td>
<td>1.30</td>
</tr>
</tbody>
</table>


The final point to make is that there is not one singular political-economy for science and technology in the UK, but there are several, relating to the nature of the political union in the UK. As table 6 shows, Scotland invests far more of its’ wealth on higher education R&D than other regions, despite an otherwise below-par R&D system. The devolved territories have long had their own research institutes, most notably the Scottish Agricultural research institutes, which as with Cambridge, became increasingly involved in life sciences in the 1970s and 1980s; mostly notably a
spin-off of the Roslin Institute in Edinburgh achieved a very high public profile with the creation of the first living cloned sheep, ‘Dolly’.

“Scottish Agricultural and Biological Research Institutes (SABRIs), such as the Hannah, Moredun and Rowett Institutes, which are funded mainly by the Scottish Executive Rural Affairs Department (SERAD) and other centres such as the Macaulay Land Use Research Institute and the Scottish Agricultural College. In addition, there are other research institutes which are funded mainly, or wholly, by the UK Research Councils, including the Roslin Institute and the MRC Human Genetics Unit based at the Western General Hospital in Edinburgh. The Roslin Institute is, for example, a major international centre for research on molecular and quantitative genetics of farm animals, whilst the MRC Human Genetics Unit is at the forefront of international research into human genetics. The research base in Scotland also benefits from scientific and medical research undertaken within the NHS and the NHS Trusts, as well as from research in the arts and humanities undertaken by the National Museums, Galleries and Libraries of Scotland” (SHEFC, 2000).

Although ‘science’ is a matter in Scotland reserved to the centre, and powers over science have likewise not been granted to the Welsh Assembly, all three devolved territories do have their own Higher Education Funding Councils which are accountable to the devolved administrations. Via the dual support system, those administrations do enjoy considerable leverage to support investment in science and technology, Scotland from 2001 decided to support national-quality research centres more comprehensively than was the case in England36. In Scotland in particular, there has been a particularly strong drive since devolution to consolidate these various elements (Government research centres, universities, firms) into a dynamic national system of innovation as part of a wider cultural and social rebirth of the Scottish nation. This, and similar efforts in Wales and Northern Ireland, clearly represent decentralising tendencies with respect to the concentration of research around London and the South East.

36 The so-called funding of the 3a/4 departments. In England, HEFCE attempted to allocate funds more broadly than the Government wished, and came under intense pressure from Ministers so to do, despite its supposedly arm’s length status (S&TC, 2004).
9.1.2 Centralisation and the contemporary national system of innovation

However, there were a number of factors which meant that public investment was building a framework with a strong tendency towards the concentration of activities. After World War 2, as the defence industry in the UK became an increasingly important customer for R&D, and an increasingly important supplier to Governments, defence R&D in the UK emerged as an important sector within overall R&D levels, second only to the USA in terms of its share in the national mix. In the UK, defence R&D was located around the major civilian and military defence activities, predominantly located in the south and east of the country (Benneworth & Charles, 2001). Moreover, in the case of defence electronics, where the structure (and profitability) of the industry until very recently differed greatly from the civilian sector, defence research tended to crowd out civilian activities. The defence expenditure played a strong role in producing strong regional systems of innovation which affected civilian applications. Clearest of these is the emergence of mobile telephony company Vodafone in Swindon as an offshoot of Racal Electronics (which is now owned by Thales); Racal was a defence contractor who had been extensively involved in developing the EUROMUX mobile telephony system for the UK armed forces (cf. Charles & Benneworth, 2000 for an extended version of this argument).

A second and associated characteristic was that government policies towards national competitiveness often led successful regional firms with their own R&D activities to be bought out by larger London-based corporations, who then under pressure from shareholders closed their outlying research base, and in some cases entirely outsourced their technology procurement, both outcomes proving very negative for the regional technology base. This effect and its impacts, which emerged in the era of ‘national champions’ in the 1960s and 1970s was exacerbated under privatisation. In the case of the utilities, the imposition of heavy regulatory frameworks on the newly privatised utilities in gas, water and electricity discouraged long-term investments in infrastructure, and profit-taking means there were scarce resources for R&D. By the late 1990s, these industries had largely abandoned R&D; in peripheral regions, there was an absence of other types of R&D to compensate for dwindling utilities expenditure.

A third characteristic was the geography of the pharmaceutical sector: by the 1990s, pharmaceutical R&D represented one pound in every six spent on R&D spend in the
UK. This was a function of the Government’s purchasing policies, in which pharmaceutical companies were guaranteed minimum drug prices through the NHS in return for maintaining manufacturing and R&D activities in the UK. Again, those activities were concentrated in a very limited part of the UK, and so this policy, which strengthened the UK as a whole, brought with it very uneven intra-national allocations of R&D spend. Although pharmaceutical R&D was important to the UK as a whole, as figure A below shows, there was very little in the North East of England which could be described mainstream pharmaceutical R&D expenditure.

The two maps in figure A are reproduced from a Government report *Genome Valley: The Economic Potential and Strategic Importance of Biotechnology in the UK*, available at [http://www.dti.gov.uk/genomevalley/](http://www.dti.gov.uk/genomevalley/).
Bringing Cambridge to Consett? Building university-centred networks in peripheral regions

Principal pharmaceutical industry R&D and manufacturing sites

Location of UK specialist biotechnology companies

Source: Based on Ernst & Young 1996

Manufacturing site
R&D site
Government research laboratories were also located in the core regions, for a variety of reasons, but which served to reinforce the strength of those regions, and to encourage continued investment in them. The UK Government invested very heavily in agricultural research in East Anglia from the 1920s onwards, although from the 1970s, the research activities became increasingly involved in biotechnology, ensuring that biotechnology was centred around the East of England (Blair, 1991). A second factor highlighted by Heim (1987) was the importance of the negative mental pictures of the ‘north’ in the minds of post-war civil servants. Loebl (2001) noted that expenses mileage rates for civil servants made journeys within a 50 mile radius of their offices (located in and around London) much more lucrative than those beyond. Even by the 1970s, when the UK government made its last attempt to directly create high-technology firms, those two firms, Celltech and INMOS were located in the south of the country (London and Bristol respectively) despite attempts by regional authorities to persuade the Government to use these investments to support declining peripheral economies. Most recently, the Met Office, with 1000 computer engineers involved in meteorology, announced the decision to relocate from Bracknell, along the M4 corridor to Exeter, rather than to the North East of England, which had lobbied central government to try to win this prime investment.

9.1.3 Recent policies and the shifting balance of power 1980-2000.

These two sets of countervailing tendencies meant that the British political-economy of science and technology has an inbuilt set of tensions which make it hard to clearly characterise the spatial outcomes the system produces.37 In the 1980s and early 1990s, science and technology expenditure generally came under a huge amount of pressure, as the government cut back on its’ expenditure, and recessions, instability and privatisation impacted adversely on private expenditure. Under such conditions, which promoted

37 In Scotland, a quite different approach has been taken, with SHEFC and the Scottish Executive clear that they wanted to use the university sector to support the urban hierarchy across Scotland rather than concentrate university research in the central conurbation between Edinburgh and Glasgow. However, recognising the reality that the UK government was concentrating around perceived excellence, the Scottish authorities recognised their own spatial ambitions for balanced science activities would have to meet national concentration requirements. The idea was floated in 2003 to enter ‘Scottish Universities’ as a single unit of assessment in the RAE to maximise the resources they won from the centre which could then be distributed more equitably between the Scottish universities.
rationalisation of R&D activities, it is perhaps unsurprising that there was a concentration of activity. Salford University most famously faced cuts of just less than one-third of its budget in 1981 in response to the incoming Conservative government’s new science budget, but there was also a gradual erosion of the dual system, as capitation funding for students fell by 50% (1980-2000). Given that much of the pressure for decentralisation was sustained by the dual system, these cuts to the stable income level placed many universities under pressures to increase volumes of teaching, which in turn undermined their capacity to bid for additional research funds (the second leg of the dual system), thereby reducing their research capacity.

Certainly, the rhetoric in this period was that regional impacts had no role to play in making scientific decisions. When the location decision was being made concerning a new capital investment in a particle accelerator, the DTI and OST were clear that regional policy concerns had no place in their deliberations regarding whether to site the new facility in the North West or the South East (S&TC, 2000). This was of course part of a broader emergence of a strong discourse within government emphasising market based solutions (cf. DTI, 1998; 2001), which in turn implied that current situations were in some way optimal. In the field of science and technology, this implied that those regions that had strong R&D bases did so on the basis of some ‘natural’ market advantage which the government could not hope to buck. From the mid 1990s onwards, the Competitiveness White Papers were explicit that there was no specific regional role for universities. The government have more recently also made clear that there is unlikely to be any significant spatial reorganisation of government R&D, currently the most unequally distributed component of R&D (cf. table 7 above).

In figure 11b above, the effect of this on the ‘spatial discourse’ of policy makers is suggested, through a map from a biotechnology policy document in 1999. The map is taken from a DTI report into the biotechnology industry in the UK, *Genome Valley: the economic potential and strategic significance of biotechnology in the UK*. The picture shown in the map conforms largely with a ‘concentration in the Golden Triangle’ narrative given above, excepting the activities in the devolved territories, particularly in Scotland. There are two concentrations of activity, one centred around London, and the other around Cambridge, with other activities associated with university research centres.
We have already shown in figure 11a that the North East was portrayed in this report as a place of manufacturing rather than research. These maps together seem to suggest that the spatial frameworks frames the biotechnology interests of ‘the UK’ as being best served by continuing to concentrate public investment into these existing agglomerations of excellence. Thus, improving the position of the North East involves building a set of activities that demonstrate to external investors, including HM Government, that the North East is a place where biotechnology investment can take place.

This may take place within the existing spatial discourse: a commitment to national excellence can allow genuine excellence to be promoted outside the ‘golden triangle’ of London, Cambridge and Oxford. The Regional Innovation Fund and Smith Review both provided tens of millions of pounds for investment in science and technology activities, disproportionately (entirely in the case of the Smith Review) to peripheral regions. HEFCE provided some £25m capital funding to pay for the reorganisation of higher education in Manchester, leading to the creation of the new University of Manchester, the institution which was in 2005 the recipient of the largest HEFCE grant. The northern regions were encouraged in 2003 to develop science councils, and in parallel with a large-scale regeneration project, a Science Council for the North was formed early in 2005 to provide a regional focus to science spending (cf. 9.3).

Since 1999, increasing science spending has been a priority of the government, and just as falling real levels of science funding effectively forced concentration, increasing funding levels might likewise allow the promotion of diversity, pump priming of potential research excellence, and investment in activities outside the golden triangle. These various activities and opportunities seem to suggest that within the government’s rhetoric of national excellence and spatial discourses of the Golden Triangle, there are opportunities for local actors in the North East of England to demonstrate that they add national value. In this section, we explore three other areas where opportunities have been exploited to improve the material and symbolic situation of the region. The focus is on the role played by university spin-off companies in demonstrating that the North East is a place where scientific excellence can flourish, and investment in science and technology can produce material economic returns.
We have already argued that there is a strong spatial indifference to current UK science and technology policy, and the overall effect of this has been to reinforce concentration during periods of funding cuts, and restrict decentralisation during periods of funding growth. Although there is a geography to the distribution of excellence, with this geography being dominated by the so-called ‘golden triangle’, this geography is not explicitly used in a normative way that allocates roles to places in perpetuity. The problem is subtler, that the spatial discourse gives a mystical value to the Golden Triangle, so that regional activities outside this area are assumed to be of a low quality. Consequently, their perceived low quality means that they begin at a disadvantage in trying to win funding from the centre, and failing to win such funding produces further disadvantages into the future. As a recent House of Commons Science and Technology Committee report noted, this assumption that only investments in existing sites are “efficient” is somewhat contradictory.

“There is nothing special in the soil of the so-called Golden Triangle. If significant funds were, for example, made available to the new Bolton University, we have little doubt that it would attract the talent and create a research environment to rival the best” (S&TC 2004, p.7).

The issues then arises of how universities and spin-offs can challenge that situation, given that they are small actors next to the Government. Because science and technology policy is national in scope (however the nation is defined, whether England, England & Wales, or Great Britain), it is difficult for local actors to make the case that they need special treatment. There was a case in 2004 that spin-offs were being halted by a change in the tax laws (Schedule 22 of the 2003 Finance Act) that created huge potential liabilities for academic entrepreneurs, and these risks had brought the formation of spin-offs in the UK to a virtual halt (from 228 to 12, 2003-04). Schedule 22 was as much a problem for Newcastle, arguably more so because of the prior level of activity, than many other institutions nationally. However, what brought the matter to the attention of the government was a director of a spin-off (not from Newcastle University) who was working as an industrialist for the DTI at that time. Because the DTI has the spatial
concept of a national policy-maker, the science and technology policies it makes are “whole country” policies, so actors only receive special treatment if they can make the case that there is a broader problem underlying the issue by which they are plagued. An obvious way to upscale the local problem into a general (‘national’) issue is to build networks with other actors experiencing similar problems and collectively lobby the policy-makers. In the case of the process whereby the Schedule 22 problem was solved, what the DTI took cognisance of was of what was being said by university technology transfer organisations such as the Association for University Research & Industry Links (AURIL) and the University Companies Association (UNICO).

Although AURIL and UNICO are national (United Kingdom) bodies, there are examples of where there have been regional mobilisations that have managed to create themselves as solutions to particular problems. In particular, the White Rose Consortium has achieved a particularly high profile as a partnership of research-intensive universities in Yorkshire, arguably much higher profile with national policy-makers than the regional university association, the Yorkshire and the Humber Universities Association. Likewise, universities in Manchester have managed to mobilise the idea of “Manchester: Knowledge Capital” as a spatial concept implying that their collective activity is of sufficient magnitude and quality to create economic benefits in the knowledge economy. These mobilisations are of regional actors, but they clearly draw and enrol on external resources in mobilising. Such mobilisations aim to make the case that they embody the principles of excellence, such as world class research links, industrial collaborations or participation in consortia.

In this section, we explore two areas where networks involving USOs around Newcastle University have been involved in creating ‘bigger’ networks with the potential to alter the thinking of national policy-makers in ways that have specific spatial benefits. We firstly look (once more) at the case of INEX, and how local networks were used to build unambiguous excellence which persuaded DTI of its’ merit as a real “Centre of Excellence”. We more briefly then consider how one government department was helped to develop explicit spatial policy concepts, when the November 2004 pre-budget report awarded “Science City” status to Newcastle. We look at the roles played by spin-offs in the way that relationships between local actors and external policy-makers have operated;
and then consider what roles USOs can play in shifting political-economies of science and technology in modern knowledge economies.

9.2 INEX: making the North East a place to do nanotechnology

In 8.4.2, we gave the example of how the Institute for Nanotechnology Exploitation (INEX) at the University of Newcastle had been built up in a way that suggested that it had created external recognition of its excellence, and that its’ capacity for the formation of spin-offs was important in the way it had built itself up. In this section, we look at how this local/ regionally network became (through circumstance) significant for others seeking to achieve their own goals, and thus raised its national standing in science policy. In particular, when the DTI faced criticism for the timidity of its support for nanotechnology, INEX was enlisted in a variety of ways to legitimate that central policy, in return for INEX being given extra grant funding. Although INEX was built up in the region, its adoption by DTI as an exemplar of what can be achieved in nanotechnology has rewarded it in terms of further funds. Admittedly, the example is insufficiently extensive to demonstrate that it has changed the way that UK policy-makers conceive of the North East as a place to do science. However, it does demonstrate that under certain circumstances, regional assets can temporarily acquire a parity of scale with national policy-makers, shifting the balance of power within those relationships, and allow one step in a more general reworking of the political-economy of science and technology. Of course a change to the place of the region would require many such steps, but the case does demonstrate that the inevitable centralising tendency of the centre is not inevitable, and can under certain circumstances be challenged.

9.2.1 INEX: climbing the scales of significance

In 8.2.4, we provided an overview of how INEX had emerged in the last decade as a consequence of emergent technological opportunities but also the decisions of senior managers within Newcastle University. The physical scale of activity has increased from a single professor, to an active research centre and exploitation outfit with strong connections between the two. However, another scale which has notably increased is the spatial extent of those who engage with the centre, and the terms on which they engaged,
reflecting an increasing consensus that INEX was a “Centre of Excellence”. From the
interviews, INEX’s development can be differentiated through five steps through which it
progressed, each stage providing prior conditions for the next, culminating in its’
emergence in 2004 as an extant physical facility populated by a research group, a number
of companies connected to nanotechnology, and which had already produced one
spin-out company. The beginning point was the appointment of Professor Snowdon in a
developmental chair with the remit to develop such a centre, and the five major steps from this starting point were:-

- 1997/8: Drawing up an internal proposal for a multi-disciplinary institute cutting
across existing departments and faculties as the basis of the unsuccessful approach
to the DTI Innovation Unit for exception funding.

- 1999: ONE provide Newcastle University with £420,000 for a clean room, which
is matched up against European funds to pay for a redevelopment of the Herschell
annex as a dedicated research centre.

- 2001: The DTI designate Newcastle University as the lead partner in the UK’s
nanotechnology University Innovation Centre (one of five such UIC’s funded)
(cf£4m of £7.2m award).

- 2003: INEX are designated as a ‘key hub’ of the European Nanobusiness
Association.

- 2004: The DTI award Newcastle University a £3m grant under the Micro and
Nanotechnology Manufacturing Initiative, the only capital investment made under
the Applied Research programme.

With each of those steps, the level of activity in the centre became qualitatively more
significant, although increasing in volume does not necessarily of itself demonstrate that
that growth indicates that region’s situation with respect to external actors has improved.
What appears thus far significant is that at each stage there has been an apparent increase
in the magnitude of activity within the region, firstly creating a virtual community within
the university (bidding for DTI funding in 1997), then providing some physical
infrastructure for that community (funded by ONE in 2000), then increasing the overall
volume of activity (the UIC in 2001), linking the activities to a broader international nanotechnology network (2003), then finally winning a large scale capital grant from the DTI (2004). We have represented this change graphically in figure 13 below.

*Figure 13 The changing scale of the achievements of INEX, 1997-2004*

Some of those steps have involved increasing the volume of local activity, but also in parallel with that have been steps which have increased the strength of connection between local activities, and between local and global partners. Of course, these changes are only significant in this research if they help to rework local actors’ relationships with external actors in ways that improve the situation of the North East in the UK’s political-economy of science and technology. To answer that question, it is necessary to consider how the North East’s competencies in nanotechnology have been used by external actors in their own policy debates and discussions.
9.2.2 Acknowledgement: meeting the needs of external actors 2000-2004

One of the key features of the way that nanotechnology has growth within Newcastle University is that over the course of time, the relationship of the research centre to external actors has changed, most notably that the centre has become more important to those external actors in seeking to realise their own ends. In this section, we rework the narrative in 9.2.1, with a much greater emphasis on the role played by the external partners in the development of the centre, in particular focusing on the calculus of exchange between regional and external actors, in order to set up a final part in which we consider whether there have been broader changes to the UK political economy. In 9.2.2, what we will show is how over the course of INEX’s development, INEX’s meaning to policy-makers has shifted from being an ‘unworthy proposition’ (1997) to being something which validates their policies (2004).

When the decision was taken to appoint a development chair in nanotechnology in the mid 1990s, the decision was taken purely internally to the university, at the behest of a PVC with sufficient expert knowledge in nanotechnology to know that it was a future growth area. When Professor Snowdon was appointed, his overall mission was to build an infrastructure for nanotechnology research, a level of investment which could not be provided by top-slicing academics’ research programmes, but needed a dedicated investment from an external partner. Consequently, his first task was to try to assemble an internal community within the university, which together could be represented as a coherent ‘bundle’ of scientific capacity. By discursively creating this community, this community could then in turn be used to sell the idea that Newcastle University was a place where nanotechnology could conceivably be done.

Snowdon pursued this at first internally by trying to persuade departments to engage with the idea of a central nanotechnology facility. In doing that, he built up a knowledge of the university’s nanotechnology capacity. That led to a bid to a central government investment fund for infrastructure, the so-called Joint Infrastructure Fund. Although that bid was unsuccessful, and a lobbying team from the university were unable to persuade the ministry of the capacity within Newcastle University, the university managers retained faith in the potential of nanotechnology. Further support was sought for the
same idea, a ‘hard’ infrastructure to support the existing potential ‘soft’ nanotechnology community in Newcastle\textsuperscript{38}.

The next step was taken through winning regional funding which did not directly require the proof of excellence against external competitors, but that the research base had potential to produce commercial outputs. ONE, the regional development agency, was persuaded to provide £420,000 to equip a clean-room and incubator units within the university. At that time, ONE and other northern RDAs had criticised the government for failing to invest in good knowledge economy propositions in peripheral regions. The DTI had responded with a £10m Regional Innovation Fund to be spent on supporting commercialisation activity; ONE needed to show successful examples of the RIF being spend on high quality science commercialisation propositions. The university lobbied the RDA very hard, and the strength of the internal commitment between the centre manager, university managers and academics to nanotechnology helped persuade ONE to invest the funds developing a set of incubators within a refurbishment of the Herschell Building.

At the same time, Newcastle University formed a consortium bid with Nottingham and Durham Universities to apply for an Inter-disciplinary Research Centre from the UK research councils. Although that bid was unsuccessful, it reached the final shortlist of five, and did bring those nanotechnology activities (and infrastructure) which were at Newcastle to the attention of the DTI. The fact that the RIF project (the incubator units) existed demonstrated that there was a proposition with some commercialisation expertise at Newcastle University. The progress of the IRC bid to the shortlist stage demonstrated to national policy-makers the academic quality of what was on offer. This attention led to the DTI awarding Newcastle University a University Innovation Centre award. This programme was announced in a White Paper launched in February 2001 as part of a programme which signalled the end of austerity in science expenditure, and set out a programme for massively increasing the resources in the science base across the UK.

\textsuperscript{38} One interviewee avers to the importance of an unofficial meeting at which decisions over resource allocations were taken at this time (c. 1999) within the university to maintaining the university’s support for nanotechnology, the so-called “Monday Morning Meeting”.

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Although the focus of this expansion was on rewarding excellence generally, there was a recognition that maximising the economic value of that research needed investment in exploitation infrastructure. This white paper first raised the concept of a permanent third funding stream for UK universities to spend on industrial engagement. The UIC concept was to identify university/business partnerships which facilitated the transfer of knowledge between universities and SMEs. £30m were allocated to the programme in 2001, and five centres were funded; the North East UIC was in Nanotechnology and Microsystems and it received £7.2m. This funding was significant for two reasons. Firstly, it was the second largest of the awards made, behind a communications and IT UIC in Bristol (£7.62m). However, one interviewee claimed that its’ greater significance lay in the fact that it was at that time the largest DTI science and technology grant made in the region. Although large DTI grants had been made to the region in the 1990s, they had been for things like the attraction of inwards investment (such as the £30m that went to the ill-starred Siemens investment) or the millions that went into the ongoing subsidies for the coal industry. The UIC award was made by a government at the time under extreme pressure to demonstrate their commitment to manufacturing in peripheral regions, from which it drew its core votes. However, it remained rationalised in terms of achieving national goals, raising innovation and productivity levels in the UK.

The next step in INEX’s development came in 2003, Newcastle University, and INEX were invited to become one of the key European hubs of the European Nanobusiness Association. This provided an external recognition and validation of the progress that had been made so far in Newcastle, although no new resources were associated directly with the status. We have already argued that many regions were pursuing similar strategies around growth technology areas including nanotechnology. Our argument is that this ENA award suggested that there were other external bodies who recognised the scope of what had been already achieved at Newcastle, and that others outside the UK regarded it as more than a ‘me too’ development. Of course, there were other facilities in other English regions that were also included as key hubs. In figure 14 below, we show the physical location of these twelve hubs, plotted on a map indicating the spatial division of science and technology within Europe, based on the so-called ‘Blue Banana’ idea.
Figure 14 The location of the twelve European NanoBusiness Association key hubs, 2003, with respect to the European economic core (blue banana)

Source CIA available at: www.lib.utexas.edu/maps/cia04/european_union_sm04.gif, authors’ own annotation

This map is useful because it does provide a broader narrative for the emergence of nanotechnology business in Europe, that it is focused around existing innovative agglomerations, but that new growth areas are emerging. Much is known for example about the success of the Öresund knowledge agglomeration (cf. Maskell et al., 1999; Vestegaard 2004), and the past success of Nokia in accessing university research
strengths in Finland make the designation of Helsinki equally plausible. Thus, the acknowledgement by EBA of INEX’s competencies does seem to ‘place’ nanotechnology within Newcastle, and to place Newcastle as an emerging nanotechnology region.

The final step in this growth process was the awarding in 2004 of £3m to INEX to invest in nanotechnology infrastructure. This was in material terms a very significant grant; the DTI allocated some £18m to projects across the UK, and the funding received by INEX was more than twice the amount of any other project. This £18m is the first tranche in some £90m that the DTI has proposed to spend specifically on promoting the translation of nanotechnology from the laboratory into particular products. What was also significant was the map of nanotechnology manufacturing that this created – the most significant set of investments in this funding round were supporting the North East, whilst the traditional core areas were to receive much lower levels of funding39. This seems to substantiate a rhetoric within government that they envisaged a future for regions such as the North East to engage in high technology manufacturing. This is true not just for the case of the North East, where another large project was awarded to a fine chemicals company (Thomas Swan), but also that this investment was being used to support the chemicals industry in the North West, as well as renewal of the offshore engineering sector in Scotland. This investment programme seems therefore to involve a bending of science and technology spending to achieve that particular vision for the geography of nanotechnology manufacturing. The regional allocations are shown in table 7 below.

39 These figures illustrate the importance of past science and technology regimes in determining current spending. London’s only project, for example, is managed by the Paint Research Association, a former Industrial Research Association, previously subsidised by industry levies and privatised in the 1980s. The majority of the West Midlands expenditure comes from two projects going to Qinetiq, formerly the Royal Signals and defence research laboratories at Malvern, Worcestershire.
Table 7 Regional allocations for the first round of the Applied Research programmes for the DTI’s micro and nanotechnology manufacturing initiative

<table>
<thead>
<tr>
<th>Region</th>
<th>NMMTI investment</th>
</tr>
</thead>
<tbody>
<tr>
<td>North East</td>
<td>£8,963,501</td>
</tr>
<tr>
<td>North West</td>
<td>£7,684,631</td>
</tr>
<tr>
<td>East of England</td>
<td>£4,581,862</td>
</tr>
<tr>
<td>West Midlands</td>
<td>£4,509,026</td>
</tr>
<tr>
<td>South East</td>
<td>£2,870,036</td>
</tr>
<tr>
<td>East Midlands</td>
<td>£2,684,454</td>
</tr>
<tr>
<td>London</td>
<td>£1,480,956</td>
</tr>
<tr>
<td>Yorkshire and the Humber</td>
<td>£1,424,513</td>
</tr>
<tr>
<td>Scotland</td>
<td>£1,192,583</td>
</tr>
<tr>
<td>South West</td>
<td>£1,102,500</td>
</tr>
<tr>
<td><strong>Total UK</strong></td>
<td><strong>£36,494,062</strong></td>
</tr>
</tbody>
</table>

Source: DTI Press Release, 23rd August 2004

What is perhaps significant about Government investment in INEX is that it emerged in the wake of the Government using the success of INEX a number of times in the course of defending its actions against parliamentary criticism that insufficient was being done to promote nanotechnology in the UK. In April 2004, the Parliamentary Committee for Science and Technology published a report entitled *Too little, too late? Government investment in nanotechnology*. The DTI used the case of INEX, and of the North East more generally, to argue its’ case, effectively to try to legitimate and vindicate its current policy positions.

In the DTI’s original memorandum to the Inquiry in 2003, INEX was cited as an example of an organisation successfully commercialising Research Council-funded research; this was used to argue that basic science research in nanotechnology was producing applied science benefits through spin-offs and licensing deals. In DTI’s response to the committee, the DTI cited Orla Proteins, a Newcastle University spin-off resident at that time within INEX as an example of a nanotechnology spin-off that had successfully used regional venture capital funds; this was used to deny the committee’s claim that government rules for venture capital funds were preventing regional nanotechnology
SMEs from accessing those funds. Moreover, they argued that a wider array of specialist centres (implicitly like INEX) were a more effective use of the £90m funds than doing what the committee suggested, spending all the funds on creating a single national nanotechnology institute at Rutherford Appleton Laboratory in Oxfordshire. In the Parliamentary debate following the publication of the report, the Undersecretary for Industry cited INEX as an example of where investment by regional development agencies in science had created assets that were globally renowned, specifically arguing against the charge that RDA science investment was wasting funds on consultancy reports rather than producing scientific outputs.

A final sense of the importance of INEX as a means of justifying Government policy can be seen in the way that INEX was used by the Government in its’ response to EU Commission proposals to treble R&D investment in nanotechnology, whilst simultaneously concentrating on a limited number of European centres of excellence. Given that the UK Government had decided not to create such a UK centre of excellence, the UK’s proposals of spreading funding around a range of centres could potentially undercut future UK attempts to win nanotechnology funds from the Seventh framework programme. The European Scrutiny Committee in the UK’s House of Commons (lower house) noted this contradiction, and invited the Science Minister to respond, where INEX was invoked in defending the Government’s policy. The Minister’s argument was that the Government was supporting centres with a particular set of attributes which made them ‘world class’; “with good skill levels, appropriate equipment to meet the needs of industry, a strong industry/product focus, an identified business plan, and strong management”. Moreover, INEX was explicitly identified as world class, and possessing these attributes, when the Science Minister argued that INEX was the first such “suitable consortia” to be supported by the Government.

A sense of the importance of priority given to the investment by the Government is given by looking at the web-page on which the results of the first round of the Applied Research Programme were announced. This web page is reproduced below as figure 15, and shows that although there were a total of 26 programmes, the INEX case was cited specifically as a centre for industry, albeit a centre based at Newcastle University. All the other grants in the announcement were made as an award covering up to 50% of project
costs. By contrast, the INEX award was for £3m investment funds for the development of an industrial centre without requiring a further match of funding. All these together seem to indicate that by 2004, INEX seemed to be regarded as a successful venture, and that by supporting it, the government was also supporting the UK research base, thereby countering the perception in 1997 “of nanotechnology in Newcastle as an unworthy venture”. Moreover, spin-off companies and commercialisation activity seemed to be at least a residual part of the value placed by the government in INEX, in its capacity to meet bring these technologies closer to market.

Figure 15 The announcement of the £3m investment in INEX on the Number 10 Downing Street (UK Prime Minister) Website

As the scope of what has been undertaken in Newcastle in terms of nanotechnology has increased, so its’ value to other actors in the domain of science policy has become more important. National policy actors have regarded the idea of nanotechnology at Newcastle as plausible, and have more recently been willing to provide increased resources to
Newcastle, primarily to achieve national science and technology policy aims. However, in the context of a spatially indifferent national system of innovation, changes to patterns of funding necessarily change the national political-economy of science and technology. Although clearly the case of nanotechnology has not overhauled the subaltern position of the region, it is possible to regard the changes that have taken place in a broader sense having reinforced the desirability, and hence status and position, of Newcastle and the North East of England within the nanotechnology political-economy. In the closing part of this section, we explore the extent to which links can be drawn between successful spin-offs in nanotechnology, and an increased willingness of the UK government to fund nanotechnology R&D in the North East.

9.2.3 Changes to the political-economy of science and technology in the UK?

The main message emerging in this section is that it is possible to construct a science asset based on local resources, and then to increase the scale of the activity in ways that increases its’ attractiveness to external partners. The INEX establishment was ‘born global’, in the sense of being built up from a virtual community of scholars with their own global research reputations (cf. figure 10). INEX performed an act of ordering them into a coherent group which possessed research excellence alongside critical mass, infrastructure and an activity programme. This ordering activity was initially entirely internal to the university, and then later, contained within the region, but this nevertheless produced a research exploitation centre with capacities which other organisations sought to draw upon to validate themselves. More recently, this scale has been extended to the European level, through the EBA recognition, but there is some anticipation that INEX will benefit from increased EU investment in nanotechnology R&D in Framework VII, along with similar foreign centres such as IMEC in Belgium.

Both EBA and DTI have enrolled the success of INEX, and stabilised the ‘INEX story’, one version of which is presented in Hansson et al. (2004). Spin-offs have been part of this success, although in a

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40 Spin-offs are a very important part of the way that the ‘IMEC story’ is told. IMEC was funded by the Flemish Government as a consequence of increasing federalisation of the Belgian state after 1989, and provided a large scale research facility for micro-electronics. IMEC has produced a number of spin-offs, and was exemplified as the ‘model’ technology push approach to promoting USOs (Clarysse et al., 2003; 2004), in contrast to the low energy or selectivity models.
symbolic way much more than a material way. Science and economic policy-makers in the UK regard spin-offs as good indicators of successful valourisation of research, something in turn upon which a significant amount of emphasis has been placed 41.

The main limitation to what has been achieved is that the success of INEX has not increased the sensitivity of those involved in science policy decisions to the spatial implications of those decisions, and the capacity of science policy decisions to ‘create’ the spaces in which science is done. The case of INEX seems superficially to suggest that there is not a regional science problem, if peripheral places like the North East can develop strengths in commercialising nanotechnology activity. There remains a lack of a recognition within government of the role played by government investment in shaping the distribution of that expertise. The Parliamentary Science and Technology Committee explicitly recognised that there were problems in current expenditure patterns, as we have already quoted:-

“There is nothing special in the soil of the so-called Golden Triangle. If significant funds were, for example, made available to the new Bolton University, we have little doubt that it would attract the talent and create a research environment to rival the best” (S&TC, 2004, p.7).

However, explicitly reshaping expenditure patterns seems a step beyond what is allowed in discussions of government expenditure. Notably, in the report on nanotechnology, Too little, too late, they implicitly (and contradictorily) called for a centralisation of the nanotechnology manufacturing research programme funds into a single flagship national institution to be presumably based at the Rutherford Appleton Laboratories in the Golden Triangle town of Didcot (S&TC 2004b).

One link can certainly be drawn, and that is the success of INEX has led to a change in the allocation of one set of science and technology funds, to the definite benefit of the region. We have already noted that current science and technology excellence depends heavily on past investments, so these current investments may yet produce more

41 Indeed, there were some interviewees at the time of the research who expressed the opinion that they felt that the Government was likely to adopt third stream funding formula which took account of the numbers of spin-offs formed by universities. In response to the Lambert Review of university/industry collaborations, many universities expressed the opinion that too much emphasis was placed on spin-off deals, and not licensing deals.
significant future benefits, as INEX, INSAT and the associated researchers manage to acquire a larger share of national and European research funds. However, this case does not demonstrate that there has yet been a more general shift in attitudes and assumptions within the UK science and technology policy community that might precipitate a wider political-economic change. We therefore turn to look at how successes in nanotechnology and biotechnology commercialisation have themselves affected the way policy-makers think of regional science policy in the UK, and the emergence of a particular spatially inflected science policy, that of the “Science City”.

9.3 Spatial concepts in the political-economy for science and technology: the “Northern Way” and “Science City”

We have argued that it is very rare for university spin-out companies to be able directly to change government policy. There may be some very successful businesses which capture policy-makers attention, and significant problems that raise more general issues may also provoke policy-responses.\(^42\) In the case of Schedule 22 of the Finance Act, its’ problems for spin-offs were highlighted by someone with close acquaintance of spin-offs. However, policy-makers in the UK are responsible for making policy for the whole of their territory, a consequence of the spatial indifference of much policy, including the vast majority of science and technology expenditure. Consequently, policy-makers look to collective and representative organisations to provide answers to problems of a national interest. The risk, as we have seen, is that this national interest is defined in terms of supporting existing excellence with future investment, so that uneven geographical patterns of R&D expenditure continue, with negative consequences for the capacities of particular places to compete in the knowledge economy.

In this section, we look at the emergence of specifically spatial concepts within the UK science policy arena, and link these back to perceptions of the success of spin-out companies from the university of Newcastle. From 2000, a number of RDAs became increasingly interested in they the scope they had within the UK arrangement to actively

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\(^42\) For example the case of British Biotechnology plc, which became the subject of a Parliamentary Inquiry in 1998 when a failure of a single product to win regulatory approval led to a significant fall in share price which seemed to jeopardise the venture capital based business model for the UK biotechnology industry.
promote science (specifically, the science or research base) in their regions. The North
East and North West had both launched Science Councils, and One NorthEast had
announced its’ five year “Strategy for Success” to create regional centres of excellence
that would increase the size and the external significance of science policy in the region.
The initial government response to this fitted with its’ commitment to national policies;
indeed, in 2003 it announced that all English regions would have some variant of science
councils to promote the economic benefits of the regional science base. However, in
2004, a potential opportunity emerged to encourage national policy-makers to develop a
more regionally differentiated approach to science funding. The so-called “Northern
Way” set out a programme for the revitalisation of the Northern Regions based upon
using Government expenditure in investing in existing strengths rather than compensating
for failures. This document gave specific prominence to the idea that universities could
act as motors for promoting creativity and innovation in their regions. In November
2004, the Chancellor of the Exchequer announced – apparently entirely unexpectedly – in
the pre-budget statement, that three cities within the Northern Way were being designated
as “science cities”, and invited them to produce proposals for additional government
investment in facilities which could increase the economic impact on their regions. In
this section, we look at the Northern Way and Science City processes, at what emerged,
how they used past successes in producing spin-outs, and the creation of a new spatially
inflected concept, the Science City, within the UK national science and technology
political economy.

9.3.1 Compensating for the Sustainable Communities plan: the Northern Way

Science and technology policy is not the only policy arena in which there is a strong
spatial indifference which expresses itself in a focus on problems of national significance.
In the early 2000s, the Government had decided that congestion in the south and east of
the country was acting as a brake on national economic growth. This was a national
problem in the sense that it was constraining the growth of London, which is seen of
especial importance because of its’ status as a ‘world city’. The concept of ‘world city’
had entered the UK policy discourse in John Gummer’s time at the then-Department of
the Environment, around 1995. The analysis had remained largely unaltered during this
period; London’s regional economy was a motor for the whole UK; strong business service clusters were underpinned by the presence of overseas organisations whose alternative locations would be cities in other European countries rather than elsewhere in the UK. Viewed within this conceptual framework, problems of congestion in and around London were then clearly a problem for the rest of the UK.

The solution to this emerged late in 2003, under the title of the Sustainable Communities Plan (SCP). This had been developed by the Office of the Deputy Prime Minister to deal with the urban and congestion problems undermining economic growth. However, in the course of that policy process, it became clear that very different places had different problems, not least that provincial cities were suffering from large scale urban blight, whilst the problem around London was much more one of congestion. In the 2003 SCP, £5bn were allocated to develop four new ‘growth poles’ (i.e. new towns) around London, aiming to directly relieve the congestion, whilst a mere £½bn was provided to deal with the problems of housing blight facing northern cities. In tandem with this, ODPM invited the three northern Regional Development Agencies to submit their own proposals for “growth pole” solutions for their regions. This is what became the basis of The Northern Way, an attempt to improve the contribution of the northern regions to the overall economy by building on their assets and removing the barriers they faced to growth. In the summer of 2004, the idea was developed into a final report, presented to Government in October 2004, and duly noted. One of the main assets that the Northern Way highlighted was its’ knowledge infrastructure, highlighted in figure 16 below.
The value of this infrastructure was regarded as its potential for helping the three northern regions to close an apparent £39bn productivity gap with the rest of the UK. Within this, a key mechanism by which the Northern Way report legitimated its' claim to be

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43 This was calculated as the difference between average GVA levels, and what the UK’s GVA would be if the regions below average GVA improved to the level of the average.
about “widening the winner’s circle” was that this infrastructure had the potential to drive innovation. As the final report noted:–

“The Northern Way will make a full contribution to this national goal and drive innovation across the North, by establishing the Northern Science and Industry Initiative. We intend to:–

• increase rates of science and technology based business start-ups and spinouts; and
• increase private sector and public sector investment in research and development.”

Source: The Northern Way

The publication of the Northern Way was followed very shortly afterwards by a cryptic announcement from the Chancellor in the Pre-Budget Report, November 2004:

“To build on our new ten year science framework with its £2.5 billion investment in science and to make Britain the best place for R and D, …

• as part of their £100 million technology investment programme, the northern Regional Development Agencies will promote ‘Science Cities’ for the North, starting with Manchester, Newcastle and York.”

9.3.2 The role of USOs in developing and legitimating the Science City concept

The difference between what emerged in Newcastle and the two other first-round science cities was that there were not already proposals in place in Newcastle in November 2004. What appears to have been the case is that the proposal was extended to cover Newcastle because Manchester and York each had approached the Treasury in seeking additional government funding to support their own plans for knowledge-based growth. In Manchester, the “Manchester: Knowledge Capital” (qv) ideas had been developed since late 2002, as part of the development of a so-called core city prospectus for the city. In York, the Science City York programme had been running for six years, as a partnership between the university and the city council, and latterly, the RDA, Yorkshire Forward. York University were looking for new funds to invest in the redevelopment of their

44 The Pre Budget Report creates a framework to focus discussions around spending allocations in the run up to the Budget proper, which tends to take place four or five months after the PBR.
campus, the £500m Heslington East expansion, and the Chancellor’s announcement provided a mechanism for this. By contrast, there were no such ready-made off-the-shelf science city activities in the North East of England.

HM Treasury invited the RDA and City Council to work together to submit a proposal for the science city to be considered within the 2005 budget process (for announcement in April 2005). A partnership was formed between the RDA and City Council, and included the International Centre for Life and Newcastle University (as the two current hosts of leading scientific and translational assets)45. This informal group met a number of times to develop these proposals, which were published late in February 2005 with the intention that this would be early enough to include announcements in the 2005 Budget. The partnership developed a concept for the science city that argued that the region had already been successful in developing a novel form of science commercialisation, and that was a specifically ‘urban’ form of activity, hence the need for the science city idea.

“2.2 The Science City will be, therefore, the location for high levels of a number of related activities. These include scientific research and development, as normally undertaken in a University environment, and University based research in social science and arts disciplines that facilitate the development and utilisation of new technologies. It will also encompass translational research and development and technology commercialisation, including the incubation of new businesses. Supporting these activities will be specialist services, including venture finance, legal services and business advice.” (p. 3)

However, this was not a free-standing theory, part of its’ value as a theory was that claims could be made that the actors involved had already delivered cognate outcomes. Clearly, one exemplar for where this had already successfully been achieved was at the International Centre for Life (qv). The concept that was promoted in the Science City prospectus was an enlargement to the ICFL site, along with creating two analogous developments on two further sites following this spatial model of organisation. These

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45 One of the authors of this report was involved in the development of the report on the basis of the work that had been done in this project establishing the wider value of spin-off companies to peripheral regions. Part of this paragraph relates the experience of the author in participating in this forum.
two sites were the University central campus and the Newcastle General Hospital site. As the prospectus noted,

“in one concentrated area there may be related research, development, commercialisation, teaching, business incubation and specialist service provision. The benefits to be obtained from the co-location and inter-action of such activities has been effectively demonstrated by the International Centre for Life. The Science City will build on this experience at a larger scale” (p. 3).

One of the sites that was to be promoted at the City Centre campus site covered

“Molecular Engineering, bringing together converging disciplines of Chemical Engineering, Chemistry, Physics, Engineering and Nanotechnology, including the DTI-funded University Innovation Centre” (p. 5).

In this way, parallels were drawn in the role to be played by INEX in the redevelopment of the university central campus to that of the ICfL for the Discovery Quarter (the name for the expanded Life Park activities). Likewise, the prospectus also envisaged a role for the university departments as kernels of the activities, providing High Science Content assets to interact with commercialisation expertise and translational facilities on a single site. We have already noted that spin-offs have played a role in legitimating the activity at the International Centre for Life. By hosting a number of bioscience spin-off companies, and other activities closely involved with biotechnology spin-outs, such as CELS and BioNE\textsuperscript{2}T, ICfL was able to transform others’ perceptions of it from a failing property and entertainment venture into a serious, successful and productive science activity\textsuperscript{46}. Likewise, INEX was cited to show that the city’s (or region’s) expertise in commercialising science was not just a one-off asset, related to unique biotechnology capabilities, but that in other cases where the university had a strong research base, the university also had a set of skills in commercialising that knowledge. In making that claim, what was used was of course a simplified version of INEX – portrayed as a centre

\textsuperscript{46} This should not be taken to imply that ICfL was a failure; the transformation in perception of its’ success is clearly inter-related with a transformation of its actual success. Others’ perceptions are obviously affected by the production of beneficial outcomes and successful achievement of targets; so spin-offs affected others’ perceptions of ICfL’s success in this way because ICfL had been successful in supporting and encouraging them.
which had produced a number of spin-off companies. The prospectus eventually sent to the Treasury in 2005 made the argument that the generalisability of the commercialisation and translational expertise in Newcastle meant that other high quality science activities in the university could benefit significantly by organising using ICfL ‘extended science park’ concept.

This provided two things to the science city planning process. Firstly, it ensured that there was a ready-made science city concept for the North East, in a similar vein to Manchester: Knowledge Capital or York: East Heslington, grounding the theory into the region in a normative way. The idea was worked into the region, and ‘stuck’ in the region, in a way that had actively to be pursued because of the lack of a previous ready-made science city concept. Secondly, they demonstrated that there were other research activities in the region which were already producing commercial benefits; the implication was that those benefits could be increased qualitatively with the provision of some supporting infrastructure provision, and reorganising that provision around the extended science park concept. The North East science city concept was around producing a set of extended science parks in the city, which would improve overall regional competitiveness, and ensure that translational activities benefited from externalisation benefits of locating in the creative milieu offered by core cities.

The net effect of these two outcomes ensured that the North East, where there was not this history of activity, was not disadvantaged with respect to Manchester and York, where there had been considerable previous investment in the ideas and concepts. We have already highlighted that there is a tendency in the national system for science and technology to reward past success and investment, by equating it with the scientific excellence necessary to produce national rewards. What in this sense the ICfL and INEX case studies did was demonstrate the existence of “excellence” in the form of a proven past success in commercialisation. This meant that Manchester (and to a lesser extent York) were prevented from dominating the Science City discussions on the grounds that past investment in them had already demonstrated success, whilst Newcastle had not.

These past investments which had gone into the Manchester and York projects were not insignificant. The new University for Manchester involved a one-off HEFCE
restructuring grant of £25m, and this was a key part of “Manchester: Knowledge Capital”. The fact that the Northern Way took place within a discourse of encouraging success risked producing a set of policies which rewarded any existing success in the North, and which as a consequence would have encouraged concentration around Manchester. It might have been possible had the North East not produced a convincing and plausible Science City concept - that was able to catch policy-makers attention - that the funds would have primarily gone to York and Manchester. The link to spin-off companies is admittedly somewhat tenuous, but it does appear that the success of the science city concept in Newcastle was based on having two very different and successful projects, ICfL and INEX. We have already demonstrated (cf. 8.4) that spin-offs were an important component in how those two projects came to be regarded as successful, and featured in how North East actors argued ‘their’ science city concept would produce tangible economic benefits.

Since then, the Science City policy has been further rounded and developed in ways that are somewhat different to the original concept, which was of three city growth poles based on mixed use high-technology campuses underwritten by the university and hospital. The activity has been focused on developing a single site on the location of the former Newcastle Breweries at Gallowgate, Newcastle to extend the benefits of the university westwards and to help rebuild the city as well as creating new university estate. What is significant in this regard is that the spin-off companies were embedded within the discourses that the university used to develop the idea of the Science City concept to the point at which it was acceptable to external investors, in this case Government Ministers.

9.3.3 Changing the political-economy – science cities for every region?

In 9.3.2 above, we have briefly analysed how ‘USOs’ became intertwined in a policy which was being developed specifically for the North East of England. One reading of this situation might be that Newcastle University’s experience with USOs shaped the way the Science City concept was developed in Newcastle. Certainly, the Newcastle Science City concept was different to that being developed in either Manchester or York. Moreover, one of the Newcastle University academics who was involved in developing the policy was himself the academic principal of a spin-off from the university of
Newcastle. This meant that the university was seen to have some expertise in the developing of the concept rather than merely involving detached academics in developing theoretical concepts. However, there are a number of limitations to this analysis.

The first is that the way that USOs have become involved is principally in a symbolic manner, rather than in a direct and active manner, or even an indirect manner. None of the USOs had themselves been actively lobbying for the creation of these facilities or building of critical mass in those facilities by attracting large-scale external investments. Although ICfL/ the North East did win the Institute for Bioinformatics, and the bid was designed by SMEs, those SMEs were not themselves USOs, but rather more established high technology regional firms. Indeed, the of the twelve spin-offs we interviewed, only two were involved directly with ICfL or INEX in any kind of way involving technology knowledge-exchange manner, and other spin-offs used the facilities they offered. Where USOs did seem to be important was in constructing the ‘success’ of these two projects; the fact that some spin-offs were produced was then presented as an indicator of future potential, rather than the quantitative benefits that these spin-offs have brought. Indeed, the fact that Lord Sainsbury cited these spin-offs as signifiers of potential future benefit to validate a general approach suggests that this narrative was accepted at some level by external actors.

The second issue relates to the significance of the “Science City” process. In one way, the process was not important; HM Treasury, for example, were clear that the “Science City” concept provided an organisational principle for RDAs to arrange their science investments (cf. 9.3.1). Moreover, in the March 2005 budget, a further three science cities were announced, Birmingham, Nottingham and Bristol, in the Midlands and South West, diluting any potential impact of the brand in privileging particular regions to be recipients of particular types of government investment. Certainly, the local actors stated that the Science City initiative was important to them, and USOs were used in developing an argument about why they had the capacity to deliver the science city concept. However, the evolution of the concept into something more generic and national in scope suggests that the fundamental structural problem remains; the Science City prospectus was not a way for the North East to rescale its’ achievements, to argue that there was
something particularly special or noteworthy about INEX or ICfL that made them of national significance (and hence deserving of special investment).

This then leads to the third issue, which is that there has clearly not been a change in the mode of organisation at a national level of science policy assumptions and framing approaches. Regional science and science city concepts emerged in the ‘north’, with the potential to create special territorial claims for getting double economic value out of investing in science, as each pound spent would create productivity benefits but also bring regeneration benefits. However, through national policy processes, in which even northern Universities have argued against having any kind of regional consideration within science funding priorities, these spatially-rooted concepts have become rescaled as ‘national’ concepts, and then reapplied to the regions in ways that allow the inherent spatial biases towards the south and east of the country to re-emerge.

Although this appears somewhat pessimistic, it is possible to regard the Science City process as a positive outcome in one regard. Although the region does exist in a subaltern relationship with the national political-economy of science and technology, the region itself is not a simple object, it has internal dynamics. It is possible that internal changes may alter the intrinsic value of the region to others, thereby reworking it within that political economy. Just as we saw in chapters 6 and 7, how the university reworked its internal mechanisms to improve its external impact, so the regional innovation system has the potential to undertake a similar programme of change. In 8.3.1, we indicated how one actor argued there was a tendency in the North East to spread any resources very thinly. This undoubtedly relates to the fact that much public expenditure in the region is redistribution and compensating for failure directed through local authorities and partnerships; the RDA very early on took the decision that 75% of its budget would be devolved downwards to sub-regional partnerships – thereby spreading those resources across the region. That philosophy is at odds with contemporary thinking around science policy, emphasising, as we have seen, concentration through its’ equation with excellence, and excellence as the source of the national economic benefits.

Previous regional science and technology investments have had a distinctly distributive feeling; the Three Rivers project in the 1990s was about creating technology centres in
each sub-region, likewise, early incarnations of Knowledge House were about creating regional networks and capacity, rather than investing purely in excellence. Even in the initial UIC proposal in 2001, the funds were split between all five institutions, albeit somewhat unevenly. However, the Science City prospectus makes two apparently significant steps in the direction of concentration. Firstly, the prospectus states that partners recognise the reality that competing in the knowledge economy necessitates the centrality of urban places to knowledge production. Secondly, it privileges a single institution, in this case Newcastle University, as the recipient of funds to produce these benefits. If the North East were to aggressively concentration its’ regional funding into producing a very limited number of centres of excellence, then the exemplars of INEX and ICfL suggest that this will yield more national and international (particularly European) research and experimental development funds. Thus, although the Science City prospectus process was not highly significant externally, it could be regarded as a step to realigning regional science policy framework towards competing more aggressively for national spending.

9.4 Spin-offs and the new political-economy of the North East of England in the knowledge age

In this chapter, we have considered how successful commercialisation activities – in which USOs have comprised part of the justification of their success – have challenged the subaltern position of the North East in the UK’s science political-economy. The political-economy is dominated by a series of discourses which are apparently spatially indifferent, drawing on seemingly spatially neutral ideas such as ‘excellence’, ‘quality’, ‘efficiency’ and ‘economic value to the UK’. Although these notions do not contain any inherent spatial biases, the way they have become conceptualised in the UK creates barriers to less successful places improving their own position. The neutrality of these discourses hides the fact that UK science and technology investment is channelled into a relatively limited number of places, and that recent determination to concentrate investment is threatening to further accentuate this uneven geography. For a region like the North East, it is clear that these spatial imbalances can be challenged with some degree of success. Clearly, INEX has been able to establish that it is a centre of
excellence, and the UK interest in FP VII, for example, lies in ensuring that INEX receives capital investment from the European Commission.

This raises questions about the significance of this particular change, and the extent to which it has made the North East better regarded as a place to do science. It is possible to segment the construction and operation of the science political-economy into three levels, specific, general and paradigmatic, and use this segmentation to examine the extent and the significance of those changes. The specific level is in particular decisions and outcomes, determining how particular programmes with operate and deciding which regions will benefit in particular projects. The general level is the agenda for science policy, deciding which disciplines to fund, producing mechanisms for allocating resources, and implementing concepts into policy measures. The paradigmatic level is the background assumptions underpinning science policy, so answering questions such as why publicly fund science, in whose benefit is science funded, and what benefits will flow out from that science.

In this research project, looking at the territorial (regional) impacts of USOs, our view of significance of particular outcomes is framed as the degree to which particular USO-related outcomes embed particular spatial activities into regularities which lead to recurrent science and technology investment. In this sense, the least significant activities are those which ‘bend’ particular projects and programmes towards a territory. Although we have seen that investment flows tend to endure, there is also a tendency to value flows into the South East higher than those into the peripheral areas, often implicitly hiding assumptions about how the economy operates. This is neatly illustrated by S&TC in arguing why they believed a national nanotechnology institution should be located in the core regions:-

“The Institute of Nanotechnology-led survey for the DTI on the industrial nanotechnology landscape indicated that at present the geographical balance of companies involved in nanotechnology is tilted towards the Midlands and the south of the UK. There would, not unreasonably, be strong pressure from industry to ensure that any new facilities would be sited in this region. Indeed, there is still significant pressure in this respect. We were told by Patrick McDonald from the
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DTI that ‘it is essential to build on the critical mass we have at the moment, so Oxford and Cambridge, London. We have to build on those’.” (S&TC 2004a, para. 44)

This suggests that changes embedded at the generic and paradigmatic scales are more significant in determining longer-term changes to the political-economy of science and technology. In science and technology policy, for example, the concepts of “excellence” and “quality” ensure that in many cases, *ceteris paribus* institutions in the Golden Triangle are favoured. Changing this (or any of the) paradigmatic assumption is a huge task, and would indeed represent a real change in the UK’s political-economy of science and technology. At a more generic level, for example, Warwick University has managed to build a generic advantage in manufacturing technologies, ensuring that researchers close to the Warwick Manufacturing Group are able to draw on some of the esteem of that research group.

In the case of Newcastle, there appears to be evidence that changes have been achieved at the level of the specific; INEX and the life science research around ICfL have been able to attract particular flagship government projects in nanotechnology and biotechnology respectively. Indeed, DTI expenditure on nanotechnology R&D is heavily geared towards the northern regions, and the North East achieves the greatest share of any single region (some feat given that it is the smallest of all the English regions in terms of population, workforce and economy). This situation arises as a consequence of INEX being built up by a core team within the university, and gradually expanding its’ reach outwards as it became more plausible and worthy as an investment proposition. Thus, it could be said that the creation of INEX as a multi-scalar asset network has resulted in the North East being made into a place to do nanotechnology manufacturing research. This construction has been achieved in part through the success of INEX, which did draw on success with USOs to validate its’ approach to commercialisation.

The evidence is less convincing at the level of the generic; what is clear is that there was a change to the science agenda around the year 2000, what Perry (2003) calls a switch-point, associated with the Daresbury closure announcement. This allowed two regional science issues to be placed on the agenda, regional science funding, and
Peripheral technopoles. In each case, these items came onto the agenda, but it was not possible to legitimate those ideas within the current paradigm of UK science policy. With regional science councils, the idea was first proposed in the North West, and transferred to the North East via consultants Arthur D. Little. By 2003, however, in response to a Lords Inquiry into science and regional development, the Government had decided that all regions would establish such councils, ensuring that there was no possibility for these institutions to undertake special interest pleading. One of the next wave of science councils to form was in the South East (SESTAC), who developed a set of model guidelines for science councils at the behest of the RDAs and Research Councils. Thus, an idea which was heavily contextualised when initially developed was rescaled away from the region into something acceptable to the UK science and technology paradigm. Likewise, this appears to have happened with the case of the “science cities”, with a concept designed to use science to deal with problems of dereliction and housing market collapse in northern cities being extended to cities in the Midlands with much less need for regeneration (but with arguably stronger science bases).

Clearly, then, these changes have had almost no impact on the paradigmatic structure of science and technology in the UK; had regional science established itself at the generic level, with the emergence of particular dedicated regional science funds, then that might have been followed by a switch at the paradigmatic level. Regional science remains almost anathemic as an organisational principle in the UK science and technology economy, suggesting inefficiency, waste, and interference, and obliterating the potential it has (and has elsewhere been demonstrated to have) to improve national productivity by relieving congestion pressures in the core at the same time as promoting high-technology economic growth in the periphery. Research Councils UK, in its evidence to the Lords Inquiry, demonstrated how the science paradigm actively undermines the embedding of regional approaches to science, creating and insisting on a tension between excellence and regional policy goals.

“There is a natural tension between the Research Councils and RDAs in terms of remit. Research Councils are committed to supporting excellent research to meet national needs and do not have a regional funding policy. The regional focus of
RDAs can provide specific and targeted opportunities for joint working and exploitation of the Research Councils research.” (LS&TC, 2003, p. 303).

In the introduction to this chapter, we raised the idea that challenging the political-economy of science and technology required a rescaling of activities, making local successes of the equivalent scale to national interests. At a very specific level, some upscaling has taken place, with INEX and ICfL regarded as centres of national excellence, and hence strategic national importance. However, it has not been possible thus far for these very specific improvements to produce more general changes. It could be that the North East could develop sufficient of these successes in ways that led Newcastle more generally to be regarded as an institution in the national interest, which in turn led to a favourable presumption towards the region. And whilst the evidence in this chapter suggests that this outcome is possible, it also suggests the magnitude of the task necessary to achieve those changes. It has taken concerted effort from within the university for ten years to achieve those successes. Admittedly, some of that concerted effort was about removing internal barriers and problems, and creating a more excellence- and growth-driven university, and that effort should not have to be fully repeated in the future. Some of that effort was about creating and restoring an aura of plausibility to Newcastle’s reputation as a university undertaking commercially valuable science. However, making the change from to being an institution of strategic national importance appears to be a long way in the future, requiring considerable further effort and success from within the university.

In the previous paragraph, there is a suggestion that some particular one-off changes within the university can produce recurrent benefits in terms of portraying the institution as one of national significance. The question is the extent to which USOs are recurrent benefits for portraying the university as successful. Clearly, in the case of Newcastle, its cultural transformation was assisted by the sale of Novocastra, and the failure to extract value from Mindware. It could be that creating a stream of successful spin-off companies in fields in which the university has technological strengths will help in the creation of these large and nationally remarkable projects. It could be that the Stephenson Centre, for the sake of argument, was able to attract significant external funding justified in terms of its capacity to deal no only with existing local firms but also to create new spin-outs
itself from the research capacity within the university. The Institute for Ageing and Health mooted under the Science City project likewise needs to demonstrate commercial benefits, and a mix of emergent and existing USOs may enable this institute in the future to establish its’ national strategic importance. Obviously, this is something which we are not in a position to currently answer, but it raises issues for the comparative analysis – we have observed that in some cases, spin-offs have come out of big, eye-catching projects, but this suggests the converse might also be true, that spin-offs might make it easier in the future to legitimate such flagship activities.
10 Concluding discussion

This report has been prepared as part of a comparative project looking at two less successful regions, to explore the extent to which spin-off companies have played an role in changing the economic status of the region. In one sense, it is hard to draw firm conclusions from the single case study which allow the more general development of theory, because our generalisation is based on drawing across multiple case studies. However, the case study does appear to suggest that spin-offs have played a role in the economic impacts of the university in the region. There appears to be some evidence – as with the case of Twente – that these impacts have been achieved through upscaling particular regional activities and giving them a wider economic significance. USOs have in turn been embedded in those activities, and been an important manner of the way that those activities have been upscaled, often through their discursive powers and capacities to be valued by external agents because of their fulfilment of ‘commercialisation’ and their promise of future ‘entrepreneurship’.

The Newcastle story appears remarkable because a series of unremarkable activities seem to have given rise to a fundamentally successful outcome. Taking any five year period in the recent history of Newcastle University, it would appear that the importance of commercialisation ebbed and flowed without leaving a significant impact. However, what can be seen is that a series of activities have gradually accreted that appear to have culminated in a shift in the way that the region is regarded by one section of external investors in science and technology, namely the UK government, and that that could potentially presage a shift in the position of the region in the political-economy of science and technology. In this final concluding discussion, we produce a revised narrative of the key events and their outcomes in which their significance is embedded within a narrative of how Newcastle became important to the UK government in achieving some parts of their policy programme which could not be achieved within the extant policy paradigm (referred to in the previous chapter as lacking spatial nuance). From that synthetic narrative which begins to establish the wider significance of the university and USO-centred events, it then becomes possible to hint at a broader story for the
relationship between universities, USOs and the territorial economic development of their host regions.

10.1 Spin-offs and the rescaling of economic activities in the periphery

The recent history of the latest phase regional economic engagement at Newcastle University begins in the early 1980s, with the creation of the Newcastle Technology Centre as well as the inauguration of HESIN as an organ for inter-university collaboration. In this period, the university stated its commitment to creating spin-off activities and commercialisation activity. At the same time as this, a number of spin-off activities emerged. The North East at the time was a very hostile economic environment, the manufacturing economy was imploding under Thatcherite monetarism, and there were very few endogenous or exogenous resources which could be used to build sustainable firms. Within this, the university played a role as a safe haven from the hostile environment, and a number of early spin-out companies emerged as annexes to research groups, with the university’s benign indifference allowing professors and research staff to anchor themselves using the university’s cachet and resources to build up companies. Newcastle Technology Centre was not particularly helpful in this regard, but it did provide some technology services for some of these starting companies, in a number of cases around writing business plans and other activities which could help win further finance.

The next phase of the university’s activities was the phase of greater support under NUVentures, in which the university sought to more pro-actively identify investment opportunities within academic research groups and encourage the formation of companies. This increased openness to entrepreneurship – in the early and mid 1990s – was as vital to allowing some of the first wave of spin-offs to remain within the university as it was to promoting the second wave of spin-offs identified in Chapter 5. A number of the companies which were to grow to be the largest were those which formed earliest but then stayed for a long period of time within the university. The problem during this phase was that there was some uncertainty over the value of spin-off policy, and in particular the lack of a large demonstration effect that spin-offs could help to support the core missions of the university. In tandem with this continued benign
indifference, the university embarked upon the International Centre for Life investment which provided some incubation space for high-technology companies. So, in this second phase, important seeds were sown for the third phase of spin-offs, covering the late 1990s and early 2000s.

In this third phase, the university began to realise that spin-offs had territorial benefits, but also that USOs could be instrumentally useful as part of developing arguments for larger scale investments. With respect to the former, in chapter 8 we have seen how the university activities helped to shape and embed a particular regional sequence of innovation, and take what was hitherto a low science content activity, and create a network of activities oriented towards high science content activities (those activities which are themselves most groundbreaking and form part of the stories of ‘totemic sites’ averred to in Chapter 2). With respect to the latter, the university began using their success with USOs to win more regional development funds that could be spent in such a way that they were invested in “second stream” scientific research (i.e. core mission). These expenditures in turn helped to win bigger projects and activities. With the case of INEX in chapter 9, we have seen that USOs were continually used as a way of demonstrating in a very practical way the potential economic value of further investment in the research base alongside a commercialisation infrastructure. Thus, the ‘building up’ of the justification for, and the reality of, ICfL and INEX has involved several waves of reference to USOs, generic spin-off successes indicating a demand for incubators, the success of biotech spin-outs of the potential for a strong regional biotech industry, the emergence of nanotechnology spin-offs justifying the new pedagogic approach taken by INEX through the so-called Newcastle approach.

The enhanced value of these activities is further validated through the Science City discussions and policy which emerged from November 2004. By early 2004, INEX and ICfL were in effect two freestanding nodes strongly connected into global networks of scientific production and weakly connected to the corporate development of Newcastle University. Through the Science City process, these two examples were used to illustrate to policy-makers what could be achieved with the Newcastle approach, particularly in terms of creating high-technology growth poles to close the regional productivity gap with the south of England (a core concern of DTI and ODPM through their Public
Service Agreements with the Treasury). Even within this attempt to change or influence national policy, USOs were a visible part of the discussions and presentation from the Newcastle Science City Partnership (2005). According to a Newcastle University Press release in September 2005, the UK Minister for Science, Lord Sainsbury argued

“UK science and innovation are key to meeting the challenges of an increasingly competitive global knowledge economy. Science Cities will be one of the focal points for transforming the best of British ideas and discoveries into new products and services.” (Newcastle University Press Release 23rd September 2005, available online at www.ncl.ac.uk/press.office/press.release/content.phtml?ref=1127321865

This then suggests an outline model for the upscaling process, by which spin-offs, the result of a variety of Newcastle University policies, were embedded within these larger outcomes. The first is that the university created itself as a ‘point of stability’ within an adverse, sparse or hostile regional economic environment for entrepreneurship and innovation. The second is that the university built up a community within that point of stability, that drew sufficient innovative and entrepreneurial elements from outside the university into this space of stability that it behaved as an effective micro-regional innovation system. This micro-RIS behaviour was in turn taken forward by a number of industrial sectors, such as elements of biotechnology and nanotechnology, which demonstrated particular elements of success. In parallel with this, the university continued to invest in these areas, thus particular key nodes within this micro-RIS built up to be more resistant to the corrosive powers of the external environment in their own right.

The success and stability of these key nodes, such as INEX and ICfL in turn allowed the university to convince policy-makers and investors that investing in Newcastle or the North East of England would help them meet their own needs. However, the way that the institutional space was configured meant that these investments helped to reinforce the micro-RIS, and so helped to increase its scope of activity and hence its regional footprint. Most recently, this micro-RIS appears to have been upscaled to the urban scale, or at least to have that potential, as represented within the Science City policy, which may create a
recurrent funding stream to invest in science in the North East of England. This would represent a (arguably beneficial) shift of the North East’s position within the political-economy of science and technology, which (and this is where the narratives lacks any more substance than pure conjecture). This rescaling is represented diagrammatically in figure 14 below.
Figure 17 The rescaling effects of Newcastle University through the regional innovation system, national policy paradigms and global production networks

Source: authors’ own design
10.2 Universities, their spin-offs and regional economic development in the periphery

The concluding question to which we turn in this working paper is the wider paper posed within the literature review (p.13)

“how can university spin-offs rework political-economic relationships in ways that improve the situation of their host regions in wider knowledge-based economies”?

There seems to be a heuristic emerging from this single case of Newcastle University, and the heuristic is worth enunciating as a first step towards building a better-rounded conceptualisation drawing equally on the second case study, of the Twente region. There does seem to be evidence that although spin-offs are ‘small’ actors, and unconvincing as sole agents of change in the North East, in the case of Newcastle, USOs have become inter-woven in bigger trajectories of activity. It is these larger trajectories of activity which have developed particular types of ‘success’ and allowed them to be seen as ‘big’ actors within national policy discourses. Of course, what is not clear within this heuristic is any kind of typology of or dynamics for the development of “trajectories of activity” which have the potential to challenge the scalar envelope to re-place the North East of England within its wider political-economic context.

The heuristic seems to be that USOs are associated with the development of what might be considered as points of stability around universities. Universities are large businesses, but do not necessarily have ‘space’ for spin-outs. The policy of actively supporting spin-outs over twenty years at Newcastle seems to have created a protected space in which a number of inter-related activities have been able to slowly incubate. Only when there is a genuinely world class strength in commercially exploitable research (or at least the imminent promise of that) has the activity or RIS been rescaled upwards to increase the relational value of Newcastle to other external economic actors. This does seem to fit neatly with the kinds of relational/ innovative thinking about old peripheral regions that is emerging elsewhere in the literature (inter alia Chapman et al., 2004; Bathelt & Boggs, 2005). This literature seems to provide the natural departure point for attempting to
conceptualise more generally on the nature of regional economic development in the periphery from the two case studies in this project.
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