“University spin-off policies and economic development in less successful regions: learning from two decades of policy practice”

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Introduction

Although there has been in recent years a remarkable consensus about the notion of a knowledge society, there still remains considerable disagreement about the details of how knowledge adds value and creates competitive advantage (Temple, 1998; Armstrong, 2001). The generally accepted understanding of how a ‘knowledge economy’ might function is through accumulation of ‘knowledge capital’ as a new growth factor, knowledge capital being characterised by increasing returns to scale, the potential for knowledge overspill and agglomeration (Longhi, 1999; Lorenz, 1999). These features are important, because new technologies have created new market opportunities whilst greatly intensifying the effects of competition (Castells, 1996), with advanced countries losing many jobs to countries with much lower labour costs (Reich, 1991; Sabel, 1994), placing a premium on innovation and improved quality (Porter, 1998).

This ubiquitous requirement for innovation increases demands for knowledge inputs within production, favouring particular types of naturally-innovative society (Asheim, 2001). Innovations have to respond to a range of different forces, and individuals able to understand the interplay of those forces are highly valuable, and are well rewarded for their knowledge work (Wood, 2002). Such ‘knowledge societies’ (Stehr, 1994) are consequently very different to previous social organisational forms, often with uneven distributions of risks and rewards according to individual human capital endowments (Reich, 1997; Beck & Beck-Gersheim, 1997). Knowledge ‘work’ now involves applying different knowledges together besides generating new knowledge,
qualitatively transforming the organisation of science towards more application-focused collaborative research (Gibbons et al., 1994; Zysman & Borrus, 1994).

These economic changes have stimulated new policy responses from government. Globalisation and the mobility of knowledge production has constrained government’s regulatory authority (Peck & Tickell, 2002). Markets are believed to change so quickly that nothing will attract or sustain fixed investments that the market will not support (Charles & Benneworth, 1999). Governments seek to ‘steer’ rather than ‘drive’ the economy and favour policies promoting commercially-valuable knowledge creation in support of new economy activities rather than investment in fixed capital (Martin, 2003). In parallel with this, Governments are coming under increasing pressure to reduce their overall taxation levels, and to increase the social returns generated by particular government investments.

It is perhaps then unsurprising that Governments should be looking to universities to support the creation of these knowledge economies (Goddard & Chatterton, 2003). Although universities may have been founded as autonomous institutions, the increasing ubiquity of higher education has left universities in many countries reliant to a large degree on central government funding (Klofsten & Jones-Evans, 2000). Likewise, Governments have long been significant funders of research activities, which has eroded the autonomy of universities and increased their reliance upon, and hence responsiveness to, central government control. Because universities have for so long been in receipt of state funds, Governments are increasingly interested in identifying how these past investments can be used to realise current economic development returns.

There are a wide range of different ways in which universities can produce positive economic impacts within their broader national systems of innovation. Freeman et al. (1995) notes how the American and Soviet science systems produced very different economic impacts because of the much more pluralistic way in which innovations were commercialised within the American system. At a regional level, there is an increasing literature on universities and regional development, looking at the multi-faceted benefits which universities bring to their territories (Boucher et al., 2003). However, it is clear that these benefits do not emerge automatically, and more recently, concern has been emerging that observations from a very limited number of successful places have led to generalisations being asserted which do not necessarily
hold well (Benneworth, 2002). Armstrong (2001) characterises these places which have been so lionised as the “totemic sites” of the new economy, places such as Silicon Valley, Research Park Triangle, and Silicon Fen. Armostrong regards these places as key sites in an ideology of science-based industry, implying a possible reality gap between the perception and reality of new economy activities. Therefore, care has to be taken in making sense of the regional benefits which universities bring to their territories, and it must not be assumed that it is just universities’ activities which have made these places successful (cf. Hassink, 1992).

In this paper, we explore this issue in one particular – and increasingly popular - policy domain field, university spin-off companies (USOs). Pirnay et al. (2003) offer a generic definition of USOs which we find particularly helpful: “[n]ew firms created to exploit commercially some knowledge, technology or research results developed within a university” (p. 356). The idea of the university spin-off company has become increasingly popular in recent years with policy-makers; in part that can be attributed to the fact that USOs seem like a relatively cheap way to promote the development of knowledge economies in different places. Policy-makers have been supported in this by research-based universities who have seen USOs as a means of generating revenue and thus reducing their exposure to external (governmental) interference. Spin-off companies can be regarded as an intrinsic part of the ideology of science-based industry, or quintessential new economy activities, but clearly, analyses which begin from a single one of those positions risks tainting the eventual analyses with the preconceptions embodied in each position.

What is indisputable is that the number of USOs being formed the advanced economies has increased in recent years (AUTM, 2001; HEFCE, 2002; ARC, 2003). There are also corresponding and growing pressures on universities to “adopt a more proactive participation in their region’s economic development” (Pirnay et al., 2003, p. 360). However, the opening discussion suggests that USOs may bring fewer of the economic development benefits which have become attributed to them beyond the particular totemic sites in which the theories were developed. In this paper, we explore the issue of whether USOs bring economic development benefits outside Armstrong’s “totemic sites of the new economy” (p. 524). We ask the question “to what extent does a policy of promoting USOs benefit a region, particularly in less successful regions with a less rich regional knowledge base?” To begin to explore
this issue, we begin by considering why spin-off companies in less successful regions might not bring all the assumed benefits.

**Spin-outs in the periphery?**

There is a clear geographical dimension to the new economy which the preceding discussion has not properly noted. There is general acceptance that competitiveness, productivity and ultimately wealth are becoming increasingly dependent on stocks and use of knowledge capital. The geography of the new economy is one in which these knowledge capital stocks are extremely unevenly distributed (Keeble & Nachum, 2002). This unevenness appears to be increasing, and indeed seems to be a barrier for less successful places to themselves participate in the knowledge economy. The knowledge economy paradigm is rooted in the analyses of Solow (1994) and Romer (1994), who arrived at the idea that knowledge capital differs from other forms of capital in that there are no discernable diseconomies of scale. Consequently, knowledge production becomes increasingly centralised, and their theoretical implications have been subsequently borne out by the emergence of urban knowledge hierarchies topped by a handful of world cities, supported by regional hubs and national centres (R. Smith, 2003). These urban hierarchies sustain a highly unequal geography of production which continually centralises activities upwards through the hierarchy (Short & Yeong-Hyun, 1999).

This creates significant problems for those less successful places which lie outside or at the bottom of this global ‘command-and-control’ network. These are the places which we refer to in this paper as “peripheral”, not necessarily peripheral in a cartographic sense, but removed from the nodes of power and communications by which contemporary economic activity is organised and mediated (Beaverstock *et al.*, 2000). In seeking to develop knowledge and realise economic potential, these peripheral places face a dual bind; on the one hand, they lack existing potential which implies that current economic activities are less successful than in other places, and on the other hand, when success does emerge, it is removed from the region and centralised and relocates to core places (Anderson, 2000). In this sense, the geography of this new knowledge economy is no different from that of earlier economies. The difference is that whilst economic success in manufacturing economies was linked to productive activities, which governments could use policy
tools to shift around, the knowledge economy seems too ethereal and mobile to contemplate such redistributive activity (although there are good examples of national and regional authorities creating new high technology places, such as Sophia-Antipolis, *cf.* Longhi, 1999).

It is easy to see how this problem manifests itself in the case of university spin-outs. The archetypal places where USOs have succeeded are in the main already successful places, such as Route 128, Silicon Valley, and Silicon Fen (Saxenian, 2000; Wicksteed, 2000; Bathelt, 2001). Consequently, it is hard to disentangle the success of these companies separately from the extremely supportive entrepreneurial environment within which these companies are founded (Dubini, 1989; Johannisson, 1993). In some cases, it is possible to see how particular entrepreneurs and companies have shaped and improved regional innovation systems, so that the economic benefits are attributable to the spin-offs. A regularly-cited example is ARM, a Cambridge spin-off, which became important in promoting networking and venture capitalist funding for other local firms in the Cambridge area (*cf.* Wicksteed, 2000; Quince, 2002).

It is less clear that these conditions hold true in less successful regions. The idea of the ‘dual bind’ suggests two reasons immediately why USOs might not be the panacea for these regions economic development problems. 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 than in more successful places. “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). This might reduce the attractiveness of the policy by increasing its cost, and also by diffusing its impact. As Venkataraman (2004) notes, attempts to increase promote technological entrepreneurship in less successful regions by increasing venture capital provision often end up channelling funds to “franchising, household services, retail or corner grocery stress, restaurants and other imitative products and services” (p. 161).
The second issue is that those USOs which overcame these barriers would tend ceteris paribus to be less successful and have less of an economic impact than in economic ‘core’ regions. Autio (1997) refers to this as a “growth myopia”, the assumption that economic growth is entirely dependent on the existence of high technology start-up firms. 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 gap between the core and peripheral regions.

Is there then no role for university spin-off firms in supporting economic development in less successful places? This deduction is intuitively problematic, because it does seem to run counter to broad swathes of recent analyses which have demonstrated that USOs can act as drivers of economic development in ‘ordinary’ places (inter alia Etzkowitz, 2001; Lockett et al., 2003; Asheim & Coenen, 2003). It is indeed possible that recent USO promotion policy is broadly misguided, a result of what Venkataraman (2004) refers to as the tendency of policy-makers to try to address complex problems with simple solutions. “Typically they climb up on a pedestal and shout loudly, point to the hill that needs to be taken, and assert ‘this is the way we are going’ ” (p. 165). Certainly, then, USOs contributions to regional development is a more complex than immediately apparent. To explore this issue more closely, we now excavate inside the various reasons why policy-makers have become attracted to ideas of USOs, that is the assumptions made about their economic development value.

**The stylised facts of university spin-outs**

It is possible to identify a wide range reasons why USOs have become a focus for policy-makers’ attention in recent years. Armstrong’s analysis would suggest that politicians have focused on USOs as an attempt to imagine the more entrepreneurial world they seek to bring into being. However, there are good examples of USOs generating benefits which provide a more rational foundation for promoting USOs. Certainly, USOs do seemingly embody all the virtues of a knowledge society (Etzkowitz, 2001). Their wealth and employment creation is a ‘free’ return to past scientific investment, at relatively low direct cost (Di Gregorio & Shane, 2003). They provide income streams to their parent universities, allowing new investment in basic science, relieving pressures on public science funding (Dahlstrand, 1999). Finally,
they embody a modish light-touch partnership approach between the state, university and firms (Etzkowitz & Leyesdorff, 2001).

The policy promotion of USOs has certainly produced results in terms of numbers of new firms created. 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, 2000). Although some of this success is an artefact of the over-exuberance of the late-1990s bubble economy, the more recent figures suggest USOs are fulfilling their promise to generate wealth and create innovative, high-productivity firms (UNICO, 1999). These individual, micro-scale successes have led to the development of set of ‘stylised USO facts’, which allow policy-makers to rationalise why USOs could potentially be valuable for their territories:-

1. USOs are ‘high-tech’ employers, paying good wages and promoting entrepreneurship (Etzkowitz, 2001),

2. USOs build on global technological and client knowledges in building new networks to access finance, sales and marketing (Dahlstrand, 1999),

3. USOs retain close linkages back to their ‘parent’ institution, through equity holdings incubators, technological transfer, recruitment and research collaboration (Heydebrook et al., 2002),

4. USOs are sources of entrepreneurs whose technological entrepreneurship can transform the wider regional economy (Etzkowitz, 2001; Venkataraman, 2004).

5. They are sources of technological spill-over, and can promote and shape the emergence of regional technology clusters (Di Gregario & Shane, 2002; Benneworth & Charles, 2004) and

6. USOs stimulate business support services and infrastructure, benefiting other start-ups (Lockett et al., 2003).

In this paper, we are interested in exploring whether USOs have the potential to improve the economic situation of less successful regions, and examining these stylised facts, it appears that they operate at two scales. “Facts” 1, 2 and 3 are facts
relating to the type of firms which USOs tend to be, whilst “facts” 4, 5 and 6 suggests that universities create more generalised and wider benefits for their host regions. Although all the stylised facts could conceivably be true in particular less successful regions, the logics they follow are likely to vary between the two classes. The firm based facts are likely to overemphasise USOs’ benefits for their regions, because firms in LFRs grow \textit{ceteris paribus} more slowly than firms in core regions. Conversely, if USOs create wider regional benefits, these are likely to have much greater impacts in LFRs were the innovation support environment has fewer existing assets making the new assets much more significant in generating positive outcomes. These two dimensions are inter-related, because as Keeble & Nachum note (2002), firms in the periphery tend to be less successful in part because they have access to fewer of the hard and soft supports factors which promote growth rates in the core.

\textit{USOs as high-technology firms}

The first set of assumptions that are made about the value of USOs is that they are valuable because they are high-technology firms, which sits well with the observation that many of the most successful economies are dominated by high technology firms. One reason that these assumptions are problematic in the general sense is that it over-determines those spin-off companies. Recent work into USOs has found that they are an extremely complex phenomenon which confounds any attempt to categorise them along the lines of stylised facts. Pirnay \textit{et al.}, for example, find ten different definitions in circulation, six of which date from the last five years (since 1999); they highlight different kinds of spin-off, from student start-ups to high-growth flagship ventures. Even within this, different kinds of USOs have very different economic impacts, from the volume of resources they take to stimulate, through to their eventual economic impact. Clarysse \textit{et al.} (2003) find that different institutions’ own approaches are promoting very different types of firm.

Twente’s TOP programme exemplifies the ‘low selectivity’ model, in which anyone with an idea is given a small resource to move forward, which generates number of firms, but encourages low growth potential firms. Rosa (2003) notes that UK graduate entrepreneurship programmes from the early 1980s to the late 1990s could be characterised quite simply. “The most successful [graduate start-up] businesses were not in biotechnology, computer software or other cutting edge knowledge driven
businesses, but restaurants, retail stores and furniture manufacturers” (p. 452). Conversely IMEC in Flanders, a long-established technical institute, encourages a small number of high-growth potential firms and helps them to participate in networks to access the technological, managerial and financial resources they require to achieve that growth rate.

Secondly, in arguing that USOs improve the economic situation specifically in less successful regions, there is also something of a scale gap between the direct contribution made by firms and the observable regional benefits. This general scale problem, that USOs only involve tiny numbers of firms in comparison to the size of regional economies, is neatly exemplified in van der Sijde et al. (2002). They note that the University of Twente’s spin-off programme created 920 jobs in 216 firms in the first sixteen years of its life (1983-1998). At that time, Overijssel Province had around 330,000 employees (1996), so it is hard to argue that that level of employment creation — representing only 0.3% of all jobs in the province — has involved a significant improvement in the regional economy, and sensibly, van der Sijde et al. hold back from making that claim. Certainly, there is no direct intimation that USOs of themselves have the capacity to close the economic gap between less successful regions and core regions in the new knowledge economy, particularly considering Rosa’s observation that graduate start-ups tend to be low-technology, imitative and locally-oriented.

A third issue relates to the way that USOs are defined, and in particular that many of the numerical analyses take a very loose definition of what counts as a university spin-out. Pirnay et al.’s (2003) definition has four main elements, requiring a new company (autonomous from the university) to be created from a university (not government research laboratory or technical school), exploiting academic knowledge (tacit/codified) and for profit. However, analyses which trace the economic benefits of spin-offs often take much looser definitions, encompassing graduate students, and in some rare cases, recent graduates (within five years). Massachusetts Colleges (2003) for example, define a connection to a state university as a firm “engaged in the commercialisation of technology first developed at one of the universities, they were founded by a faculty member or graduate, started life in a university incubator or had a CEO who had graduated from one of the eight [MA universities]” (p. 4). If the definition is drawn that widely, then USOs form a significant part of the economy.
Consequently, it is hard to see how a small scale policy activity can rectify the deep-seated economic problems which are faced by peripheral industrial regions.

The picture emerging here is that studying USOs themselves is not particularly useful for understanding they can make to regional economies particularly in less successful regions. Certainly explaining the success of these regions requires placing more weight on the “mysterious potency … of the entrepreneur” than the material benefits (jobs, multiplier effects, output) that USOs bring (Armstrong, 2001, p. 534). A university’s material contribution to its regional economy is likely to be much more significant (thousands of jobs; hundreds of millions euro budget; student, staff and procurement spend) than that of USOs. An analysis of Edinburgh University’s commercialisation office found, for example, that the direct impact of the university through employing 4,500 staff and spending one-third of its budget locally was much greater than the direct benefit of the USOs it created (Charles & Benneworth, 1999b). Might not it make more sense for universities to license their technology to generate revenue which they spend directly to increase this material contribution, rather than devote resources to new firm formation?

**USOs as nodes in regional innovation systems**

Perhaps the stylised facts overdraw the boundaries between firm-based and regional advantages – Etzkowitz argues that the entrepreneurs infuse the economy with a greater dynamism, suggesting a need to focus on the broader regional dimension. Di Gregario & Shane (2002) point explicitly to the idea that USOs embody technological spill-overs, which are intrinsically value-added phenomenon from economic perspectives. However, how can we make more systematic sense of this broader regional dimension given the “facts” 4 to 6? Perhaps a better explanation of van der Sijde et al. (2002) is given in Groen & Jenniskens (2003), that there has been an improvement in the regional environment stimulated by the USOs. They note that although the numbers in the programmes around Twente may be small, they create much larger networks in which individuals and firms not directly associated with the university can participate. In Twente, an old textile and agricultural region, these networks do not already exist in any form, and by participating in these networks, the USOs improve the overall environment. USOs can be regarded as one of the eponymous “many visible hands creating heterogeneous entrepreneurial networks”.

However, the stylised facts about regional benefits are not themselves either simple or unproblematic, because just as USOs vary widely in what they achieve, they also vary widely in terms of the regional development impacts they have. Pirnay et al. (2003) characterise four types of spin-off firm, high-technology/ high-growth, local consultancy, a new technology business and a student service company. Each of these types of firm clearly has very different regional impacts not just as a firm, but through the interaction with the regional innovation system.

The second issue is that universities themselves try different types of technology transfer policy, and these encourage firms with very different regional spill-over effects. Clarysse et al. characterise three types of spin-off promotion activity undertaken by universities, which they term low-selective, the supportive and the incubator approaches. Each of these focus on promoting very different types of firms, draw on the existing regional environments in different ways, and consequently have very different regional impacts. “The supportive model relies very heavily on the regional dynamic to function effectively” (Clarysse et al., 2004, p. 30). As they explain earlier, “The interface service needs to have sufficient contacts with local experts, business entrepreneurs and specialised consultants in order to support the research team during the spin-out process” (p. 26). Even in those cases where universities explicitly hinder spin-out activity, firms can still emerge, as in the case of Johns Hopkins in the USA (Feldman & Desrocher, 2003).

The contribution of spin-outs to a regional economy: upgrading the local environment

There are clearly a set of issues around spin-off firms which suggest that it is problematic to assume that USOs automatically bring the benefits to their regional economies which have been seen in more successful economies. This is not to say that USOs might not improve the economies of less successful regions, under certain circumstances. The question is, are those conditions too restrictive for USOs in practise to materially improve the conditions of their host territory.

The benefits which USOs bring directly to peripheral regions are fairly limited, and it does seem unlikely that sufficient evidence could be found that a single USO or group of firms could be said to have upgraded a particular regional economy except in very exceptional cases such as Hewlett Packard or some of the Massachusetts Institute of Technology spin-offs. This is not helpful, because it brings us back once more to the
problem that the model only seems applicable in exceptional regions. What we propose is that we focus instead on looking at how the actions of the USOs help to contribute to upgrading the territorial innovation environment. Therefore, in the remainder of this paper, we will focus on these broader territorial benefits that USOs bring, and explore different theoretical perspectives which can be used to explore these benefits. This provides the basis for a model which we suggest can be used to explore how particular cases of USOs are benefiting less successful regions.

Our argument is that the key to the link between the entrepreneurs and the regional development benefits lies in looking at the ways in which the university/USO relationship can create territorial benefits on which others can draw. Our heuristic is that in working together, universities and USOs create some kind of asset on which other firms can draw which makes those other firms more successful. Because our interest is in less successful regions, the natural way to consider these ‘assets’ is as the types of resources which are typically missing from these regions, such as finance, technology, and managerial skills. Our model for the territorialisation of these assets is that the asset becomes territorialised when the relationship can be drawn on by a third party in a way that improves their own economic performance. This general process is outlined below in figure 1.

Infusing and reconfiguring territorial knowledge pools

Figure 1 above is useful in that it is clear in what is the process is by which the USOs assist the regional economy. However, from the preceding discussion, it is clear that there are a range of different things which could potentially be covered in the definition of the territorial resources on which third parties draw. These might range in scale from universities establishing incubator units for ‘their’ USOs which become more general ‘hatcheries’ for local businesses which might cost millions of euros, to involving past alumni in the teaching in graduate entrepreneurship programmes, which might be done pro bono. We suggest that there are three literatures covering the micro-dynamics of learning communities which might help us to open up the black box of precisely what is meant by a ‘territorial knowledge pool’. To do this, we consider three literatures, communities of practice, improving the local business support environment and clustering between university spin-offs and other firms.
University commercialisation activity as a ‘community of practise’

One way of looking at the impact that USOs have on their regional environment is as the spin-off process involving the creation of a community of practise (Wenger, 1998) within the university in which the university becomes more open as an organisation. The idea of a community of practise was developed by Wenger to explain situations in which groups appeared to spontaneously self organise a cultural infrastructure to deal with the uncertainties and ambiguities in their own environments. Wenger’s own analysis included an example of an insurance claims processing office with a relatively high staff turnover, and the analysis focused on how workers built an understanding of the particular problems dealing with ambiguities in the claims process and encultured new recruits into accepted practises, norms and shared identity (Brenner, 2003).

Wenger’s idea has been since extended in a variety of different directions, particularly expanding the work-place to the more general level of regional, sectoral or multi-site communities, what Duguid and Brown (2000) refer to as a network of practise. The focus on the single organisation community does seem well positioned to generate insights into understanding the learning processes at work within the boundaries of particular universities. Just as the claims processors had to transform data written by a range of individuals into a common format acceptable to the payment firms, technology transfer officers within universities can be regarded as transforming knowledge between that produced to a set of academic norms so that it can be applied in ways that firms find useful.

This seems to raise the possibility that these commercialisation activities within a particular institution may be understood as a community of practise, which builds up to provide universities with the capacity to deal with outside agents. Following this line of thought, this raises the question of what function does the university spin-off play in this process. Clearly, if we focus on the community within the university, there are only a very few links back to USOs, such as institutional directors. There are a series of questions around what roles USOs play in the community within the university. There seem to be a number of interactions which university commercialisation staff have with USOs (Jones-Evans, 198; Rappert et al., 1999; Benneworth, 2001):-
Resources: the USO may provide dividends, royalties, equity sales or research funding to the university which encourage further spin-out work,

Prestige: universities can prove their commitment to regional engagement, individuals hold directorships, USOs are common targets for external funders.

Experience: individuals in the university learn about the process of spinning-off a firm which they can apply into other situations,

Partner: the USO can be consulted or otherwise involved in the institutional development of the university, through equity committees, Senate and personal networks, and

Shaping the ILO: although USOs are peripheral within ILOs at the start and end of the process, they may move to become central players for a time, and so shape the culture and routines of the ILO itself.

The final element of this is that the above elements need to cohere in a way that makes ‘spinning off companies something that we do’ within the university. A negative experience or institutional antipathy might actually prevent the emergence of a community, despite the drivers of money, prestige and partnership already being present (Feldman & Desrocher, 2003). There are also a range of cultural and contextual features specific to each institution and each regional/national setting which influence this process; Geisecke (2000) for example, points out that biotech entrepreneurship in Germany and the US has followed very different trajectories over which local institutional arrangements have had only a limited influence.

This approach raises some interesting questions about what are the key determinants on opening up a university to be a better partner for other key local actors, and what makes universities good at spinning off new firms. Although increasing the numbers of spin-offs is generally beneficial to less successful regions, it is not necessarily transformative, because of the small scale of the spin-offs and the significant size of the regional economic problem. It also raises the question of whether spinning off firms is all that the industrial liaison function within universities does. It could be that a well functioning technology transfer community within a university can create regional advantages in other ways, which deepen and strengthen the local innovation and entrepreneurial environments.
Improving the local innovation support environment

There is a consensus that universities are important players in regional innovation systems. Although theoretical developments have been successful in identifying what constitutes successful regional innovation systems and university contributions, where theoretical development has been weak is around the processes by which these successes are created (Benner, 2003). One mechanism by which universities commercialisation functions could strengthen the regional economy beyond spinning off firms is in encouraging other innovation support activities to improve the quality of the innovation support they provide for other local firms.

USOs play a role in this process, because they participate in the building of the community of practise, as identified above. There are other potential mechanisms besides the community of practise by which universities’ experience with USOs can encourage others to support their efforts to spin-off firms. If universities pull together their own networks of managerial, financial and technical expertise to support ‘their’ firms, then these networks are clearly assets on which could draw. Writing about one particular programme in Scotland, Collinson & Gregson note that organising entrepreneurship networking events can “significantly increase interactions between the relevant constituencies responsible for new business development” (p. 204).

There are a range of similar activities which create these kinds of shared infrastructures on which others can draw. The role of USOs in these cases is in providing initial customers to provide the university the experience in working with firms, and to adapt best practise ideas to local conditions:

- University-based infrastructure: such as incubator units or science parks.
- Spin-off mentoring projects: such as Collinson & Gregson’s Connect Scotland example, and
- USOs’ own experiences as points of reference for other firms and advisors.

However, there is an additional element to this process, and that is that universities may themselves use their experience in working with their spin-offs to encourage business support organisations to be better at working with USOs. At its most basic level, this might be in stimulating enterprise agencies to be better at working with embryonic high technology small firms. However, there is larger task in ensuring
that local support organisations themselves evolve to promote the kinds of opportunities emerging from universities. USOs can be a useful tool in helping other agencies grasp the task they face. Regardless of their absolute economic value, policy-makers are generally very supportive of USO activity. USOs can therefore have a symbolic power in the debates in particular places about business support activity (cf. Benneworth, 2002).

However, although USOs might have the potential to exert symbolic influence, USOs tend to be very small organisations, and their managers understandably preoccupied with core issues of company survival, continuing R&D and growth of shareholder value. How can USOs be expected to engage with very localised and very administration-focused debates around business support provision? One way is in universities enrolling USOs when the universities debate with government and development agencies about what is appropriate for meeting the needs of new and emerging high technology firms.

Within this, there is of course a broader question about whether these institutional changes do add up to a regional transformation, particularly when particular regional systems are so complex and idiosyncratic that it is hard to judge whether a change is ‘transformational’ or not. Is it possible to identify developments which are unambiguously improvements? This is something clearly demanding further theoretical reflection (Benner, 2003), but we would highlight two possible areas where answers may to be found. Bellini (2002) uses the idea of real services in the Italian sense of external professional services which provide the critical factors for growth. North et al. (2001) focus on which kinds of services substitute for resources that SMEs are typically lacking, and which can encourage SMEs to innovate incrementally rather than rationally, which undercuts growth potential.

Direct USO links to the regional innovation system

USOs need not be restricted to a symbolic influence on regional innovation environments. As USOs are knowledge actors, they can clearly contribute to that environment in their own right. Just as universities can enrol some of the symbolic value of USOs in making their arguments, so USOs can enrol some of the benefits and expertises in universities and transmit them to other firms. It is accepted that large and successful innovating firms can configure their local innovation systems,
which Lundvall refers (1998) to as the local style of innovation. In the weakly innovative environments with which we are concerned, this suggests that possibly USOs can draw on or enrol university strengths to condition that environment.

USOs may build networks, which draw to some extent on linkages previously mediated by the university, and other firms may benefit by coming into contact with them. In this way, we are not looking to some hyperbolic reading of entrepreneurial flair and dynamism, rather, we are considering the networks which USOs themselves build which can augment and even extend the technological and technical capacities within universities. Dahlstrand (1999) argues that spin-offs directly “encourages the development of inter-organisational linkages and personal networks through which new technologies and knowledges can be shared and created” (p. 381). It is possible to envisage a number of activities by which USOs build these kinds of networks:

- R&D Partnerships: encouraging other local firms to extend or sustain their technical and technological bases.
- Demanding clients: encouraging their local suppliers to be more innovative, and to adopt innovative practices and technologies.
- Consultants: many spin-offs are consultancy activities, and this may help (after Wood, 2002) particular domain expertises to build up.
- Drivers of new organisations: spin-outs may try to replicate some of the benefits they enjoyed in universities by creating new network organisations (Klein Woolthuis, 1999)
- Shared assets: common labour markets, peer mentoring, knowledge-spill-overs, clustering etc.
- New spin-offs: USOs can themselves lead to second generation spin-offs which may also be well-connected high technology small firms (Benneworth, 2004).

One observation is that although there is some diversity in these kinds of activities, there is a clear link between the university’s own attitude to spin-offs and the kinds of regional benefits that the spin-offs bring (cf. Dahlstrand, 1999). Universities hostile to spin-outs may require entrepreneurs to be so motivated that once spun-out, they become serial entrepreneurs and generate many new spin-offs (Mason & Harrison,
Conversely, if the university promotes many graduate spin-offs, then this will encourage consultancy, mentoring and networking. If the university incubates a few high technology high growth firms, then R&D partnerships and demanding clients may potentially be promoted.

This raises an interesting question concerning the value of USOs and their relationship to universities’ policies, because different types of policy influence (after Clarysse et al., 2004) not only the number and type of the USOs, but also the impact they have on the regional environment following spin-off. We have tentatively sketched out how different policies might lead to different territorial outcomes, but given our interest in this paper in low innovation environments, there is a further question relating to how different types of USO relate to the existing infrastructure; a supplementary question exists over the evolution of the environment, whether USOs in different contexts can build up a significant local supply chain in ways which leaves an imprint on the regional industrial structure.

Towards a model of upgrading regional economies

Returning to the heuristic model outlined in figure 1 above, the different literatures used above are each of value in understanding elements of the relationships between universities and USOs. The review of the three bodies of literature undertaken above suggests that there are a number of key questions which can be used to explore whether a set of USOs in a particular place are contributing positively to the economic development of the host region. The key question which such a study would address would be “Do a set of changes within a region add up to a regional transformation?” Although this paper has no way of determining whether a particular set of changes is strategically significant enough to be classed as a transformation in the language of Venkataraman, the discussion at least sharpens some of the issues about whether USOs are contributing positively to their regional economy. From the review above, some of these key issues can be highlighted:-

- What are the key determinants which have constrained opening up the university to external actors?
- Is spinning-off firms is all that the industrial liaison function within that university does, or do they have a broader functional university role?
• Are USOs being used as sources of symbolic power in regional debates about business support?

• What is the relationship between the business support infrastructure and the spin-offs which are emerging? and

• Are USOs in the particular regional contexts build up their own significant local supply chain in ways which leaves an imprint on the regional industrial structure?

In figure 2, we highlight a revised version of the model we offered in figure 1, to highlight where we might explore these key questions raised above. The review seems quite clear that the regional benefit need not be produced simply by interactions between the university and its’ spin-off. It is important to stress that the regional knowledge pool remains an important part of the contribution that USOs bring, through the various elements of relationships between universities and their spin-outs. However, a revised version of the model is shown in figure 2 below, the key point being that there are other actors and other relationships contributing to this positive relationship. In figure 2, we highlight three important relationships which have to be explored in order to make sense of the regional impact of USOs in terms of creating territorial learning and knowledge assets. These relationships are not reducible to a single literature, and so to conclude the paper, in this final section, we reflect on how we might begin to understand the key turning points and determinants of the three main relationships we identify in figure 2.

The first relationship (1) is entirely internal within the university, and that is the formation of the commercialisation activity within the university. Although we have noted that the communities of practise literature is useful for exploring this process, the decisions that the university takes are important in shaping the kinds of USOs which form, and their subsequent interaction with other firms. This internal process is therefore interdependent — and to some extent determining — on the eventual territorial impact. The key dimensions of this are the mechanisms and the selectivity in creating USOs, the relationship of the firms to the universities’ leading technological strengths and the way that USOs’ successes or failures condition the strategic importance of USOs to the university.
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 which promote regional development (North et al., 2001). However, when universities start producing USOs (and those USOs are the result of university strategies) then this builds two types of interdependency with business support communities. The first is that USOs may need business support whilst within the university itself, and to maximise its’ equity growth, the university may choose to try to encourage BSOs to configure their activities in ways which benefit their fledgling companies. Secondly, the future business support needs of the territories become interdependent on the types of companies the universities are producing. Consequently, it seems intuitive that business support organisations and development agencies would enrol the universities strategically to help them shape the business support infrastructure.

The third relationship (3) is between USOs and other businesses, not directly mediated through universities. Part of this activity might be thought of as clustering, working collaboratively to solve innovation projects, and more generally from benefiting from proximity. However, 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, and equally, deeper webs of relationships between USOs, their spin-offs and other firms may improve the innovation environment in those places.
Bibliography


Figure 1 Heuristic model of how university/business interaction creates a more generalisable territorial advantage
**Figure 2  A mapping of the literature onto the heuristic UBI model**