



Revisiting the innovation and economic development engines of universities: building strategic multi-focus knowledge hubs

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Universities face significant pressures to play a more active role in tackling major national and global societal challenges, addressing technological and innovation challenges in industry, and helping to stimulate an innovation-led, export-driven economic recovery. At the same time, they face growing calls to become engines of regional innovation and economic growth, strongly anchored in place and responsive to regional needs¹.

Responding to these and other pressures, universities in the UK have been developing strategic approaches to underpin their innovation and economic development (IED) missions. This has seen knowledge exchange (KE) activity increasingly being positioned as core for realising impacts from research and teaching as well as from the exploitation of the wider resources and expertise held within the institution. University missions are therefore multi-dimensional addressing multiple objectives, spanning research excellence, education and supporting innovation and economic development.

Despite the varieties of pressures on universities, it is their potential to become 'regional innovation engines' that often dominates debates on strengthening the roles of universities in the economy. This is in spite of strong evidence that KE activity stretches well beyond regional-boundaries of universities². More recently, questions are starting to be raised as to whether such a dominant regional focus for guiding the strategic development of universities is appropriate. This recognises that, just because some universities' priorities are not primarily driven by the needs of their regions, it does not mean that they will not play an important role in that region:

“ [p]aradoxically looking for universities' direct and active linkages and roles within the regional innovation system may significantly underestimate universities' local impacts and links³.”

Acknowledgements

The author would like to gratefully acknowledge Eoin O'Sullivan and Barry Moore for their contribution to the development of the ideas presented in this paper. Thanks are extended to Barry Moore in particular for his comments on this article.

¹ The term 'region' is used here to denote a sub-national spatial area which has some degree of economic coherence and over which the university sees itself having a particular influence.

² Abreu, M., Grinevich, V., Hughes, A., and Kitson, M. (2009) Knowledge Exchange between Academics and the Business, Public and Third Sectors, UK Innovation Research Centre report;

³ Power, D., Malmberg, A. (2008) "The Contribution of Universities to Innovation and Economic Development: In What Sense a Regional Problem?" Cambridge Journal of Regions, Economy and Society, vol. 1.

Hence, rather than focusing on the regionally bounded activities of universities, a more powerful, holistic question emerges: how can universities, through their activities and linkages, capture value for their region?⁴

Much is also made of the importance and value of diversity in the UK university system. However, it is not clear how universities are differentiating themselves within the sector and how this might affect their 'regional innovation engine'. Greater understanding and clarity on how diversification across the sector interacts with regional roles is critical for developing appropriately targeted and effective policies for strengthening the role of universities in innovation and economic development.

This article contributes to the debate by exploring how universities in the UK are differentially positioning their resources and strengths to contribute to innovation and economic development with different levels of sectoral, technological and geographical influence, including their regional innovation systems.

Positioning universities in the innovation system

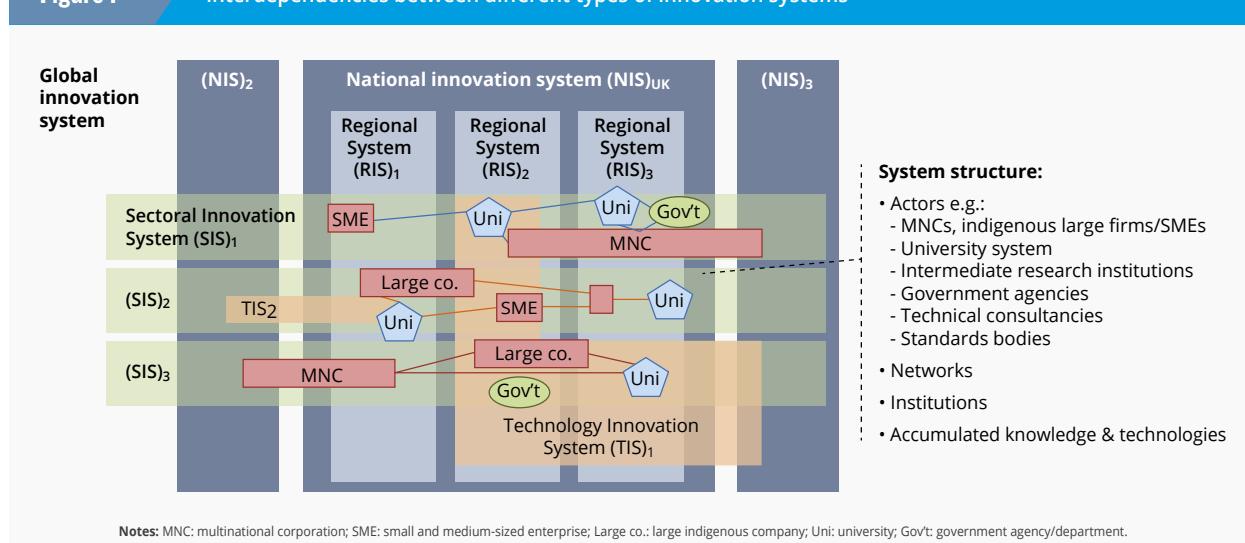
In exploring the positioning and function of universities in the innovation landscape, it is useful to recognise different types of innovation systems within which they are becoming embedded. Innovation systems are organised around particular challenges, with linkages forming between interested actors (firms, universities and other organisations) and with linkages forming between interested actors institutions (rules of the game) that govern their relationships. 'Healthy' systems should be transient and evolving, reconfiguring as the originating challenges adapt. Importantly, the nature of the challenge can vary significantly, for example:

- Industry-specific innovation challenges enabling new products and services to be introduced or significantly improved
- Major technology-driven challenges, for example developing new platform, enabling or production technologies that will underpin products with different industrial applications
- Major socio-economic challenges of national and global significance (e.g. sustainability or ageing)
- Spatially defined innovation and competitiveness challenges e.g. institutional weaknesses or a dearth of critical skills within a given region

The type of challenge will identify appropriate boundaries for the system, influencing its structure (actors, linkages and institutions), and particular strengths and weaknesses. Innovation systems formed around regionally specific challenges are thus but one type of system into which universities become embedded.

Increasing thought is being given to the inter-dependencies between different systems⁵. Firms - and universities - often operate within particular sectoral or technological systems with geographic footprints spanning multiple regions (including internationally), while simultaneously being embedded within a particular place with specific, spatially-bound institutions, capabilities and competences (Figure 1). A key implication is that the activities in one system may well have complementary or contradictory effects on other systems. It is also not clear what effect strengthening one regional system will have on other regions, both proximate and remote, not least due to feedbacks through sectoral and technological value chains, and wider spatial economic distributional effects (e.g. on relative prices, wages and capacity).

Figure 1 Interdependencies between different types of innovation systems



Source: developed in collaboration with Eoin O'Sullivan, building on Markard and Truffer (2008).

4 Bennenworth, P., Hospers, G.-J. (2007) "The New Economic Geography of Old Industrial Regions: Universities as Global - Local Pipelines." *Environment and Planning C: Government and Policy* 25.
 5 Markard, J., Truffer, B. (2008) "Technological Innovation Systems and the Multi-Level Perspective: Towards an Integrated Framework" *Research Policy* 37.
 6 Cohen, W.M., Levinthal, D.A. (1990). "Absorptive Capacity: A New Perspective on Learning and Innovation" *Administrative Science Quarterly*, vol. 35; Geiger, R.L. (2010) "University Supply and Corporate Demand for Academic Research" *The Journal of Technology Transfer*, vol. 37.

Recognising the interdependence between demand and supply

There are also important interdependencies between demand and supply conditions within a system, not least the capabilities of firms to absorb and exploit the resources, knowledge and expertise generated within universities⁶. This will condition the nature and scale of value realised by firms from their knowledge-based interactions with universities. In the regional context research has found that *“regional [innovation] systems with stronger capabilities and a progressive knowledge base will also tend to be better equipped to exploit new technological opportunities, to adapt existing activities to emerging business environments, and to learn more rapidly about how to build new capabilities and advantages”*⁷. The structure of local industry and the parts of the value chain present in the region, how these industries are transforming, the strength of demand conditions and local institutions, all shape how a university can position itself within its region⁸.

Revisiting the functions of universities in innovation systems

How universities contribute to innovation is increasingly well recognised, stretching well beyond their roles in expanding the stock of codified knowledge, translating fundamental research into inventions that can be commercialised, and their roles as educators. Through their increasingly direct linkages with universities, firms are able to develop and enhance the capabilities and competences that feed into their innovation processes (e.g. tacit and codified knowledge, know-how, practices and processes, tools and techniques), and do so at different stages of value chain, from early stage technology development to scale-up, production, logistics, marketing and sales. These linkages touch many sectors of the economy, stretching well beyond manufacturing and technology-product driven firms, to include those within the services and public sectors, and often well beyond the regional boundaries of universities⁹.

Increasing attention is also being given to the proactive and strategic initiatives and activities within universities aimed at strengthening the system-wide conditions in which innovation takes place¹⁰. Indeed, scholars argue that they are becoming knowledge hubs in the economy, seeking to *“become even more deeply embedded in innovation systems, seeking to actively foster interactions and spillovers to link research with application and commercialisation, and taking on roles of catalyzing and animating economic and social development”*¹¹. While these roles are often framed in a regional context, these ‘system development’ roles are evident in

sectoral and technological systems. Examples include: building the underpinning skills and infrastructure critical to the functioning of the system; informing system-specific strategies; working alongside key firms and stakeholders to provide system leadership; and developing standards and the wider institutional framework shaping the system’s innovation processes.

Table 1 brings these many functions together. Inevitably, different universities will specialise in different combinations of functions, drawing on their internal capabilities and competences, and their specific context. Some will provide a broad range while others will focus their strengths such as developing human capital in particular areas or providing applied research solutions to industrial challenges.

Focusing the knowledge hub: multi-focus strategic objectives

A lot of KE activity is initiated and undertaken by individual academics – or self assembling groups – forming connections with external users with little direct involvement or direction by higher levels of the university. In recent years, universities have been developing and strengthening their IED missions, strategically repositioning KE activity as core to their ability to realise impact from their research and teaching activities, and to leverage their wider set of expertise, resources and infrastructure. These strategic approaches often seek to complement and facilitate – rather than substitute – individual-level activity.

Universities’ IED missions often emerge through an iterative and interactive process between senior leadership and the academic base of their institution, and reflect a balancing between accumulated internal resources, capabilities and competencies, interests of academics, strategic ambitions of the leadership, and opportunities and constraints of the demand opportunities available to that university. There is also a significant element of path dependence, moderated by internal and external learning to identify new approaches and effective practices.

Analysing universities’ IED missions reveals three key focal points for their objectives: strengthening the internal environment for KE, expanding the interface with external users, and enabling the university to develop proactive, collective, and institution-wide responses to strategically important innovation and economic development challenges.

These latter ‘system-embedding’ objectives act to embed the university, as an institution, into particular innovation systems and can be further disaggregated

7 Iammarino, S., and McCann, P. (2013) *Multinationals and Economic Geography: Location, Technology and Innovation*, Cheltenham: Edward Elgar Publishing Ltd., p. 162.

8 Lester, R. (2005) ‘Universities, innovation, and the competitiveness of local economies. A summary Report from the Local Innovation Systems Project: Phase I’ Massachusetts Institute of Technology, Industrial Performance Center, Working Paper Series MIT-IPC-05-010; Uyarra, E. (2010) ‘Conceptualizing the Regional Roles of Universities, Implications and Contradictions’, *European Planning Studies*, vol. 18.

by the nature of the innovation challenge: regional, technological, sectoral and socio-economic. What emerges from this analysis is that universities are becoming multi-focus knowledge hubs, often seeking to become more deeply, structurally, and simultaneously embedded into multiple innovation systems. They are reflecting on what types of systems they belong to (as defined by the challenge), where within these systems they can contribute, and how (what functions) they can most effectively do so. This leads to specialisation and diversity within the university system. And as a result, the extent to which IED priorities align with their region varies substantially both between universities, and between different IED priorities even within the same university.

System embedding objectives will also guide the appropriate geographic focus for KE activity. This will depend critically on where relevant (parts of) firms and other organisations are located. Assuming universities set their strategic IED priorities based on an understanding of where they can make significant contributions, imposing a geographic boundary a priori may hinder their ability to achieve these goals.

Table 1: Diversity of functions performed by universities in the innovation system

Category	Function
Developing talent and human capital	<ul style="list-style-type: none"> • Developing skilled labour (both generic/domain specific skills) • Developing entrepreneurial/enterprise skills • Workforce development and training (generic, advanced)
Developing and deploying knowledge/ technologies for innovation & problem solving	<ul style="list-style-type: none"> • Knowledge generation through user funded research/co-produced research • Adding to the stock of codified knowledge e.g. through publications, patents, prototypes • Transferring existing knowledge/know-how e.g. through consultancy, informal linkages • Investing in and enabling access to, specialised infrastructure, instrumentation and equipment • Providing technical assistance • Commercialising new technologies through new venture creation and licensing
Strengthening system and spatial conditions for innovation	<ul style="list-style-type: none"> • Providing leadership and expertise to inform policy/system development • Strengthening local/system capabilities and capacity for entrepreneurship and innovation • Supporting internationalisation activities of firms & attracting talent, investment, resources • Developing infrastructure supporting innovation and economic growth • Providing business assistance/support • Strengthening other competitiveness conditions (e.g. regional quality of life) • Facilitating access to finance for R&D and innovation
Providing spaces for open-ended conversations and entrepreneurial experimentation	<ul style="list-style-type: none"> • Convening academics/industry researchers/innovators networks • Supporting creation of industry identity • Developing industry-responsive curricula • Bridging disconnected actors in system • Hosting and participating in standards setting forums • Providing forums for potential investors • Understanding industrial development pathways and market opportunities • Providing spaces with necessary support encouraging entrepreneurial experimentation

Source: developed from Coates Ulrichsen, 2012; Lester, 2005; Breznitz and Feldman, 2012; Gunasekara, 2006; Youtie and Shapira, 2008; Jacobsson and Vico, 2010; Uyarra (2010).

9 See e.g. Abreu, M., Grinevich, V., Hughes, A., and Kitson, M. (2009) Knowledge Exchange between Academics and the Business, Public and Third Sectors, UK Innovation Research Centre report; Hughes, A. and Kitson, M. (2014) Connecting with the Ivory Tower: Business Perspectives on Knowledge Exchange in the UK, UK Innovation Research Centre report.
10 Uyarra, E. (2010) "Conceptualizing the Regional Roles of Universities, Implications and Contradictions", European Planning Studies, vol. 18; Gunasekara (2006); Breznitz and Feldman (2012).
11 Youtie, J., Shapira, P. (2008) "Building an innovation hub: A case study of the transformation of university roles in regional technological and economic development" Research Policy vol. 37.

Capturing value for regions

How then, can universities, as they evolve into multi-focus knowledge hubs, help to capture value for their regions?

While much attention typically focuses on incentivising universities to address region-specific innovation and competitiveness challenges, one can easily overlook their roles in generating spillovers from their wider research, education and KE activities, and from their wider asset base. This includes the benefits from becoming more strongly and deeply embedded into global sectoral and technological systems and the implied effects on the location of high value activities within these global systems. The relative importance between a more direct, proactive regional mission and efforts to further locally anchor spillovers will likely depend on the spatial competitiveness of the local area and its ability to appropriate benefits from university activities, as well as on the university's own role.

It is also important not to underestimate the university's role as, often, one of the largest employers of highly skilled individuals in the local economy, as major purchaser of goods and services, and as owner of large amounts of local real estate. These roles can have large direct and indirect effects on their localities. However, what makes universities distinct from other large local employers such as hospitals, are their unique roles as a critical, knowledge-generating component of the regional innovation engine.

Anchoring spillovers locally

University-based activities are known to have important spillover effects on regional economies¹². For example:

- Spin-off and start up companies emerging out of universities locating nearby, creating and supporting local jobs and attracting investment to the area
- Education activities having a very real effect on the availability of skilled labour in the local economy
- Supporting the emergence and evolution of local knowledge-intensive and high technology clusters
- Attracting revenues to the area through academics' knowledge exchange activities
- Playing very real and important civic and community roles in their localities
- Generating powerful (global) reputational effects for the region, particularly where it has a widely recognised reputation for excellence in areas of research, education and KE

There is strong evidence that universities play an important role in attracting R&D-related investments to the area¹³. The excellence of the science base, the availability of expertise, and the ability of universities to work with industry are all important factors in R&D location decisions¹⁴. Geographic proximity can make it easier for firms to keep up-to-date with scientific advances; facilitate the formation of personal connections and exchanges; and ease the flow of tacit and embodied knowledge¹⁵. Therefore becoming a national or global centre of excellence in a particular domain of strategic importance may generate powerful forces for attracting high value investments, talent and innovation-related activity to the area.

The analysis of universities' IED missions reveals that even those whose primary system-embedding objectives are driven by sectoral, technological or socio-economic objectives, with little regional alignment, often simultaneously reflect on how they might further anchor benefits arising from these activities locally.

Aligning to regional priorities

The extent to which universities actively align their IED missions to sectoral priorities within regions is revealed in **Figure 2** which explores the factors shaping the sectoral focus of KE activity. Approximately half of universities in the UK took some steps to proactively align their sectoral focus with priorities in regional economic strategies. While this was more frequent for less research intensive, broad discipline universities (68%), 42% of higher research intensive universities also did so. In addition, for 70% of these latter institutions, important business clusters in their region also influenced the sectoral focus of activity (compared with 84% for less research intensive universities), reinforcing the linkages and co-evolution between universities and their local industrial clusters. Demand opportunities and an understanding of where they could contribute most effectively were also important factors in shaping the patterns of sectoral activity in most non-specialist universities (regardless of research intensity).

Different places are also known to have quite different levels of spatial competitiveness for enabling innovative activity and attracting and retaining scarce resources such as R&D investment, labour and capital. Segmenting the above data into universities located in the greater south east – frequently recognised as the most competitive region of the UK – and the rest of the UK, reveals that the sectoral focus of universities is shaped by regional strategies in just 34% of cases in the greater south east, compared with 64% elsewhere. However, regardless of active regional alignment, many universities – both research intensive and those less so – see local business

12 See e.g. Jaffe, A.B. (1989) "Real Effects of Academic Research", *The American Economic Review*, vol. 79; Anselin et al. (2000).

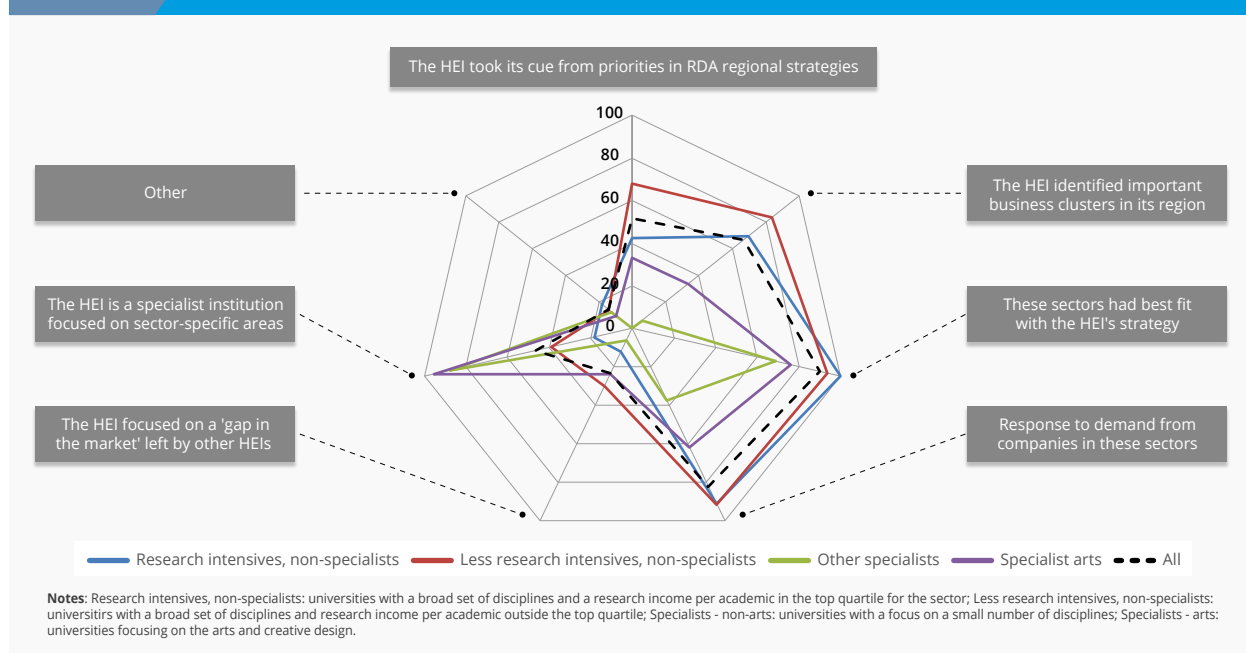
13 Jaffe, A.B. (1989) "Real Effects of Academic Research", *The American Economic Review*, vol. 79; Abramovsky, L., Harrison, R., Simpson, H. (2007), "University Research, and the Location of Business R&D", *The Economic Journal*, vol. 117; Varga (2002).

clusters as important for shaping their sectoral focus (63% in the greater south east and 70% for the rest of the UK).

Given that universities often have a strong sense of local civic responsibility¹⁶, it is unsurprising to find a more proactive regionally-aligned IED mission in areas with relatively weaker spatial competitiveness. Universities

can help to raise the capacity of that region to more fully appropriate the benefits from the activities of its universities. However, it might not always be the case that universities should take the lead on strengthening regional spatial competitiveness, if other organisations (e.g. Local Enterprise Partnerships) are more appropriately placed and have sufficient capabilities to do so.

Figure 2 Drivers of the sectoral focus of UK universities, 2012/13



Source: HEBCI survey 2012/13, HESA.

Conclusions

Many UK universities are looking to become increasingly strategic, multi-focus knowledge hubs, more deeply embedded within different innovation systems addressing different combinations of technological, sectoral, socio-economic and spatial challenges. With the exception of spatial challenges, the geography of interactions for other types of strategic challenge will depend critically on the geographic footprint of its associated system. While not all universities adopt region-oriented IED missions, they nevertheless remain strongly embedded in their local economies, actively reflecting on how they can further locally anchor benefits arising from their activities and linkages.

The functions of universities in the innovation system are many and varied, contributing both directly to the innovation processes of firms, as well as to the strengthening of the wider system conditions in which innovation takes place. Importantly, universities' differential sets of internal capabilities and competences, combined with where (types and parts of challenges) and how (functions) they seek to

contribute, result in a diverse set of knowledge hubs operating around the country.

In configuring a university's 'innovation engine' to capture value for the region, recognition needs to be given to the appropriate balance across:

- the need for proactive strategies targeted at strengthening regional competitiveness;
- the spatially-bound capabilities and competences for innovation;
- the ability to become embedded as centres of excellence in sectoral or technological systems working to attract high value activities to the region;
- the potential for further anchoring local spillovers from wider activities and resources.

Inevitably, given the diversity of universities in the UK and their very different spatial contexts, the appropriate weights attached to these different components of the engine will vary, and result in a diverse system that can address regional as well as global, sectoral and technological challenges.

14 Thursby, J. Thursby, M. (2006) Here or There? A Survey of Factors in Multinational R&D Location, Report to the Government-University-Industry Research Roundtable, National Academies Press;
 15 Boutellier, R., Gassmann, O., von Zedwitz, M. (2008) Managing Global Innovation: Uncovering the Secrets of Future Competitiveness, 3rd edition, Berlin; New York: Springer.
 16 Summarised in D'Este, P., Iammarino, S. (2010) "The Spatial Profile of University-Business Research Partnerships" Papers in Regional Science, vol. 89.
 17 Uyarra, E. (2010) "Conceptualizing the Regional Roles of Universities, Implications and Contradictions", European Planning Studies, vol. 18.