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Guest editorial

Science and the city: comparative perspectives on the urbanity of science and technology parks

Introduction

The new economic spaces represented by science and technology parks have, for differing reasons, become central to a range of interests in society. They have grown to prominence alongside issues of university–industry links in policy formation regarding regional and local economic development by central and local governments. They are an important part of political discourses projecting the dynamism of national, regional, and local economies, and they are not without substance to the business sector. In short, something of a policy orthodoxy appears to have developed around this interrelated set of ideas (Perry and May, 2010).

The International Association of Science Parks (IASP) has defined a science park as:

> "an organization managed by specialized professionals, whose main aim is to increase the wealth of its community by promoting the culture of innovation and the competitiveness of its associated businesses and knowledge-based institutions. To enable these goals to be met, a Science Park stimulates and manages the flow of knowledge and technology amongst universities, R&D institutions, companies and markets; it facilitates the creation and growth of innovation-based companies through incubation and spin-off processes; and provides other value-added services together with high quality space and facilities."[(1)]

It is a definition for which in many ways we hold an ideal type in our imagination—a sort of composite definition derived from a retrospective look at the most conspicuous success stories internationally. The likes of Stanford Research Park have typically taken a long time to bear fruit (Link and Scott, 2003), while their success can hardly be separated from their wider urban economic environment. As a consequence, of course, this science park ideal is rarely met in practice, as developments have emerged in varied forms across highly diverse national and global–regional contexts—international technological and developmental flows combine with national and regional political projects to produce heterogeneity in the physical expression of science spaces.

Alongside a host of closely related and physically rather similar sets of industry, office and technology parks, and corporate campuses, science parks have emerged often quite stealthily as part of a new (sub)urbanity whose contours and full implications in terms of land-use and energy consumption (or sustainability for short) have only just begun to impress themselves on our consciousness. Science spaces in the form of science and technology parks and corporate R&D campuses have been an important and growing part of the suburban matrix but have also had their own generative effects on suburban ideology, politics, and economics. Indeed, American capitalism's suburban fix (Harvey, 1985) has its own contradictions. Some of those emerging contradictions mean that the suburban built environment format has itself now become a barrier to accumulation. For example, there are question marks over the continued use of the many corporate head office and R&D campuses thrown up at the height of 20th-century American monopoly capitalism (Mozingo, 2011).

Moreover, the ideal–typical definition alluded to above clearly underplays the wider political, symbolic, and physical impacts that are associated with major science spaces, and perhaps reflects something of a tendency in professional circles to focus on either the

[(1)] http://www.iasp.ws/en

networks of interfirm and institutional linkages that characterise specific science spaces, on the one hand, or the practice of real-estate development, on the other. It is hardly surprising, then, that much of the academic and policy research effort on the subject of research, science, and technology parks has focused on the efficacy of individual spaces in contributing to local economic development, including questions of their specific contributions to business performance (Westhead and Storey, 1994). This theme issue examines the physical, economic, political, and symbolic relationship of the new economic spaces represented by science and technology parks to the urban systems of which they are some of the newest constituent elements.

Science and the city: urban, rural, suburban and postsuburban?

In the United States, from their inception, science, technology, and office parks and corporate campuses represented an acceptable political compromise within the extensive suburbs, growing in a contiguous manner around major cities of the United States (Mozingo, 2011; O'Mara, 2005).

> "The process of high tech growth was actually a process of city building. The suburbanization of science in the late twentieth century helped to urbanize American suburbs making these places closer to the classic definitions of cities in terms of their economic diversity and self-sufficiency. No longer adjuncts to the central cities around which they grew up, the high tech suburbs of the early twenty-first century are a new and influential kind of urbanism" (O'Mara, 2005, page 4).

While there were important cold war imperatives and federal government expenditures which drove the suburbanisation of these sorts of contained developments as high-amenity, high-technology employment enclaves, science parks were also significant sources of employment and local revenue that suburban residents could accept as suburban ideology gave way to distinctly postsuburban politics and planning in communities (Teaford, 1997). Indeed, as this 'new and influential kind of urbanism' has been fashioned, it has, in turn, blurred the sense of whether science and research activity in the United States is now suburban or urban—even if it is distinctly metropolitan, as Clark (2014) indicates in her piece in this issue.

In France grander state urban and regional planning projects sought to redistribute economic activity, with scientific activity often at the heart of such endeavours. Sophia Antipolis remains as perhaps the most conspicuous attempt to fashion a new settlement space—a retreat—thought suitable for fostering major contributions to industrial research and science. Yet, in France many of the new sites of scientific endeavour that were generated through national programmes were certainly not urban. Instead,

> "technopolis was far more a suburban, or perhaps post-suburban utopia rather than an urban one. It was a specialized, idyllic site in the constellation of specialized sites that often surrounded large cities in the late twentieth century" (Wakeham, 2003, page 266).

Here, then, the pattern that emerged was rather like that in the United States, producing a similar pattern of specialised trading places (Bogart, 2006) and indeed urban, suburban, and postsuburban economic and political trajectories (Phelps and Wood, 2011).

In the United Kingdom a similar military logic of dispersal of research and development laboratories and defence as undertaken in the United States was part and parcel of a more scattered noncontiguous urban sprawl (Clawson and Hall, 1973) to essentially rural settings of villages and market towns of the 'western sunrise' of the South East of England (Hall et al, 1987). In some instances these parks have grown almost by accident and stealthily in a sea of scattered rural settlements. In doing so they have generated direct and indirect high-technology employment but also unique challenges for land-use and spatial planning and local economic development strategy aimed at supporting continued development of these industries, as is the case in 'Science Vale', South Oxfordshire (Valler et al, 2012).

The Science Vale exists as a soft planning space around which the local government and scientific community and the private sector have mobilised in order to plan for growth. As detailed by Valler et al (2014) in this issue, it remains to be seen whether this soft planning space will harden into a space which will call forth new dedicated institutions to underpin future growth as in Silicon Valley. This case might be thought of as presenting an intriguing set of essentially 'rural contradictions' to contrast to the urban contradictions of a place like Silicon Valley (Saxenien, 1983).

Emerging powerfully from the West has been an international model (Forsyth and Crew, 2010), although one irony is that this model has often found its clearest expression in the developmental states (Wade, 1990) of East Asia (such as Korea and Japan) where it surely has informed the planning of science and technology parks as new urban spaces or self-contained science cities from the start [as discussed in papers by Kim et al (2014) and Forsyth (2014) in this issue]. In fact, as Forsyth (2014) elaborates in this issue, science spaces can be seen to have taken on a variety of forms in urban morphological terms, including their being present in existing urban cores, suburban campuses, and clusters and corridors of a broader urban scale.

In other nations where elements of developmentalism have been or are apparent (such as China and India), they appear to have grown organically as part of, or extensions to, booming extended city-regions. In both cases it is unclear how they relate to the wider city-region economy. Kim et al (2014) discuss how Daedeok Innopolis in South Korea, for example, appears to be largely an island of particular economic activity separate from the remainder of the city-region of Daejeon. Indeed, they chart the long history of conflict and gradual rapprochement between the Daejeon city and Innopolis authorities over the planned development of this particular science space. In the case of Optics Valley Wuhan, China, its status as one of just three national model self-innovation zones obscures what in reality is a geographically diffuse series of small science parks and incubation centres which also house a diversity of industries yet to make it onto the international scene and which are overshadowed by traditional manufacturing sectors, as Miao and Hall (2014) discuss in this issue.

All of this raises a whole series of questions about the economic basis of science and technology parks and their relationship to the larger urban agglomerations in which they are located or the city-systems with which they have relations. The record of science and technology parks representing viable industry clusters in and of themselves is mixed and, at the very least, hard to judge. The role of science parks in stimulating innovation as opposed to opportunities for firm formation and growth may be overstated—as discussed by Benneworth and Ratinho (2014) in this issue—when compared with the relocations that they commonly seem to have promoted. Moreover, that record is one that is (a) hard to evaluate given the typically long time horizon over which the record of individual parks probably needs to be judged and (b) the difficulty of isolating the effects of any given science park development from its wider urban economic environment. The record of even the most successful of science parks internationally can look very different depending on what point in time or point in the urban economic system one looks from.

Many science and technology parks have too diverse a collection of companies, industries, and corporate functions to be considered specialised industry clusters in the Marshallian sense. Others may embody industry clusters that are *too* functionally specialised. One criticism is that, conceived under a linear model of innovation, they can remain specialised islands of scientific labour isolated from the rest of the economy (Massey et al, 1992). In yet other instances, they can be home to clusters of suppliers dependent on a single lead company which can be mobile in their entirety—vulnerable to being reassembled elsewhere.

Few, it would seem, benefit from that rare and happy confluence of Marshallian and Jacobs's externalities (Phelps, 2004), the 'related variety' (Frenken et al, 2007), or economies of scope (Parr, 2002) of several interrelated industry clusters that might be said to characterise the most consistently successful and largest urban economies. The Hsinchu model of Taiwan is one of the few to experience such synergies, while the 'Stanford model' is also one that has been rather difficult to reproduce (see O'Mara, 2005).

Instead, then, Castells and Hall (1994) draw attention to the limited role that such 'technopoles' play in innovative activity when compared with the world's largest metropolitan centres. As they suggest:

> "it remains true that over the years and decades most of the world's actual high-technology production and innovation still comes from areas that are not usually heralded as innovative mileux, and indeed have few of their physical features: the great metropolitan areas of the industrialized world" (page 11).

And so the evidence regarding the contribution of purposely built campus-garden-suburb-style science park developments and indeed individual research laboratory buildings designed explicitly to promote scientific interactions (Knowles and Leslie, 2001) and economic performance is ambiguous. Nevertheless, the often rather drab modernity produced for such office parks and the corporate suburbanisation of science was also predicated on relatively autonomous subjects (Kaiser, 2004; Rankin, 2010). Despite the recent reassertion of the primacy of the city proper to economic growth, and despite some suggestion of the city itself once again becoming the laboratory or campus (Haar, 2011) for scientific and university-related developments, the fact that so much of the 'preconditions for innovation'—an activity that has itself become big business (Harvey, 1985)—are by now suburban is a significant ingredient in patterns and processes of innovation in the suburban economy (Phelps, 2012).

Science parks have diverse and ambiguous positions in relation to regional and national economic policy agendas. That is, they have, we might say, a diplomatic or international relations role within the international 'technoscapes' of modernity (Apppadurai, 1996). The presence of major international associations such as the IASP and the World Technopoles Association ensures that such technoscapes centred on the likes of science and technology parks are indeed global.[(2)]

In France (eg, Wakeham, 2003), Japan (eg, Fujita, 1988), China, and South Korea (eg, Kim et al, 2014; Miao and Hall, 2014) science parks are clearly integrated into significant national policy agendas for promoting both national economic competitiveness and internal redistribution of economic activity. With regard to 'science diplomacy', for example, an appreciation of the role of international scientific endeavours in postwar United States foreign policy has underpinned recent examination of China's use of such influence through the deployment of its own science park models abroad. As Hvistendahl (2007) documents, China has funded foreign investments in Russia, Singapore, the United Kingdom, and the US, as well as initiatives involving 'South–South' cooperation with developing countries in Africa, Latin America, and Asia. Such initiatives, led by the Ministry of Science and Technology, exert critical 'soft power' (The Royal Society, 2010) by emphasising the economic and cultural strengths of China on a global stage.

In the United Kingdom the role of particular science parks such as at Cambridge has been integrated into a national discourse of competitiveness and industry clustering after the event. In the United States, while the strength of domestic scientific research has underpinned the projection of United States political and economic interests overseas, the localism apparent within a federal system of government has also ensured that this power has, nevertheless, been projected from a patchwork approach to scientific research funding and governance,

[(2)] See http://www.iasp.ws/en and http://www.wtanet.org

as discussed by Clark (2014) in this issue. Elsewhere, strong national agendas are perhaps less clearly economic and instead inflected with ethnic and cultural politics, as is the case in Malaysia (Bunnell, 2004; Lepawsky, 2009). Here, as Phelps and Dawood (2014) in this issue describe, despite a tradition of national industrial planning, the development of technology parks and incubators has been rather uncoordinated, with the water muddied by states promoting their own technology parks. Technology parks have failed to develop into fully fledged science parks as defined earlier. While seeking to project Malaysia's modernity outward, a national project such as Kulim High Technology Park has failed as an accommodation to internal ethic and political demands to fashion innovative activity away from the capital city-region.

This issue

With the exception of Clark's paper, the others in this theme issue were originally presented at a specially convened one-day seminar bringing together a number of scholars actively researching the role of science and technology policy and urban and regional development at the Science Technology and Economic Policy Institute (STEPI) of South Korea in Seoul on 6 October 2011. Inevitably, there are therefore limits to the national and continental coverage of the papers contained in this theme issue. Nevertheless, the papers collected together here do cover examples from North America, Europe, and East Asia and—in doing so—a range of national innovation systems and national patterns and trajectories of urbanisation. In this last connection, they were also designed to cover science and technology parks and:

- their economic relations to the wider city-region and city-system economies of which they are a part, including their relations to other significant institutions such as universities and research institutes;
- the international, national, and urban political and symbolic roles that science and technology parks perform;
- the economic and territorial planning surrounding the conception and future of science and technology parks as urban, suburban, or postsuburban forms within wider city-regions.

One paradox stands at the heart of the contribution of science and technology parks to urban development and economic performance. On the one hand, science and technology parks have typically been conceived and designed along a *common* pattern that Forsyth and Crewe (2010) term the campus-garden-suburb style that is seen almost everywhere as something of a global 'model' of urban economic development. On the other hand, they embody a *diverse* set of physical, economic, political, and symbolic relationships to existing settlements and elements of national identity and policy. It is to this question of commonalities and differences in the relationship of science to the city that this set of papers addresses itself.

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Nicholas A Phelps
Bartlett School of Planning, University College London, 22 Gordon Street, London WC1H 0QB, England; e-mail: n.phelps@ucl.ac.uk

Hyungjoo Kim
Science and Technology Policy Institute, Seoul, Republic of Korea; e-mail: hjkim@stepi.re.kr

Yong-Sook Lee
Department of Public Administration, Korea University, Seoul, Republic of Korea; e-mail: yongsooklee@korea.ac.kr

David C Valler
Department of Planning, Oxford Brookes University, Headington Campus, Oxford OX3 0BP, England; e-mail: dvaller@brookes.ac.uk

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