WESTERN SYDNEY
UNIVERSITY

INNOVATION CORRIDOR

This paper was made possible by a collaborative partnership between Western Sydney University and Celestino. Funding for the scope of the project was provided by Celestino, with in-kind support provided by Western Sydney University,

WESTERN SYDNEY INNOVATION CORRIDOR: DISCUSSION PAPER

Professor Donald McNeill,
Institute for Culture and Society,
Western Sydney University.

For enquiries regarding the Innovation Corridor Strategy, contact Dr Andy Marks: Director, Strategic and Government Relations, Western Sydney University (andy.marks@westernsydney.edu.au, mob 0428 165 084)

(Please note that the views expressed in the report are those of the author and are not necessarily those of the institution.
Funding for the scope of the project was provided by Celestino, with in-kind support provided by Western Sydney University)

AUGUST 2015

INTRODUCTION: AN INNOVATION CORRIDOR FOR WESTERN SYDNEY

INTRODUCTION

This paper discusses the scope for an Innovation Corridor in Western Sydney, a means of gathering, activating, and promoting the diverse set of new opportunities within the region. As a key regional actor, Western Sydney University will play a major role in driving a set of initiatives in partnership with government, private sector, and social groups that together will offer a significant shift in gears in terms of how the region moves. From a new high-rise campus in the centre of Parramatta to a range of new incubators and education districts, Western Sydney University is making a clear statement about augmenting and developing its existing campuses which run from Hawkesbury inthe North West to Campbelltown in the South West. As a university with one of the most intense growth trajectories in Australia, its relationship to its region has been part of its history and charter from the outset.

The Innovation Corridor, as a 'futuring' model of regional development, seeks to encourage anyone with an interest in Western Sydney to challenge their existing mental geographies of the region. Aside from the growth of Western Sydney University, there are several factors coming together which are unprecedented in the history of the region. This discussion paper pulls out some of these change agents and contextualises them within Australia and internationally. Along with the University's own growth plans, there are a number of other forces driving change.

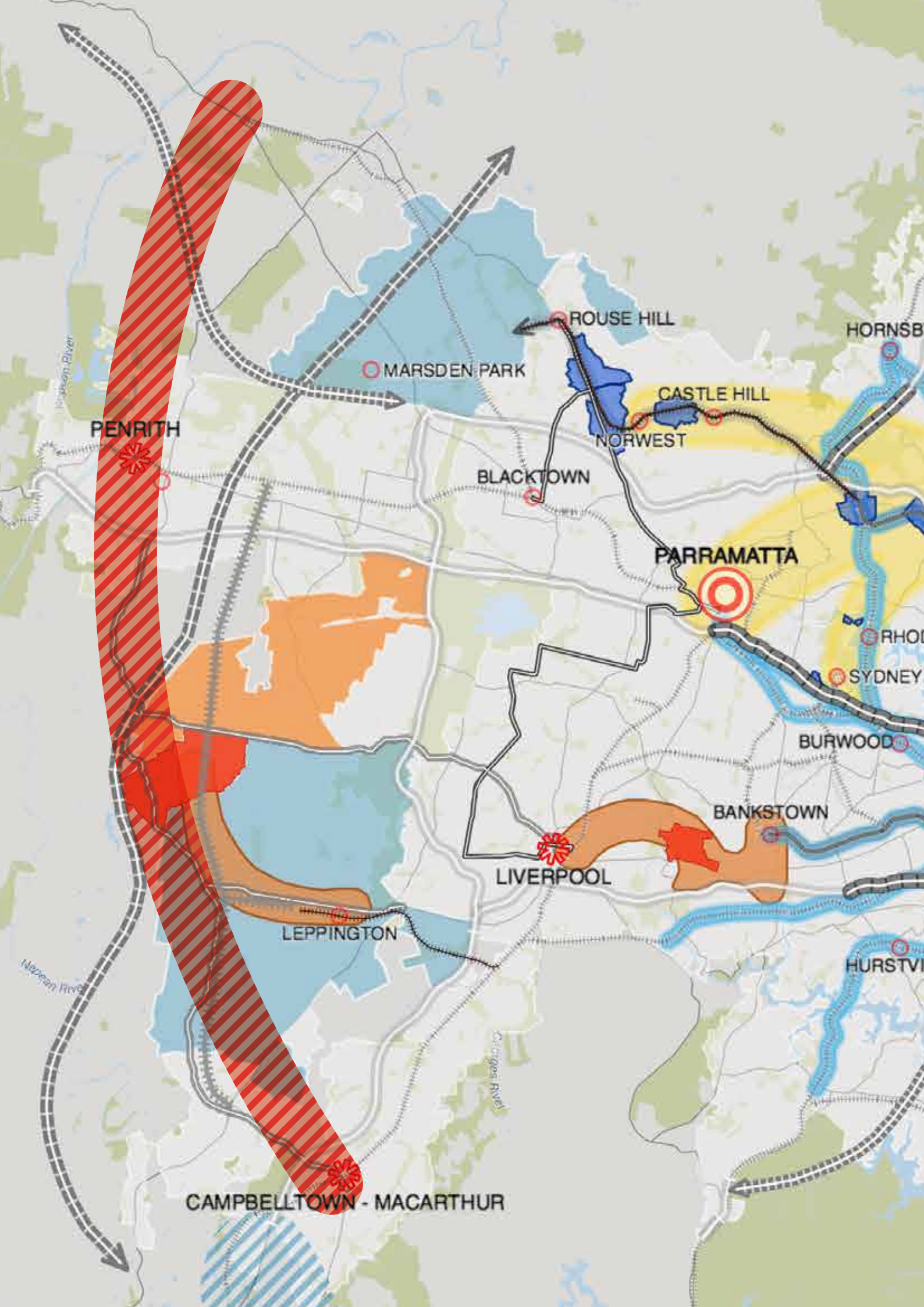
First, the NSW State government's announcement of major infrastructure investment in the West has opened up new development opportunities. The rezoning of the Western Sydney Employment Lands, in combination with the NSW Economic Development Framework, has opened up some major opportunities for innovative development strategies. In particular, the proposed M9 Orbital motorway which would run through the West from Richmond to Liverpool, along with the future route of the NW rail link, offered a new logic to how the region might be understood. Rather than being tied into a narrow set of corridors running through Parramatta, an orbital set of routes could remake the region's economic geography.

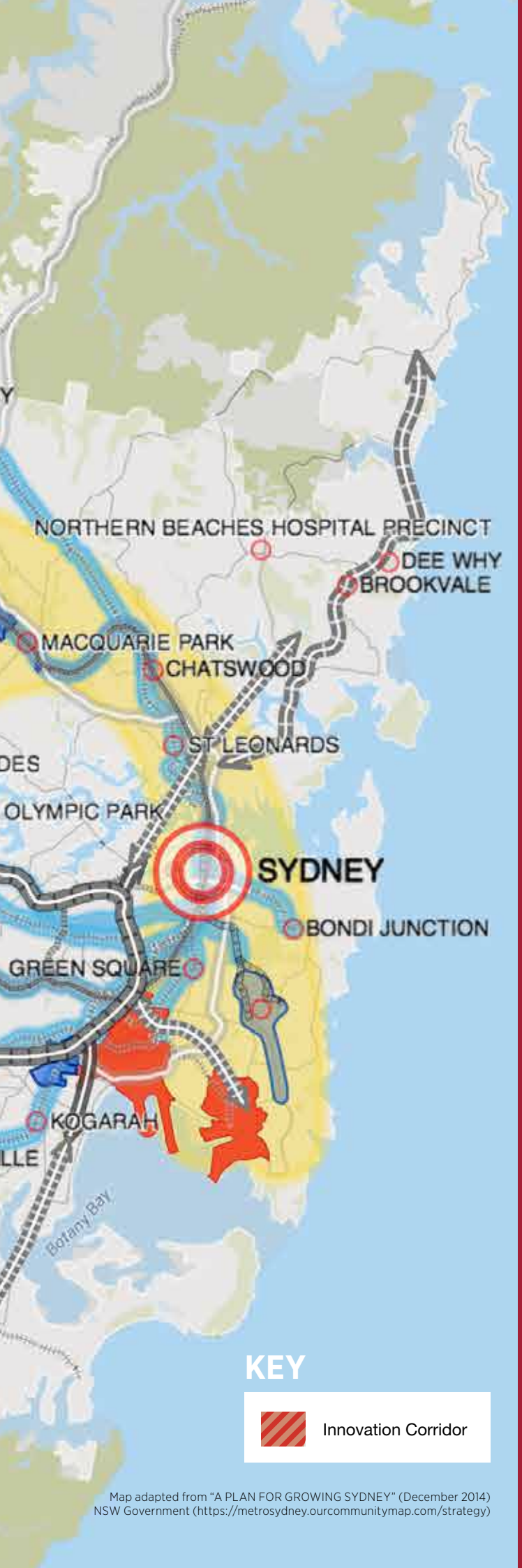
Second, the emergence of Parramatta as Sydney's second CBD, along with significant investments in the CBDs of Liverpool, Campbelltown and Penrith, will see these historic cities assume a greater role in structuring what has the potential to be a dynamic region of propulsive significance for the NSW and Australian economy. Sticking to the traditional way of understanding Western Sydney as a set of suburban residential landscapes mixed with 'old economy' manufacturing and distribution is no longer relevant.

Third, the approval of rights to develop Sydney's second airport at Badgery's Creek by the Federal Government in April 2014 will provide a significant step change for the region. While much remains to be decided about the shape of the development, given Sydney Airport Corporation's Right of First Refusal to develop the airport, there is no doubt that the multiplier effects it will bring could be extremely advantageous for the region. On the other hand, there are concerns that the airport will not be strategically embedded within a wider vision of regional development that maximizes these effects.

Fourth, the property developer Celestino has proposed a Sydney Science Park, a 287 hectare development in Luddenham near Penrith. Conceived as a mixed use community of science/technology, education and residential, the Park has few comparators in Australia. Its greenfield location marks it out from the likes of the Australian Technology Park, and its proposed innovative management model will also differentiate it from existing business parks such as Norwest and Macquarie.

This discussion paper sets out a number of ideas, observations and arguments on how an innovation corridor might give focus to Western Sydney's future economic challenges. These include: the importance of recognizing that science parks are now in their 'third generation' of management models; how to generate 'knowledge spillovers'; the role of universities in innovative regional economies; how to generate new jobs, but also plug into and upskill the existing region; the creation of new innovation leadership milieu, including venture capital investment; and how government at all levels can work to generate a lasting culture of innovation.


ROUSE HILL
MARSDEN PARK
CASTLE HILL
NORWEST
PENRITH
BLACKTOWN
PARRAMATTA
SYDNEY
BURWOOD
BANKSTOWN
LIVERPOOL
LEPPINGTON
CAMPBELLTOWN - MACARTHUR



Map adapted from "A PLAN FOR GROWING SYDNEY" (December 2014)
NSW Government (https://metrosydney.ourcommunitymap.com/strategy)

THE STRATEGIC CONTEXT

The Western Sydney Innovation Corridor is an economic development strategy developed by Western Sydney University to optimise State and Commonwealth planning, infrastructure and investment commitments in Western Sydney. The strategy achieves this by identifying, focussing, activating and growing the region's key, untapped strengths.

Following the arc of the 'Outer Sydney Orbital', the Corridor links the region's currently diffused and developing innovation entities into an interconnected span of knowledge-driven commercial hubs. The effect is the creation of a consolidated, yet diverse attractor of international and domestic investment that supports sustainable and future-focussed economic activity and employment.

The Corridor links the NSW Government's designated North-West and South-West Growth Centres, integrating the Western Sydney Employment Area and Badgery's Creek Airport Precinct, while linking together Penrith and Campbelltown-Macarthur Regional City Centres. The Corridor's bordering of Sydney's peri-urban regions also unlocks Sydney's capacity to better support rural and regional growth by its interface with the Bells Line of Road – Castlereagh Connection.

ONE CREATING INNOVATIVE SPACES

WHAT IS AN INNOVATIVE REGION?

It is clear that GWS has an innovation problem.[1] In many ways, this is just a reflection of Australia's national innovation weakness, which places it low in many indicators relative to its status as one of the top 15 world economies.[1] The places that score highly in these innovation indices are often small countries such as Finland or Singapore, or regions such as Silicon Valley, that are ranking well above what their relatively small population or territorial size might suggest. There is a strong argument that it is the territorial concentration of firms and agencies that make them competitive.
A range of arguments have been put forward to explain why Silicon Valley has emerged: a strong set of universities, experienced and risk-savvy venture capitalists, and so on. In learning regions, it is important to distinguish between 'know-how' (technical problem solving) and 'know-who': having a receptive and skilled lawyer, marketer, banker or consultant a phone call or short journey away. For example, technology specialist lawyers have arguably been key intermediaries in Silicon Valley's success. Cambridge Science Park's success has been attributed to its small town location, where dense social networks allow easy and barrier-free communication. Whether this is hubristic or not, there is a clear sense that fast markets require transparency and quick communication.

And so, there is a strong argument that the region is the ideal scale for the organization of innovation. Indeed, the concept of an innovative region is now a core element of government policy worldwide. Major economies such as the United States and the European Union have invested heavily in these approaches to growth and competitiveness. While global city central business districts tend to work well with minimal government intervention, national and regional governments worldwide undertake some form of intervention to calibrate regional economies. Cluster theory has emphasized the role of inter-firm networks as a key idea in management policy. Usually major firms in oligoptic markets drive internal R & D with beneficial effects to connected suppliers. A key observation is that apparent local competitors may nonetheless jointly build new markets, and may even share some market intelligence. Competitive firms may indeed provide the focus to make the product or business model globally competitive. However, there is a danger with cluster analysis that co-location of similar industries is misidentified with knowledge spillover.[2]

However, there is debate about how far firms in the Australian context are not innovating sufficiently. An alternative concept to that of the clusters is one of 'learning regions' where institutions such as government agencies and universities work as intermediaries to configure robust inter-firm networks, address market failures and gaps in training and site availability, to promote urban development. This is also connected to approaches which seek to integrate design and manufacturing into 'working regions'.[3]

The idea of 'path dependence' is an important concept in understanding successful regions:

> "the presence of one or two major innovative employers can attract and retain other firms thus creating a positive momentum which is difficult to stop."

If these industries become uncompetitive the opposite is true: regions get locked into decline and disinvestment. Indeed, it is increasingly argued that the Australian economy has fallen into a version of the 'Dutch disease', where its macroeconomic reliance on minerals exploitation and export has driven up prices generally and atrophied other sectors.[4] The States are one of the few institutions with both sufficient budgetary power and proximity to real world firms and institutions to make a striking change of direction.

1. Martinez-Fernandez and Sharpe 2007 **2.** OECD **2.** 2014 Martin and Sunley 2003 provide a classic, and searing, critique of Michael Porter's cluster model and, as they put it, 'brand', with 2300 citations. Without dismissing clusters per se, this paper has helped to generate a highly sophisticated critical literature on what exactly works and doesn't work in regional development, knowledge spillover, firm co-location, and the dangers of 'guru' management theory. **3.** Clark 2015. **4.** Charlton 2014; Weller and O'Neill 2014

THE KEY CHALLENGES FACING WESTERN SYDNEY

There are several key challenges facing urban economies like Western Sydney.

The first is the strong pressure being placed on manufacturing regions by – particularly Asian – competitors in a range of fields. The collapse of the Australian car manufacturing industry is the most obvious example of this, but it is clear that there are major innovation problems at a corporate level. While trade unions and worker protection regulations are often blamed for this, there is growing consensus that corporations are paying out too much in dividends than in research and development, mainly due to the shareholding power of Australia's superannuation funds.

The second challenge is how best to provide a coherent way of structuring the future employment lands of the region. For example, the strategically significant Broader Western Sydney Employment Area, which consists of over 10,000 hectares of land, and covers four different municipalities. It is argued that the suburbanization of cities has slowed and now, new economy jobs are being located in the gritty but 'reimagined' brownfield sites closer to the centre of cities. This argument has been turbo-charged by the Brookings Institution in their report "Innovation Districts", whose findings have been digested internationally.

As apparent evidence of this, the CBA is currently considering withdrawing from its offices in Western Sydney and consolidating in a single site in one of these brownfield locations, Redfern. And so the way in which employment areas are defined, marketed, managed and cultivated needs to become a lot more integrated. How the Second Sydney Airport is planned will be a key test of this: airports have gone from being ad hoc, system-designed pieces of kit to being high value, architect-designed, integrated business hubs over the space of a decade. So getting the planning for this airport right, and making it an 'urban event', is a priority.

The third challenge is that of digital disruption. Again, this is both entirely true and massively exaggerated. The rapid emergence of a series of American 'unicorns' – private companies with valuations in excess of US$1billion – between 2013 and 2015 has captured the attention of the world's business media. The celebrity cases of Uber, Airbnb, Whatsapp and Dropbox have been extensively documented. Yet there is skepticism among many observers that these firms will be able to (a) become profitable and (b) match revenues with valuations, making their IPOs either difficult or highly risky for investors. Nonetheless, the big story is the growing application of software solutions to all manner of mundane economic activities, and the cumulative effect of underskilling in these areas could be fatal for the region. In areas such as advanced manufacturing, this is obvious. But think about the basics of taxis and pizzas, and how digital disruption is impacting on Western Sydney explicitly. Taxi apps are now a key technology in the transport industry, but how will they affect dispersed regions like Western Sydney? The global Domino's pizza corporation is recognized as one of the most advanced digital distribution firms, early innovators in the use of apps for food ordering. It has franchises across Western Sydney. But this effectively means that new entrants in the pizza sector face a huge software problem right from the outset.

This links to a fourth challenge: the long-term outlook for the Western Sydney labour market. As a recent report by Urbis has indicated, the region's jobs shortfall (the resident workforce compared with the available jobs) is around 200,000, and this "is projected to get worse over the next twenty years unless structural economic change occurs within the GWS region".[5] Low value, easily replicable 'commoditised' exports are likely to be undercut by other low wage economies on the basis of price alone, and are vulnerable to currency fluctuations. And so, it is imperative that the region rapidly develops new jobs, upskill existing jobs, and understands its labour markets and economies in a way that is in itself innovative.

Sydney Science Park (image used for illustration purposes only)

5. Urbis 2013, p.46

GENERATING NEW SCIENCE AND TECHNOLOGY JOBS

So what structural changes should the region's stakeholders seek to implement? Science, technology and engineering investment is usually seen as core to a successful knowledge economy. A recent report by the Chief Scientist argues that science in Australia contributes to 11% of GDP directly, with an additional 11% of indirect contributions.[6] The report concludes that this contribution is likely to be particularly concentrated in high productivity sectors that the Australian economy requires for post-minerals extraction growth. We can infer that Sydney would be expected to play a major role in hosting these science industries, and it follows that there needs to be an adequate supply of science employment lands.

In addition, this would also drive patent activity. Statistically, regions with high levels of patents also display elevated average incomes. As one US-based report has argued:

> "For all the success of the United States, the value of invention is not evenly shared across regions because of the clustering of assets like science majors, tech sector workers, and leading research universities. As a result, metropolitan, state, and federal policy makers need to consider ways to foster these attributes more broadly and generally support research and development"[7]

In short, there needs to be a series of strategic interventions that encourage firms and institutions outside core economies to innovate and protect the intellectual property created.

SYDNEY SCIENCE PARK

Located in Luddenham, which lies between Penrith and the site of Sydney's new airport at Badgery's Creek, the Sydney Science Park has recently been given gateway approval by NSW Department of Planning. The developers of Sydney Science Park have aspirations that it will be one of the largest centres for R&D and innovation in Australia. Their aim is that it will cluster together a diverse but complementary set of innovators in industry, education and business. Their project estimate is for 12,000 jobs and 10,000 students to be located on site. It is anticipated that the presence of an existing large firm, Baiada, and other anchor tenants would provide critical mass to generate and sustain spin-off firms and supply chain players working in fields such as food technology and security.

Science parks have now evolved to such an extent that there is a significant body of scholarly and policy literature which gives us an evidence base to work out what works and what does not. It is important to note that science parks are highly diverse in size, profile, and management model. It is generally agreed that the real estate configuration of science parks is an important determinant of success, along with successful firm co-location, proactive park management, and venture financing.[8] With the right combination of elements, parks can be catalytic. Hsinchu, for example, is estimated to contribute 10% of Taiwan's GDP, and Cambridge has undergone successive waves of growth to become perhaps the world's pre-eminent park. Given the size and the scope of the projects, it is important that long term planning for science parks are undertaken at the inception stage.

The key point is that the vast majority of parks internationally are publicly funded: as such, their success or otherwise tends to be made using a different calculus from a private sector development, which Sydney Science Park is. And so, assessment of 'success' tends to be made on the basis of return on investment to the public purse, and some science parks are seen as being underwhelming in terms of success. A persistent criticism of many science parks is that they are either insensitively managed (ie, run as a conventional office park) or else inadequately focused on genuine innovation.[9] In their study of Singapore Science Park, based on a survey of tenant firms, Phillips and Yeung demonstrate that many firms are actually conducting basic sales or administrative activities, rather than research and development, or else have been leased space with little attention to whether they will add to the collective knowledge commons that is said to fuel knowledge spillover.

Yet, these potential pitfalls acknowledged, the benefits of science parks are obvious. When understood as part of a science and technology ecosystem, they provide both a supply of suitable office accommodation, skilled and pooled resources in mentorship and shared services (eg. accountancy, legal advice on specialist areas such as patent law), and integration with universities. If the major anchor tenants operate with a culture of innovation, this is likely to lead to co-location of firms that operate within the same supply chain, or else use similar technologies or sectoral skills.

It is now interesting to see how international best practice is shifting towards mixed use developments. As Katz and Wagner have argued in the highly influential Brookings Institution report:

> "Instead of building isolated science parks, innovation districts focus extensively on creating a dynamic physical realm that strengthens proximity and knowledge spillovers. Rather than focus on discrete industries, innovation districts represent an intentional effort to create new products, technologies and market solutions through the convergence of disparate sectors and specialisations (e.g. information technology and bioscience, energy, or education)." (2014, p.2)

And so, classic post-war US science parks like North Carolina Tech Triangle are finding they need to redesign space to 'reurbanize' their offer in the face of the competitive challenge from brownfield sites. The management of the Triangle are now designing mixed use urban spaces, integrating a STEM oriented secondary school into the park, improving public transport connectivity, and introducing a more varied set of food and lifestyle options for workers.

In mid-2015, the developers of Sydney Science Park visited several North American science parks to examine how best to integrate these important elements from their inception.[10]

6. Chief Scientist 2015 **7.** Rothwell et al 2013 **8.** Komninos 2002 pp. 62-68 **9.** Phillips and Yeung 2003 **10.** Jeremy Spinak, Celestino, personal communication

THE NEED FOR INNOVATION SPACES, AS MUCH AS EMPLOYMENT LANDS

What disruption definitely does mean is the likely obsolescence of traditional business models, in terms of how manufacturing takes place.

> "So, this even means that how we measure regions and economies is probably outdated: manufacturing and services are converging and are increasingly co-located in one space."

This means that what manufacturing places look like is changing:

"In the past, production occurred on a manufacturing shop floor while innovation was isolated in labs and design facilities. Yet greater technical complexity coupled with shorter product life cycles has driven firms to incorporate design into the assembly process, cutting lead time and modification costs. In this environment, firms require tight links between their research divisions and manufacturing facilities, which often come in the form of real-time exchange between researchers, engineers, and high-skilled production workers."[10]

Similarly, science and technology workplaces are now increasingly seen as requiring an urban set of characteristics, rather than being in isolated office parks. Interestingly, this can mean an extremely efficient use of space: start-up culture means that some firms with significant revenues are concentrated over a few square metres in a co-working space. While there will still be a need for the traditional suburban office park with its allocated car parking, there is now far more scope for sub-letting space – right down to desk level – and making real estate costs the smallest obstacle to firm establishment. The provision of a suitable portfolio of spaces, which may already be part-fitted for innovative firms, is thus a key element of a regional development strategy.

AN INTEGRATED HEALTH HUB: WESTERN SYDNEY UNIVERSITY AT CAMPBELLTOWN

The field of health is rapidly changing. Trends to watch include: 'big' health data becoming increasingly marketised; new crossover precision engineering opportunities in health appliances; the growing importance of therapeutic treatments and urban facilities; and the rise of personal health assessments, from wearable technology like Fitbit, to IT based telehealth treatments and platforms.[11]

Western Sydney has a series of health hubs, particular Westmead, Penrith, and Liverpool, and there is a growing awareness that they should try to specialize, competing globally rather than locally. An important 'niche' hub that Western Sydney University is developing around its Campbelltown campus, particularly around its Complementary Medicine Centre, will be a magnet for future spillover development. With a newly forged MOU between the Western Sydney University National Institute for Complementary Medicine (NICM) and Beijing University of Chinese Medicine, signed as part of the recent China-Australia free trade agreement, this will provide a significant anchor at the Southern end of the innovation corridor.

CONCLUSION

This chapter has set out the importance of innovation spaces: although there is robust debate about whether wealth is generated by networks of firms and customers, or by the role of government and the public service in shaping urban economies, it is important to recognize that our evidence bases are currently underwhelming. It is clear that Australia is generally seen as performing poorly compared with other advanced economies in the field of innovation. There are two main discussion points that emerge.

First, there are many sorts of innovation which may co-exist, such as: the disruptive (where the entire business model has to change), the architectural (where new ways of organizing the business and its products are required), the routine (where incremental changes are made) and the radical (where new technical competences are required).[12] And it should also be born in mind that, in aggregate, many small firms have a conservative, low growth business model that may suit the owner. In short, the medium-term future of the regional economic landscape should involve the creation of entirely new businesses and models, the incremental growth of existing ones, and the recognition that some SMEs simply do not want to grow.[13] This is very important given the skills profile of Western Sydney, which is under-represented in higher skilled jobs and has clusters of poor educational outcomes within the school system.

Second, to recognize the nature – the DNA, if you will – of any innovative region requires a skilled and focused research strategy. When focusing on innovation, conventional industry classifications are only of partial utility. As the authors of a Brookings Institution report on advanced industries in the United States point out, new business models also disrupt industry research:

> "A key shortcoming here includes the difficulty of classifying individual firms whose activities, in practice, span multiple industries. For example, that Amazon is an "advanced" firm is hard to dispute. However, Amazon's classification as a retailer (NAICS 4541: electronic shopping and mail-order houses) technically precludes its inclusion in the advanced industries sector, even though some of the company's individual physical establishments specializing in, for example, computer systems design or software programming, would be included. In a similar fashion, the present industry-oriented definition may miss pockets of sophisticated activities in other industries. Conversely, the method likely captures some relatively unsophisticated activities and establishments within industries that exhibit an "advanced" profile in aggregate national data but not necessarily in every particular region (think for example of the full range of firms and establishments classified in the "motor vehicle parts manufacturing" industry across the country)."[14]

These observations are also fundamental to our understanding of how the Western Sydney innovation corridor is defined, delimited and measured.

10. Muro et al 2015, p.13 **11.** Institute for the Future 2009 **12.** Pisano 2015, p.51 **13.** Holmes and Gupta 2015 **14.** Muro et al 2015, p.22

TWO
CREATING A START-UP CULTURE

BUILDING A START-UP ECOSYSTEM IN WESTERN SYDNEY

Recently, the NSW Government published its Digital Industry Action Plan. The plan in many way responds to the highly visible digital 'scenes' that have emerged in cities around the world, often named – with a hint of irony – as Silicon Roundabout (London), Silicon Beach (Sydney/LA), and Silicon Wadi (Tel Aviv). The rapid expansion of the internet, the adoption of smartphones and tablets, and the corresponding rise in social networking apps, e-commerce, and enterprise software have generated a whole new set of economic agents which are leaving their imprint on cities. The internet, along with cloud computing platforms more generally, has offered unprecedented opportunities to find customers anywhere for niche products, out-source certain tasks, and use business platforms from Paypal to Amazon Business Services to collect revenue and host sites.

This means that businesses are simultaneously far more easy to found and scale, as well as vulnerable to market competition. There has been a rapid growth in the accelerator model of firm development, where business 'angels', corporations, government or universities, provide a pool of seed money and perhaps a workspace to develop a proof of concept, and to enhance the chances of their investment being successful. These accelerators also provide mentoring, introductions, and even good old moral support to the entrepreneur, along with shared business services in law, accountancy and marketing. At their extreme, these models can develop spectacularly successful companies very quickly: the most famous accelerator, Silicon Valley's Y Combinator, has spawned Dropbox and Airbnb, for example.

The NSW State government has been responsive to the tech agenda, and recognized the existence of a 'digital precinct' on the southern edge of the Sydney CBD. In August 2015, it helped launch Chalk and Stone, a financial services incubator, in the heart of the financial services district near Circular Quay. However, much of the discussion and buzz around the digital industries remain very focused on central Sydney. There remains a very important question about whether digital work – given its inherently virtual nature – could also flourish in Western Sydney.

For example, beyond the superstrata of 'unicorn' start-ups with billion dollars valuations, such as Uber, there is a universe of low-key, but in employment terms more significant, start-up ecosystems around the world. In London, Silicon Roundabout and Tech City get the lion's share of the media's attention. But in the last three years, Croydon – on the city's periphery and a site of serious social unrest a few years ago – has generated around 1500 digital businesses. Ironically, the growth of London's tech scene has priced out many start-ups from central London, so lower cost locations such as Croydon with ageing but serviceable office stock and more affordable housing have become popular.

Given the direction of central Sydney's economy, which is likely to shake out start-ups into different economic sectors (fintech and adtech likely to be the most embedded), there is scope for thinking through which sub-sectors might find a home in the West. For example, healthtech, edtech, autotech (such as intelligent vehicle maintenance), and social enterprise start-ups would be well aligned to the major employers and potential entrepreneurs of Parramatta, Liverpool, and Campbelltown. It is often argued by start-up entrepreneurs that many of the global city accelerators and scenes end up 'crowding' investors, and excessively diluting or spreading thinly the limited technical programming skills pool. And so, it would make sense to support a Western Sydney digital ecosystem which maps loosely onto the existing industries and employers in the Western Sydney region.

15. http://www.techcityinsider.net/startups-line-up-for-croydons-50p-hub/

WESTERN SYDNEY UNIVERSITY'S LAUNCHPAD PROGRAM

In mid-2015, Western Sydney University established a series of start-up sites designed to develop an entrepreneurial ecosystem in the region. The three sites, in Penrith (Werrington Park Corporate Centre), and in Parramatta and Liverpool CBDs, bring together a series of government and private partners to create a support for early stage businesses. Importantly, they each have a particular specialist focus.

The Werrington site focuses on engineering, design, computing and digital economy start-ups. Given its proximity to the Western Sydney University Penrith campus, which has computer and engineering laboratories and facilities, there are clear opportunities to share facilities and create rapid, physical prototyping opportunities. The site will also feature a 'tech shop'/'maker space' or like component, a first for Sydney, which can provide training in manufacturing skills for entrepreneurs who want to rapidly prototype their ideas. These spaces do not require huge floorplates, run on a subscription basis, provide safety training in machine use, and have huge potential in a 'design and build' economy. They will typically offer a set of flexible, software driven, manufacturing equipment, such as advanced cutting equipment, multi-axis computerized numerical control (CNC) machines tied to CAD programs, 3D printers, printed circuit board milling, and microelectronics assembly and test stations.

The Parramatta site – in the heart of the city's rapidly developing civic centre – will be tied into this booming service sector economy. It will allow close links to the range of 'decentralised' public sector jobs, such as in policing, justice and water, which are all areas where digital innovation has a ready market. Parramatta's reputation as a food hub will also open up consumer-oriented foodtech possibilities. The existing presence of NSW Trade and Indusry business advisory services, the KPMG accelerator program, and Western Sydney University's entrepreneurship and commercialization services means that this will have a strong business support specialism.

The Liverpool site is close to the Southwest of the region's advanced manufacturing industries, along with an important health precinct, and is also close to some of the region's key logistics and supply chain firms in warehousing and distribution there are significant opportunities here to build value into existing supply chains through incremental innovation, with a ready customer base for start-ups that can show value added to existing businesses.

So, it should be clear that start-up ecosystems are about more than just building the next Facebook or Dropbox. Media coverage which presents a dualistic scene of sweatshirt wearing start-up entrepreneurs, and world-beating digital giants, miss the fact that there are huge opportunities in vital fields of health and safety regulation, 'green' manufacturing, warehousing, and public sector procurement. While start-up culture is often associated with programming, it should be emphasized that early-stage companies also require a lot of innovative marketing and customer relations skills to build early stage revenues.

This is something that Western Sydney University is already playing a catalytic role in supporting. More can be done, as many start-ups operate via a 'bootstrapping' basis where the business founder lives on a minimum wage and relies on revenues from early products to build their business. It is fundamental to recognize that there are two very different start-up economies. The first, which we could call the 'global scene' involves a race to become the global market leader in a particular niche of the digital economy (Uber and taxi-hailing apps being a classic case). It is important to recognize that by the time a firm has reached global scale, it has probably ceased to be embedded in its local region in any case. The second, which we could call the national scene, involves a restricted scope expansion plan yet with strong customer service support, and with ownership remaining in local hands rather than in venture capital funds. Some of these firms could then expand to become global players: the enterprise software firm Atlassian provides an excellent example of this. It is a hypothesis worth testing that Western Sydney could generate a lot of companies of this kind.

SCIENCE PARK INCUBATORS: CATALYSTS OF NEW FIRM FORMATION

In contrast to internet-based start-ups, many firms require longer term, capital intensive growth periods. For this reason, technology based incubators have emerged, the purpose of which to increase the chances of start-up firms to scale to a size where they can become publicly tradeable, either via acquisition by existing listed corporations or through IPOs. Although models vary, the principle is that a cascade of real estate options, both in terms of size, facility quality, and lease terms, allow firms to move through various growth stages until they are at a point where they can exit. When acquiring tenants, park managers work on a continuum between the following two extremes:

> "In the "picking-the-winners" approach, incubator managers try to identify a few potentially successful ventures ex ante. When this approach is taken to its extreme, incubators resemble private venture capital firms. In the "survival-of-the-fittest" approach, incubator managers apply less rigid selection criteria, take on a larger number of firms and rely on markets to provide the selection processes that over time will separate winners from losers."[16]

This kind of model requires significant skills in both investment and innovation management. There is a key role here for the proposed Sydney Science Park, as there are few sites in the region which will offer a dedicated, science-focused space where tenancies can be selectively offered to create spillover. Traditionally, universities and science parks have always been co-located, as it allows faculty members to move easily between university office or laboratory to the commercial site, along with employees who may be working on both sites.

16. Bergek and Norrman 2008 p.20

ANGEL AND VENTURE FUNDING, AND GOVERNMENT FUNDING STREAMS

Growing firms require capital and investment, along with know-how. A key element of any growth region is the extent of investment, and in particular, risky investment. What are the challenges here? It has been suggested that angel and venture investment is a skill set itself. Some have argued that angel investors, who may have made private wealth through success in a particular field or business type, are largely undereducated in new technologies, and may be making non-optimal investment decisions. There is scope for Western Sydney University, for example, to offer tailored courses in start-up due diligence, 'disruptive' market opportunities, and 'founder relations' to enable the best growth strategies for very specific sectors.

There is also a sense in which the region's economy needs to be introduced to angel investors either from existing industries in the West, from the core of Sydney, from inter-state, or overseas. These investors could be systematically introduced to the region's start-ups. Given that investments can start as low as $20,000 for initial 'sweat equity' development, and that new legislation allowing 'retail' crowdfunding may rapidly change this landscape in coming years, there is a lot of potential for start-up 'market-making' by regional intermediaries.[17] A more significant challenge lies in major expansion rounds of investment where banks and institutional investors can be educated in the risk profiles of particular regional start-ups. There may be scope for initiating a public sector managed venture capital fund to enable this.[18]

Above all, it is important that the region's innovation pathways are appropriate to its existing economic and social fabric. The region's start-ups, early stage companies, and SMEs should not be seen as being driven by the same growth models: some owners want to grow rapidly and others are happy to remain small.[19] Integrating SMEs into innovation systems is challenging: entrepreneurs are usually very time poor and find networking difficult to justify. There may be a mismatch between their technical knowledge and their ability to maximize angel or venture support even when formal support schemes exist.[20] And attention should be paid to the region's transnational socio-economic linkages, given the ability to channel overseas investment into regional businesses. Changes to the Significant Investor Visa Program, which came in on 1 July 2015, has meant that

> "there may be an increasing appetite for overseas investors to channel funds into start ups."

As an example, Saipen Ventures has been established with an aim of creating a $50million fund from predominantly Chinese investors.[21] But there are also many existing transnational business links, be they Italian, Lebanese, or Korean, that could be an important source of innovative activity.

CONCLUSION

There is a growing sense of traction in the creation of a start-up culture in Western Sydney. To put things in perspective, it is only a few short years since Sydney had any formally recognized 'scene' of any sort. So there is a sense that the network of Launchpads set up by Western Sydney University, and the incubator opportunities offered by Sydney Science Park, will quite quickly develop the required critical mass. This leads to three issues for discussion.

The first relates to the regional development of start-up ecosystems. Following on the idea of path dependence, it is often remarked that, for example, New York – rather than Silicon Valley – has become a centre of media and fashion tech start-ups precisely because of its existing 'old economy' strengths. And so, start-up ecosystems with carefully focused 'verticals', building on key sectors that their region already has strength and customer bases in, is most likely to breed successful firms.[22]

The second relates to how investment capital is channelled into entrepreneurial activity in the region. This can be of many kinds: corporate innovation, the procurement practices of large public agencies, smaller seed projects, and so on. Importantly, start-up cultures are rich on cash plus expertise, rather than 'silent' investors: the development of a culture and network of mentors, 'test' corporate customers, and networking events to improve marketing and pitching techniques, are all key elements in areas with relatively less developed 'big end of town' business cultures.

Third, Australian universities are now steadily waking up to the role that they can play in nurturing entrepreneurial activities from within their student and faculty body. They may be some way behind the most famous examples, such as Stanford, but there is an increasing sense that an innovation strategy that cuts across disciplines, research institutes, teaching programs, and university administration, can bring together teams with the enthusiasm to try out new business models and ideas. It has become a cliché, but it is a truism: if every start-up ends in failure, there is still a new generation of entrepreneurs who can go on and learn from their experiences.

17. Fitzsimmons 2015 **18.** Wray et al 2010 **19.** Holmes and Gupta 2015 **20.** Wray et al 2010 **21.** Shapiro 2015 **22.** White 2014

THREE
UNIVERSITIES AND INNOVATION SPACES

So what is the role that universities can play in the development of the corridor?

Presently, Western Sydney University is the dominant institution in the region and will continue, through its charter, to be central to its growth in coming years. The territorial shape of the university is important: in many ways, it is one of the principal 'orbital' vectors of the region, yet its campuses are currently organized around a set of radial corridors.

Increasingly, universities have been seen as central to territorial regional innovation systems for several reasons.[23] First, they can make direct and indirect contributions through the commercialization of research, either through the creation of spin-off companies, the creation of patents, and close working on specific problems with industry. Second, they add to the stock of human capital in the regional economy through training graduates in specialist skills. Third, they offer a social capital role: they can help build trust in local economic relations, can act as a ready-made networking site, and – if fully exploited – use their campuses for cultural, intellectual, and business events.

SCIENCE PARKS AND UNIVERSITIES

It is through the use of integrated 'triple helix' programs of government investment, corporate partnership, and university research and curriculum design that many universities have staked their reputation. And one of the key modes of doing this has been the establishment of science parks.[24] Science parks have been an important element of university innovation policy for several decades, and they have been a mainstay of mature regional development policy in many countries around the world. As the international literature on science parks shows, the most successful parks have typically grown out of existing university engagement. This shows no sign of abating, and many of the most mature parks are now entering a new phase of urban development. For example, Cambridge Science Park – already acknowledged as one of the world's leading parks – has set out a masterplan for a large mixed use expansion project on a greenfield site on the edge of Cambridge.[25]

As the Greenhouse project shows, Western Sydney University has already made a significant commitment to co-investment with a private partner to build a technologically advanced facility. There are further opportunities for Western Sydney University and Sydney Science Park to collaborate due to the close proximity between the Penrith campus and the science park.

23. For reviews of this literature, see, for example, Charles 2006; Goddard and Vallance 2013; Link and Scott 2015; Smith 2007; Smith and Bagchee-Sen 2010
24. Youtie and Shapira 2008, p.1197 **25.** Cambridge University: Green Paper; https://www.admin.cam.ac.uk/reporter/2009-10/weekly/6194/section1.shtml; Pagano

Sydney Science Park (image used for illustration purposes only)

AGRIPARKS AND THE FUTURE OF FOOD

NSW has an important agricultural sector, and the Western Sydney University Hawkesbury campus offers an important research site for innovation in this field. Agricultural production has as much potential for disruption as other sectors. For example, the increased automation of agricultural production such as pruning using technologies produced for driverless cars is being tested by Bosch in Germany.[26] This is the kind of spillover that an innovation corridor which straddles agricultural, technological and manufacturing land can bring.

The Western Sydney University agripark facility offers an important potential catalyst here.

"The park will feature a world class greenhouse facility, which will help generate a cluster of research expertise in food technology, land use management, and consumer demand."

Constructed as a joint venture between the University of Western Sydney and Horticulture Innovation Australia Limited (HIAL), the Western Sydney University Greenhouse Research, Education and Training Facility will enable unprecedented control of temperature, humidity, CO2 and light to deliver higher productivity while lowering energy and water inputs. Based on a design from the University of Wageningen in the Netherlands, the Greenhouse will provide high levels of control over humidity, temperature, light and CO2. This facility – the first of its kind and scale in Australia – will allow researchers to test multiple conditions affecting the growth of plants in protected crop environments.

STEM GRADUATES AND HIGH VALUE MANUFACTURING

Other advanced economies such as the US and UK are recognizing the need to reinvest in high value manufacturing. For example, the UK Government's recently established High Value Manufacturing Catapult organized a network of centres of excellence around nodes such as intelligent automation, printable electronics, precision forging, and energy storage and manufacturing. The aim is to increase the share of manufacturing in UK GDP to 25%, a dramatic reversal of the 'post-industrial economy' thesis.[27]

Baseline studies of Western Sydney indicate that manufacturing remains a key element of the region's economy. A shift to advanced manufacturing is thus a path of lesser resistance. As a Brookings Institution study of the US context pointed out, these are huge employment sectors and also core to economic innovation:

"A storehouse of the nation's STEM knowledge base, the sector also serves as a critical repository of skilled workers that over time flow out into the rest of the economy. STEM workers—from aerospace engineers to software developers, materials engineers, biochemists, power plant operators, mechanical engineers, and skilled technicians—matter because they make and apply the inventions that sustain innovation and growth.

At the professional level, highly trained engineers and scientists keep American business on the cutting edge through invention and entrepreneurship. At the sub-bachelor's level, skilled technicians produce, install, maintain, and repair the products and machines patented by researchers, allowing firms to reach their markets, reduce product defects, create process innovations, and enhance productivity. Moreover...although these technicians may not be directly involved in invention, they are critical to the implementation of new ideas and advise researchers on the feasibility of design options, material choices, cost factors, and other practical aspects of technology development and deployment."[28]

Although universities are seen as core elements of innovation districts, the technical colleges are highly regarded in strong economies such as Germany. They have also become an important discussion point in Silicon Valley which is suffering a skills gap at entry level appointments (what is sometimes called 'blue collar programming'). An important focus should be on increasing investment in TAFEs, improving the links between schools and universities, and securing bipartisan support for their on-going growth.

Recent statements by the Prime Minister and Leader of the Opposition suggest there is emerging Federal Government support for greater attention to the teaching of STEM skills within Australian schools, at both primary and secondary levels. There is a strategic need to assess the regional skills capabilities of Western Sydney students, and to provide opportunities to upgrade these through investments in teachers, support for after-school science clubs, and improved facilities for specialist technology teaching. Certainly, moves appear to be underway to integrate schooling into a wider technological infrastructure. For example, Western Sydney University has committed a 6,000m^2 facility on its Werrington South Campus for the establishment of a Science Centre. The University is promoting the concept as one that draws on international best practice in immersive and interactive STEM engagement with school-aged children, with plans to be operational by late 2017. The Sydney Science Park have publicly indicated that they have reached agreement with the Parramatta Catholic diocese to install a STEM secondary school on the Park grounds. Equally, other STEM focussed models of school-age, co-located engagement are currently in negotiation with additional large-scale entities across the region. These models are already evident – and in practice – internationally. It was recently announced that Oracle, the Silicon Valley enterprise software firm, has agreed to host a secondary charter (i.e. independent) school on its campus. School students would share various facilities with the firm.

26. (2014) Hajkowicz 2015, pp. 158-9 **27.** Warwick Economics and Development **28.** Muro et al 2015, p.17

LINKING GRADUATES TO THE REGIONAL LABOUR MARKET

Western Sydney University will continue to play the dominant role in the region in terms of providing skilled graduates for the region, with over 60% of students first in family to attend university, and with over 35,000 undergraduates and almost 1000 HDRs students registered in 2014.[29] Innovative regions will have strong linkages between universities, and the position of the University of Sydney's veterinary studies campus in the corridor is also significant.

Universities and professional associations can show leadership in the field of placements and internships, an area ripe for expansion. It is regularly noted that Australia has a poor rate for university-business co-operation compared with other developed countries. There are schemes already operative which show the possibility for closer partnership. For example, the Australian Mathematical Sciences Institute (AMSI) runs a PhD internship scheme, where employers pay $25,000 for a PhD student to solve a specific problem.[30] It is obvious that the successful completion of such a task would also help the firm with recruitment and increase the student's employability. Such schemes are low-risk ways for firms and institutions to engage with universities: the public sector could also operate a similar scheme in a range of areas, from smart energy to creative industries.

BUILDING ENTREPRENEURIAL SKILLS INTO THE CURRICULUM

There is much discussion in higher education circles about the entrepreneurial university, which encourages risk-taking and creative ideas to flourish through the whole university ecosystem.[31] For example, Stanford's reputation for hugely successful start-ups is driven by the reorganization of their curriculum to allow business skills to be embedded in the engineering and computer science fields. The Stanford model has been generally accepted as being based around the integration of computer engineering skills with business acumen. For example, a legendary Silicon Valley story recounts how Facebook CEO Mark Zuckerberg walked into a Palo Alto coffee bar and offered to hire the barista, an old college friend, to work on improving Facebook's imaging capacity. The barista, Kevin Systrom politely refused; within two years his company, Instagram, had been acquired by Facebook for $1bn. Systrom was a graduate of the Stanford Technology Ventures Program (STVP) an intensive program offered to computer science students as a means of combining business knowledge with programming skills. Closely related to the STVP is the Mayfield Fellows Program, "designed to give twelve students a year an intensive theoretical and practical understanding of the techniques for growing technology companies"[32]

So, universities are now looking at how entrepreneurial skills can be built into all areas of the curriculum, and not just business schools. Ryerson University in Toronto is widely seen as a good example of this: it has devoted significant amounts of its campus spaces to incubators and co-working space. It is tied into an internationalization strategy of partnership with universities working on similar technologies, which allows it to offer 'soft landing' possibilities for overseas students who may wish to establish transnational businesses.[33] In their survey of university-facilitated entrepreneurship, Nelson and Byers argue that "entrepreneurship education should not be limited to a focus on technology start-ups, which is often the case, but should instead focus on developing perspectives and skills that can be applied in many ways across many settings."[34] And so the Ryerson model works within a very diverse set of sectors or 'verticals': its start-up incubator includes relatively unusual foci such as law and fashion.

CONCLUSION

Western Sydney University already plays a key role in the economy and society of the region. With further strategic investment and partnership, it will have a catalytic role in regional development. Through the development of new research, and the provision of skilled graduates at various levels of qualification, Western Sydney University will be very influential in the region's labour market profile. As anchors of regional development, they can also play key roles as customers, intermediaries, and advocates for on-going innovation. However, for this to occur requires tacking an Australian problem: the relatively low rates of linkage between universities and external partners across the board, and the mismatch between research investment and its transfer to the wider economy. The INSEAD Global Innovation Index ranked Australia as 11th in the world for its innovation inputs, but 116th for how efficiently these inputs are turned into innovation outputs.

Many of the barriers to these linkages have been well documented in two recent reports by NSW Business Chamber, which surveyed a wide range of stakeholders from within universities, government and industry.[35] They identify several practical steps that can be taken to improve these rates of co-production and innovation, such as the creation of a formalized research marketplace, forums that allow industry direct input into curriculum development, streamlining intellectual property engagements, and SME capability development workshops. These are all important pathways for universities to drive 'learning regions'. On the other hand, if the balance slips too far towards 'instrumental' research, where universities are overly concerned with solving the practical problems of industry and government, their role in generating new 'risky' knowledge, in debating the ethics of economies and technologies, or arguing for the benefits of research which may be unpalatable to the government of the day, will be diminished.

29. http://www.uws.edu.au/__data/assets/pdf_file/0008/483362/SCS3860_A6_PocketProfile_2014_FNL.pdf **30.** Tim Dodd, 'Funding to fuel huge rise in PhD interns', Australian Financial Review 3 August p.29. **31.** Thorp and Goldstein 2010 **32.** Thorp and Goldstein 2010 p.50 **33.** http://www.researchinfosource.com/cil/2014/pdf/Ryerson%20University_s%20Model%20of%20Innovation%20Goes%20Global.pdf **34.** Nelson and Byers 2015, p.148 **35.** NSW Business Chamber 2014

FOUR
CULTIVATING INNOVATION

There is a general agreement about the barriers to creating innovative regions. Almost everyone would agree that it is the presence of resourceful, flexible and knowledgeable individuals who are 'on the ground' that makes the difference in making well-intentioned strategies actually materialize. And so this chapter discusses some of the ways in which 'innovation cultivators' – already there in schools, boardrooms, councils and governments – might be identified, incentivized, and encouraged.

'INNOVATION CULTIVATORS'

Existing central business districts are used to having chambers of commerce or other networking and lobbying groups. The range of actors that would be engaged in the innovation corridor will offer the chance to build new leadership communities of science, health and technology, capable of building international profile, providing mentoring, and enhancing levels of venture capital investment in the region. However, it is not clear that existing models of business representation are the best ways to empower innovators.

In their study of innovation districts, Katz and Wagner employ the term 'innovation cultivators' to refer to:

"the companies, organizations, or groups that support the growth of individuals, firms, and their ideas. They include incubators, accelerators, proof-of-concept centers, tech transfer offices, shared working spaces (with programs to support idea and firm development), and local high schools, job training firms, and community colleges advancing specific skill sets for the innovation-driven economy. In a small number of districts, legal counsel, patent attorneys, and venture capital firms are scrubbing project concepts to identify their value in moving forward."[36]

With this in mind, it is important to think about how these 'cultivators' might be brought together in formal and informal ways.

If we take Sydney Science Park, for example, the management there might seek to establish an advisory board of 'science and technology ambassadors'. Such ambassadors would be drawn from local employers, alumni, academics, and those who have left the region, but who retain strong ties to it.

36. Katz and Wagner 2014, p.11

LONDON'S MEDCITY

London's MedCity organisation, launched in 2014 from the Mayor of London's office, brings together three of London's leading universities: UCL, Kings College London, and Imperial. It declares its aims as being fourfold:

- "Creating a 'front door' for businesses, entrepreneurs, investors and academics to come to when they are confused by the complex environment across the region. MedCity has welcomed, directed and supported more than 100 approaches, from large pharmaceutical companies to digital entrepreneurs, businesses seeking research collaborations and investors considering setting up new funds."
- "Promoting the region as a base for life science investment and growth." through trade visits, academic, business and charity conferences.
- "Encouraging and enabling entrepreneurialism" by identifying barriers to those wanting to start business in London's medical and health industries.
- "Explaining the market" which includes bringing together academics and industries to explore commercial opportunities.

This is a nascent enterprise, and the established business plans provide an overview of some of the risks and costs involved with the initiative, as well as the positive achievements. Its longevity is by no means assured, even in an affluent city like London. However, even some of its basic activities, such as hosting workshops, bring to light the difficulty of health start-ups to get beyond the established procurement policies of the major health institutions.[37]

EVENT ECOSYSTEMS AND CREATIVE SPACES

There is a lot of discussion about the importance of 'creative' spaces for worker productivity. This may be exaggerated, but Richard Florida's work in popularizing the link between creativity and economic development has been taken seriously worldwide. Greenfield sites are now expected to mimic or offer a distinct experience to inner-city areas, and councils and developers are increasingly aware of this. The design of a greenfield to ensure a strong sense of place, social public spaces, high quality urban design, and an array of cafes and lifestyle options, will also provide a context for knowledge spillovers. Attention should be paid to how the Western Sydney arts sector might be integrated into these technology spaces.[38] In turn, there is evidence that strong 'event ecologies' enhances the density of inter-firm interaction leading to swapping product and market information that enhance knowledge spillovers. For example, many science parks are actively organizing events such as visiting business speakers, hackathons, or even simple sports competitions to encourage the mixing of ideas and individuals. This 'face to face' economy is also held to build up the trust necessary to undertake high-risk innovation projects.

SCIENCE, TECHNOLOGY AND ARTS SCHOOLING

"There is a need for far-reaching debate about how school age education is provided for beyond the classroom, through regional facilities."

The STEM agenda has been given a lot of attention in recent months, but public discourse could be enriched with more attention to the STEAM approach, which integrates arts with science and technology. For example, a school in Brooklyn combines a photography course with the building of a simple camera; Sesame Street has altered its program content to explicitly integrate different fields of knowledge (the Three Little Pigs story is given an emphasis on construction materials and structures, for example).[39]

37. Greater London Authority 2014 **38.** Deloitte 2015 **39.** Hollander 2013

WESTERN SYDNEY SCIENCE CENTRE

Western Sydney University is proposing the development of a Science Centre on its Werrington campus. These institutions, like Questacon in Canberra, serve a dual purpose: on the one hand, they fit within a regional family tourism infrastructure; on the other, they offer school students hands-on exposure to science. Scaling these museums up can address STEM provision at many levels. There are good examples of where this has been achieved internationally. For example, the Carnegie Science Museum in Pittsburgh not only boosts science facilities for a range of schools, but also hosts teacher-training and skills development workshops. It places informal science education at its centre: in other words, leisure time exposure to engaging live shows and exhibits is a key to developing student engagement. It works with a fourfold set of STEM goals, including 'inquiry based science and math education; integrated multi-disciplinary learning…rather than in silos by subject content; project-based group learning; and career awareness"[40] This latter point is very important given that the current direction of 'translational' disciplines in science and engineering means that future job options may not be within the skills set of school career advisors and teachers.

TAPPING INTO CORPORATE AND PUBLIC INNOVATION

Corporations are increasingly reducing risk by outsourcing innovation to start-ups, taking equity with possible acquisition of firm or product, but giving start-ups a 'leg up' through access and introduction to major customers and distribution lists.[41] Western Sydney University already has relationships with major corporations such as CBA, Woolworths, and Baxter Healthcare: their involvement in the innovative region will be significant. Lest this sound over-ambitious, it should be noted that innovation can be routine: even creating this kind of mindset of minor upgrades is an important shift in direction.

It is also important to note that the public sector innovation is a massive opportunity for the region. For example, Wales – with a population of 3 million – has created two new institutions: the Welsh Institute for Public Policy, which provides an evidence base for Ministers; and the Y Lab, which offers a disruptive, 'think tank' style of research aimed at addressing complex, elusive policy problems.[42]

The NSW Manufacturing Industry Action Plan expressly recommended that government should review its procurement rules to provide market opportunities for early stage companies:

> "The NSW Government should adopt a 'procurement' rather than 'purchasing' approach so that procurement strategies can improve the competitiveness of local manufacturers and service providers and their capacity to supply at short notice a full line of products and services to agencies. Processes that favour cheaper off-shore suppliers today might achieve short term cost savings with medium term costs to reliability of supply for less used products and services." (p.25)

The NSW government has announced various measures to improve this,[43] but future procurement could be geared towards encouraging innovation rather than solely cost competition. The UK based think tank NESTA has drawn attention to some of the structural problems facing public sector procurement worldwide, which could probably be boiled down to one key statement: "The fear of getting something wrong is so high within procurement that it creates a bias favouring big contracts awarded to market incumbents, rather than smaller contracts for younger innovative companies."[44] All major institutions, including the government and universities, could thus consider public procurement strategies as a key mode of stimulating upskilling and innovation, especially in SMEs.

CONCLUSION

With all the discussion of innovative industries and entrepreneurs, it is easy to lose sight of one thing: that the management of innovation is a skill set in its own right. Areas such as patent and intellectual property law, venture fund management, SME advice, business development specialisms in emerging technologies, incubator and accelerator development, and science park management all require on-going professional development to keep abreast of new trends.

Consideration might be given to two issues in particular. First, there is some concern expressed within Australia about the nature of university-business co-operation being among the lowest in the group of leading economies. Two of the major assessments of this, by INSEAD (Global Innovation Index) and the OECD (Science, Technology and Industry Scorecard) concur: the latter notes that only 3.5% of large firms in Australia collaborate with public research institutions, compared with 70% in Finland, 43% in Germany, 30% in the UK, and 22% in New Zealand. The figures are similar for SMEs. Thoughts might turn to how high-ranking countries on the indices, such as Finland and Singapore, facilitate this.

Second, how should training for innovation management best be delivered? Again, Western Sydney University can play a major role here, both in terms of executive education short courses, Masters programs, and co-funded or endowed PhD scholarships. The Sydney Science Park might also have opportunities here: the publicly-funded start-up company that managed Singapore's Block 71 incubator was successfully privatized, given the demand for start-up innovation management skills throughout South East Asia. The same could be said for science and technology museum management and curation. Partnerships between Western Sydney University and bodies such as the Powerhouse Museum, and the proposed Science Education Centre, could provide on-going, two-way transmission of best practice and skills development.

40. http://www.carnegiesciencecenter.org/stemcenter/ **41.** Lerner 2013 **42.** Symons 2015 **43.** NSW Trade and Investment 2014, p.14 **44.** Symons 2015 **45.** OECD 2014

FIVE
SHAPING THE INNOVATION CORRIDOR

This concluding chapter provides an overview of how the innovation corridor relates to existing policy strategies, particularly the NSW Government's pertinent planning, economic development, and transport strategies. The Innovation Corridor discussion is one about regional futures, and seeks to encourage anyone with an interest in Western Sydney to challenge their existing mental geographies of the region.

It is important to recognise that innovation doesn't have to be expensive. It is increasingly fashionable, indeed, to refer to 'frugal' innovation. And so,

> "Innovation has to become embedded not only within the institutions and firms that make up the region, but also among its customers, students, motorists, carers, van drivers, parents, and politicians."

MOBILITY ACROSS THE INNOVATION CORRIDOR

This paper has continued to work with the idea of an innovation corridor. It would be fair to say that this is a less defined transport route when compared with famed technology corridors such as the South East of England's M4 corridor, or Boston's Route 128, which are very significant motorway systems, but rather an attempt to 'think orbitally' as a means of complementing the existing East-West corridors such as the M4 and the Western rail line. At this stage, the Federal Government's roads proposals are likely to remake the geography of the Western Sydney Employment Area. The NSW government's NW rail link is another massive infrastructural investment that is likely to provide a significant uptick in the region's coherence.

The Sydney Science Park's and Western Sydney University's LaunchPad's proximity to the site of the Western Sydney Airport and planned State and Federal Government road and transport infrastructure projects will, if appropriately coordinated, integrate well with designated 'employment', 'residential' and other mixed-use regional masterplanning priorities.

Other parts of the Western Sydney orbital transect provide more challenges for integration. Corridors can be both 'zippers' (pulling together different elements of the region into functional coherence) and barriers, cutting off or 'bypassing' areas that may have ingrained social problems such as low educational levels. While regional policy is no substitute for targeted social policy, care should be taken to 'join up' different state agencies, councils and institutions around the emerging corridor. It is particularly important to consider that the market would likely dictate high density commercial growth leading in one direction from the airport towards Sydney CBD. Councils, particularly, have a major role to play in connecting their localities to the wider opportunities the corridor has to offer, both in terms of land use planning and economic development strategies.

Overall, however, a key principle must be that as Sydney's population grows, East-West commuting vectors will become exhausted, and an orbital strategy – based around the proposed motorway and other linkages – is something that will become inevitable.


PARKROYAL

INNOVATION AND THE AIRPORT REGION: CONFIGURING THE SECOND AIRPORT

At this stage, there is still uncertainty about how Sydney's second airport at Badgery's Creek will be developed, and in turn how it will affect the alignment of the Western Sydney Employment Area. The Federal government's refusal to fund a rail link has been roundly criticised, and is likely to limit the airport's scope. However, in many ways smaller airports may be as efficient for local business as aerotropolis type models. For example, Hong Kong International Airport, which has extreme connectivity, still has freight bottlenecks due to the volume of traffic that goes into the airport, and has generated a 'halfway' depot (a kind of bulk-breaking) in between the centre of Hong Kong and the airport itself.

"The airport and motorway infrastructure will benefit the region, but institutions like the university, government and councils need to work to make sure they capture benefit and avoid the 'bypass' and 'splintering' effects that fast connections can bring."

What is very likely, though, is that the new airport will offer various economic development opportunities. First, there will be a range of niche jobs related to the various elements of cargo logistics, airport management, airline employment, air traffic control, and food and beverage. Second, even if the airport is largely focused on domestic traffic, this could allow new network possibilities for firms that have supply chains across Australia, with time sensitive products, and with strong face to face requirements such as customer relations. Third, 'temporary' clusters such as trade fairs are now identified as being important to connect producers to customers, allowing informal review of supply chains and information exchange between customers and suppliers.[46] It may appear humdrum, but a supporting infrastructure of hotel and conferencing facilities proximate to the site could be fundamental to enhancing relationships at a sector level between producers and customers.

And so, it is important to recognise that the success of the new airport will be 'chicken and egg': without high volumes of business travel and competitive exports, airlines will not put on significant quantities of service. It should not be 'what the airport will bring to the region' but rather 'what the region will bring to the airport'

APPROPRIATE INNOVATION

In a recent discussion paper for the Centre for Western Sydney, geographers Fagan and O'Neill argued that "while economic prosperity benefits many GWS households in the early 21st century, differential access to employment opportunities continues to underpin significant social and spatial inequalities for parts of GWS" (p.10).[47] Despite the catalytic potential of the many new innovation spaces in the region, it is important to consider the demographic and labour market background of the region. There are many Western Sydney residents who are lacking the skills required to participate in the innovation economy. Moreover, despite the powerful rhetoric put forward by economic populists such as Richard Florida and Enrico Moretti about the multiplier effect that innovative jobs have on regions as a whole, this has not been well substantiated. It is by no means clear that working for (or via) a 'disruptive' digital business such as Uber will be any better in the long-run for a taxi driver than existing employers; process innovation can allow Australian firms to become more competitive, but at the possible risk of net job loss as new technologies such as robots become more widespread.

And so it is important also to have a discussion about what kind of innovation is appropriate for Western Sydney, bearing in mind its extremely diverse labour markets. The idea of 'frugal innovation' has become increasingly popular in recent years, referring to the ability to innovate where producer and consumer are working with limited resources. In other words, instead of expensive research and development laboratory style innovation approaches, more emphasis should be placed on cheaper technologies, which include simpler ways of testing products (through user generated data on social media), more focus on social entrepreneurship (which could be an important element of accelerator activity), and ways in which Sydney's high costs of living can be reduced through an expanded – and defended – sharing economy. [48]

ECONOMIC DEVELOPMENT PRIORITIES

There are other priority elements of the NSW Economic Development Framework which can be integrated within the vision of the Corridor. These include the attraction of business events, from trade fairs to academic conferences; integrating NSW public sector decentralisation plans into the corridor; following through the recommendations of the Agriculture and Minerals Industry Action Plans in relation to the peri-urban sites such as the agripark; and capitalising on international education expansion. Western Sydney's existing manufacturing base can be refined through targeted training and introduction to new technologies, both in terms of business management (eg. introducing 'software as a service' benefits) and in additive manufacturing, which could in the medium term reduce the need for outsourcing.[49]

Furthermore, and very importantly from the point of view of the LaunchPads and Science Park initiatives, the NSW Digital Industry Action Plan also has a range of proposals that will benefit the region if they can be captured. Much of the stimulus for this lies between Federal and State Governments, but there are signs that governments at all levels are recognising the specific requirements of digital economies. In the UK, for example, London's growing importance as a digital economy centre has been recognised with a new visa category, new public angel and venture funds, R and D tax credits, a 'patent box' (a reduced tax rate for profits accruing from patented inventions), and improved transport links between innovation hubs. And so the ability for government, universities, and firms to develop similar policy mechanisms to spread Sydney's digital capabilities beyond the CBD is within our grasp.

46. Bathelt and Glückler 2011 **47.** Fagan and O'Neill 2015, p.10 **48.** see, for example, Radjou and Prabhu 2015 **49.** Clark 2015 pp. 163-4

CONCLUSIONS

This paper has reviewed some of the key literatures on innovation and how it can be tied into territorial and urban development strategies such as 'learning regions'. At a time of a major rebrand of the region's university, it is also timely to consider how Western Sydney's identity is changing. And so the following conclusions suggest some on-going priorities in terms of how the region might be shaped.

The first task facing some of the major institutions with a stake in Western Sydney is to consider how its spaces – which can range from high spec laboratories to shared work spaces to advanced logistics warehousing to industrial estates – can be linked into an innovative ecosystem. The innovation corridor straddles a diverse range of employment spaces, from laboratory buildings in the Sydney Science Park to start-up space in the LaunchPads to cutting edge greenhouse technology in the Agripark.

The second major task is to think about how the region is defined, socially, economically, and politically. Does the diversity of the region, which has some of Sydney's highest and lowest unemployment local government areas, for example, require a more expansive vocabulary? Are we using the right metaphor – the corridor – to describe it? Innovation spaces around the world have attracted a number of descriptors such as arc, corridor, vale and valley, hub, and core, so it is important that the Innovation Corridor has a coherent branding, and marketing, strategy as it develops. This involves thinking beyond the region, recognising a Sydney-wide innovative ecosystem, and the global nature of economic development. This may require embracing 'co-opetition': strategic collaboration with apparent competitors to raise the overall regional capacity. For example, Edinburgh Science Triangle is a marketing vehicle funded by several of the city's ostensibly competing science parks and tech hubs, with strong city council management input, with the express assumption that potential investors or firms will look at city-regions as a whole.

So the more discussion and debate about the region – talking its different futures into existence – the better. One other important point: short electoral cycles can wreak havoc with innovation. Experience elsewhere suggests that conscious efforts by regional politicians to build bipartisan support for policy is an important element of learning and working regions.[50] This is a major challenge, but one where universities, particularly, can provide leadership. Many studies of successful innovation regions highlight the importance of a shared basic minimum of consensus on policies that will not change or be politicised during election campaigns.

The third task is to think about how the region, and its innovation, is to be measured. On the one hand, the level of statistical knowledge of the economic activities of the region is underdeveloped. Furthermore, breaking it down into local government areas is still an insufficient way of understanding the distribution of jobs, the skills and capacities of workers, and so on. And we might be missing some key innovative practices: a study by the UK based NESTA policy institute uncovered a range of 'hidden innovation' activities, some of which were very substantial indeed, such as the presence of a huge range of genetic tests within the National Health Service.[51] A series of detailed qualitative studies, such as supply chain ethnographies, a compendium of 'success and failure' narratives, entrepreneur biographies, experimental economic heat maps, and social media-generated consumer studies, are required to refine and deepen the indicators we get from statistical aggregation sources.

The fourth task will then be to consider the appropriate governance mechanisms. The emerging Greater Sydney Commission will be a key actor here, but delivering innovation spaces will only be one, possibly incidental, element of its remit. More targeted, finer grained approaches might be required. For example, Special Economic Innovation Zones might be considered as a mode of defining a specific area and applying different taxation, marketing, management, and tenanting investments to it.[52] As these are likely to include large areas of both public and private land, this government mechanism might be quite different to the existing practice in NSW with its large precinct-defined agencies of urban development.

The next task is to continue to deepen the evidence base around future industries. In their forecasts for NSW government, Access Economics projected that the construction and health care and social industries will grow gradually over time: yet we could add that both are sectors where Western Sydney could disrupt and innovate quite rapidly. For example, a number of the key case studies of advanced technology that have appeared in government documents are located in Western Sydney: in the field of cleantech, BluGlass, an advanced semiconductor company that produces technology linked to LED lights and solar cells is in Silverwater; Broens, a precision engineering firm working in aerospace, defence, health and automotive technology is in Ingleburn. Identifying these business leaders and involving them in the corridor's evolution is an important element in building out the corridor's strengths. Considering how the needs of major employers, such as the companies locating in Sydney Science Park, and the agriculture and health precincts, are aligned to the graduate and post-graduate profiles of Western Sydney University is a key challenge for the next few years.

50. Clark 2015 **51.** NESTA 2007 **52.** Access Economics 2010, p.105 **53.** Access Economics 2010

REFERENCES

Access Economics (2010), *The NSW Economy in 2020: A foresighting study.*
http://www.industry.nsw.gov.au/__data/assets/pdf_file/0006/53691/NSWEconomyin2020_Final_100917.pdf

Bathelt, H. and J.Glückler (2011), *The Relational Economy: Geographies of Knowing and Learning.*
Oxford: Oxford University Press.

Bergek, A. and C.Norrman (2008), 'Incubator best practice: a framework', *Technovation 28: 20-8.*

Brindle, S. (2015), 'Y Lab: a new public services innovation lab for Wales', 27 July
http://www.nesta.org.uk/blog/y-lab-new-public-services-innovation-lab-wales?utm_source=Nesta+Weekly+Newsletter&utm_campaign=5256b63b49-Nesta_newsletter_29_07_157_27_2015&utm_medium=email&utm_term=0_d17364114d-5256b63b49-181310489

Castells, M. and P.Hall *Technopoles of the World.* London: Routledge.

Charles, D. (2006), 'Universities as key knowledge infrastructures in regional innovation systems', *Innovation* 19: 117-30.

Charlton, A. (2014), 'Dragon's Tail: The Lucky Country After the China Boom'. *Quarterly Essay* 54

Chief Scientist (2015) *The Importance of Advanced Physical and Mathematical Sciences to the Australian Economy.*
http://www.chiefscientist.gov.au/wp-content/uploads/Importance-of-Science-to-the-Economy.pdf

Clark, J. (2015) *Working Regions: Reconnecting Innovation and Production in the Knowledge Economy.* London: Routledge.

Deloitte (2015) *Building Western Sydney's Cultural Art Economy – a Key to Sydney's Success*.
http://www2.deloitte.com/content/dam/Deloitte/au/Documents/Economics/deloitte-au-economics-western-sydney-cultural-infrastructure-report-250215.pdf

Dodd, T. (2015), 'Funding to fuel huge rise in PhD interns', *Australian Financial Review* 3 August p.29

Fagan, R. and P.O'Neill (2015), *Work, Places and People in Western Sydney.* Centre for Western Sydney

Fitzsimmons, C. (2015), 'How to become your own venture capitalist' Australian Financial Review
http://www.afr.com/personal-finance/how-to-become-your-own-venture-capitalist-20150406-1m2soe

Goddard, J. and P.Vallance (2013), *The University and the City.* London: Routledge.

Greater London Authority (2014), https://www.london.gov.uk/mayor-assembly/mayor/mayoral-decisions/MD1458

Gruen, N. (2015) *Government as Impresario: Emergent Public Goods and Public-Private Partnerships 2.0*. London: NESTA.
http://www.nesta.org.uk/sites/default/files/government_as_impresario.pdf

Hajkowicz, S. (2015), *Global Megatrends.* CSIRO Publishing.

Hollander, S. (2013), 'STEAM blends science and the arts in public education', *Wall Street Journal* 2 December
http://www.wsj.com/articles/SB10001424052702304747004579224003721262792

Holmes, S. and D.Gupta (2015), 'Opening Aladdin's Cave: Unpacking the Factors Impacting on Small Firms', proceedings of Small Business Conditions and Finance, Reserve Bank of Australia annual conference, , **http://www.rba.gov.au/publications/confs/2015/pdf/holmes.pdf**

Institute for the Future (2009), *Healthcare 2020* **http://www.iftf.org/uploads/media/IFTF_SR-1276_HC2020_Perspectives.pdf**

Katz, B. and J.Wagner (2014), *The Rise of Innovation Districts: a New Geography of Innovation in America.* Washington DC: Brookings Institution.
http://www.brookings.edu/~/media/Programs/metro/Images/Innovation/InnovationDistricts1.pdf

Komninos, N. (2002), *Intelligent Cities: Innovation, Knowledge Systems, and Digital Spaces*. London: Routledge.

Lerner, J. (2013). '*Corporate venturing' Harvard Business Review* **https://hbr.org/2013/10/corporate-venturing**

Link, A. N. and J.T.Scott (2015), 'Research, science and technology parks: vehicles for technology transfer', in A.N.Link, D.S.Siegel, and M.Wright (eds), *The Chicago Handbook of University Technology Transfer and Academic Entrepreneurship*. Chicago: University of Chicago Press. 168-187.

Martin, R. and P.Sunley (2003), 'Deconstructing clusters: chaotic concept or policy panacea?' *Journal of Economic Geography* 3 (1): 5-35.

Muro, M., J.Rothwell, S.Andes, K.Fikri, S.Kulkarni (2015), A*merican's Advanced Industries: What they are, where they are, and why they matter.*
Washington DC: Brookings Institution.**http://www.brookings.edu/~/media/Research/Files/Reports/2015/02/03-advanced-industries/final/AdvancedIndustry_FinalFeb2lores.pdf?la=en**

Nelson, A. and T.Byers (2015), 'Challenges in university technology transfer and the promising role of entrepreneurship education', in A.N.Link, D.S.Siegel, and M.Wright (eds), *The Chicago Handbook of University Technology Transfer and Academic Entrepreneurship*. Chicago: University of Chicago Press. 138-67.

NESTA (2007), *The Innovation Gap.* **http://www.nesta.org.uk/sites/default/files/the_innovation_gap.pdf**

NSW Business Chamber *Industry Research Collaboration.* Discussion paper.

--- (2014) *Industry Research Collaboration: Stakeholder Insights.*
http://www.nswbusinesschamber.com.au/NSWBC/media/Forms/NSWBC-Industry-Research-Collaboration-Insights-Paper.pdf

NSW Trade and Investment (2014), *Progressing the NSW Economic Development Framework.*

OECD (2014), OECD Science, Technology and Industry Scoreboard 2013. OECD Publishing. **http://dx.doi.org/10.1787/sti_scoreboard-2013-en**

Pagano, M. (2014), 'Why Cambridge is at the heart of Britain's economic recovery', *Independent* 17 February
http://www.independent.co.uk/news/business/analysis-and-features/why-cambridge-is-at-the-heart-of-britains-economic-recovery-9134717.html

Phillips, S.M. and H.Yeung (2003), 'A place for R & D? The Singapore Science Park', *Urban Studies* 40 (4): 707-32.

Pisano, G. (2015), 'You need an innovation strategy', Harvard *Business Review* June p.51.

Radjou, N. and J.Prabhu (2015), F*rugal Innovation: How to do more with less.* London: Profile/The Economist.

Rothwell, J., J.Lobo, D.Strumsky, M. Muro (2013) *Patenting Prosperity: Invention and Economic Performance in the United States and its Metropolitan Areas.* Washington DC: Brookings Institution

Shapiro, J. (2015) 'Australian VC fund to channel China's wealth', *Australian Financial Review* 16 July p.23

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

Smith, H.L. and S.Bagchi-Sen (2010), 'Triple helix and regional development: a perspective from Oxfordshire in the UK', *Technology Analysis and Strategic Management* 22: 805-818.

Symons, T. (2015) 'How not to spend it: 6 ways procurement blocks innovation',
http://www.nesta.org.uk/blog/how-not-spend-it-6-ways-procurement-blocks-innovation

Thorp, H. and B.Goldstein (2010), *Engines of Innovation: the Entrepreneurial University in the Twenty-First Century.* Chapel Hill: University of North Carolina Press.

Urbis (2013), *Broader Western Sydney Employment Area: Economic Issues and Drivers Study.*

Warwick Economics and Development, High Value Manufacturing Catapult Profile,
https://hvm.catapult.org.uk/documents/2157642/0/HVM%20Baseline%20report

Weller, S. and P.O'Neill (2014), 'De-industrialisation, financialisation, and Australia's macro-economic trap', *Cambridge Journal of Regions, Economy and Society* 7: 509-26.

White, K. (2014), 'Startups are the new corporates, corporates are the new startups', Startupsmart 18 November
http://www.startupsmart.com.au/growth/startups-are-the-new-corporates-corporates-are-the-new-startups/2014111813644.html

Wray, F. et al (2010), 'Finance and local and regional economic development', in A.Pike, A.Rodriguez-Pose, and J.Tomaney (eds) *Handbook of Local and Regional Development.* London: Routledge.

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

WESTERNSYDNEY.EDU.AU