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Delivering change

Supporting links between universities and high-growth firms in cities

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"The Centre for Cities is a research and policy institute, dedicated to improving the economic success of UK cities.

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Executive Summary

The recent recession and subsequent recovery has concentrated economic growth in cities. The firms that are driving economic growth are largely in knowledge intensive businesses and services, and are increasingly urban. For many UK cities, their greatest concentration of knowledge and innovation is their universities and therefore **national and local decision makers are looking to support collaborations between universities and high-growth firms**.

The UK is improving with regards to these collaborations, and its cities are well placed to deliver further change. National policies, for example the Catapult Centres, are generally well received by businesses and universities alike. However, in practice, these policies have to be delivered locally. It's at the city level that decision makers understand their growing businesses and their universities. And it is cities that can address and overcome the barriers to collaboration.

City decision makers should use their local knowledge and relationships to identify where there are opportunities to build on successful collaborations.

Cities should help businesses and universities to overcome perceived barriers to collaboration and in turn build scale.

To achieve these twin aims, cities need…

…**a flexible approach**

Cities need to understand and act upon the strengths of their growing firms and their universities without being overly prescriptive.

While some cities are focusing on their comparative or historical advantages the most successful examples also support growth in their smaller firms either through informal links or by embedding supply chain benefits.

…**to act at the right scale.**

Cities need to intervene (for example fund programmes or map industry needs) at a scale that benefits both their growing firms and universities.

While some cities invest to ensure continued and improved benefits from successful relationships between firms and universities, for other cities building networks between cities can ensure they have sufficient scale to match the challenges of businesses with specific expertise in universities.

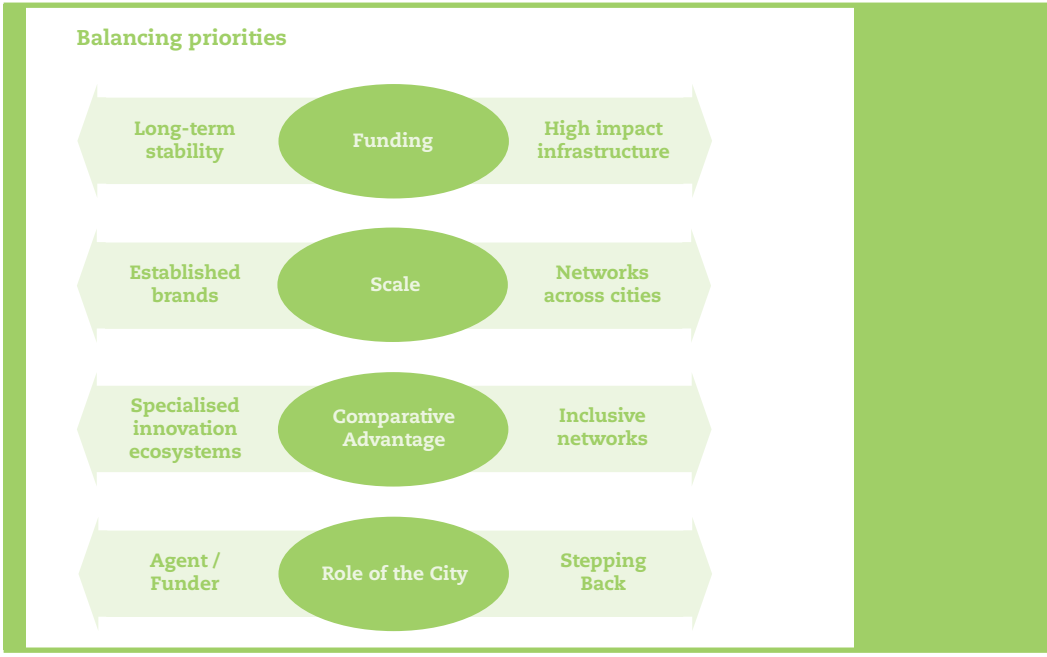
Some of the most successful collaborations, for example Interface Food and Drink or the N8 Universities, are established across city boundaries. Cities need to ensure that they break the barriers for smaller firms to engage with firms and universities from different areas.

…**to ensure high-growth firms can benefit.**

Cities that have strong networks, economies and collaborations need to ensure collaborations do not suffer from the congestion effects of their successful innovation ecosystems, like networking fatigue (for example in Cambridge) or focusing on a local comparative advantage to the cost of growing firms in other sectors (as may be apparent in Otaniemi).

Cities need to target barriers to collaboration, building on successful collaborations and ensure continued expansion and the benefits of scale are available to growing firms.

The economic recovery will be driven by knowledge intensive sectors. Cities where growing businesses can work in effective collaboration with their universities will be well placed to capitalise on this.



Introduction

Changes in culture and industry over the past two decades have put a greater value for firms firstly on knowledge, and secondly on 'open innovation' between companies, between industries and between institutions. This has strengthened the role of the university in city economies as a knowledge – and therefore value-generator.

In turn, there is an emergent consensus that collaborations between universities and high-growth firms are increasingly important for the national economy as innovation enables its growing firms to compete globally.

The UK is now a world leader in University-Business Collaborations.

The UK has long had a thriving higher education sector; 10 of the global top 100 universities are in the UK including three of the top 10.[1] However there has also been a persistent assumption that British universities have done badly compared with their international comparators (particularly Germany and the US) with regards to collaboration with businesses and universities.

Historically the evidence suggests that this may have once been true, but over the last five years the UK has jumped from 11th to 2nd in the global rankings for university – business collaboration.[2] The Wilson Review 2012 reported that improvements over the last 10 years were largely due to a cultural change (from both firms and universities) towards open innovation and in particular the role of universities in providing high level skills and world class research.

This change in approach can also be attributed in part to the change of funding models that universities have undertaken over this period alongside wider government policies aimed to support collaborations. This shift has encouraged universities away from attempts to make professors 'commercially-minded', towards supporting the links that exist and improving the benefits of them.

UK cities are increasingly looking to universities as a hub to strengthen the links and attraction to – as well as productivity of – high-growth firms. Whilst there are many examples of cities doing this well, others struggle turning their ambition into reality.

This report is centred on case studies that – rather than showing best practice – highlight different ways of approaching the issue. Drawing the lessons from how cities, universities and businesses are delivering on their ambitions to drive productivity and innovation in their growing firms in different ways and at different scales. The paper sets the framework for these decisions and considers the ways in which cities can remove the barriers to high-growth firms collaborating with universities.

1 Times Higher Education, World University Rankings. Available at http://www.timeshighereducation.co.uk/world-university-rankings/2012-13/world-ranking (accessed 11/04/2014)
2 Global Innovation Index, Available at http://www.globalinnovationindex.org/content.aspx?page=data-analysis accessed 11/04/2014

Key Questions and issues

Why cities?

Cities are where the vast majority of collaborations between firms and universities are happening. Cities are also best placed to establish and support these collaborations.

UK Universities are overwhelmingly in cities. Three quarters of UK Universities are based in cities, and over nine in 10 are within a 45 minute drive.[3] Cities are home to 60 per cent of business births in the UK and 53 per cent of businesses. Cities are also most attractive for knowledge intensive jobs (73 per cent of KIBS jobs are in cities)[4] and universities have been shown to add value to these sectors.[5] With highly skilled labour forces, knowledge intensive jobs and the majority of universities located there, cities are well placed to bring together different skills sets, working relationships and financing risk profiles. It's therefore cities where these relationships are formed and where the decisions about support should be made.

Why universities?

Universities have been actively pursuing different sources of income following the Browne report (2010) and the resulting cuts to HEFCE funding. But matching different skill sets and risk profiles can help both universities and businesses.

The increasing emphasis placed by universities on business collaboration[6] has been partly attributed to changes in financial incentives. Primarily the shift in the approach of HEFCE to reflect discreet payments for knowledge exchange programmes and changes in Higher Education Innovation Funding.[7] Alongside this, universities are increasingly under pressure to ensure they are working with businesses, in part to ensure their access to REF (Research Excellence Funding).

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3 HEFCE, 2014
4 Centre for Cities (2014), *Cities Outlook 2014,* London: Centre for Cities
5 OECD, 2007 Competitive regional clusters: national policy approaches
6 HEFCE, 2013. Higher Education – Business and Community Interaction Survey
7 HEFCE, 2012. Industry-Academic Links in the UK' (HEFCE 98/70) and 2012. Funding for knowledge exchange - Higher Education Innovation Funding (HEIF)

There has also been a wider cultural change towards open innovation – particularly in growing knowledge intensive industries, this has led to a higher demand for links with universities. Income from knowledge exchange between UK Higher Education Institutes and partners rose 45 per cent in terms of real value since 2003-04.[8] Furthermore, for many sectors, commercial partnerships can improve both their research and teaching, attracting students increasingly conscious of career opportunities (also captured in the Key Information Set criteria).[9]

The Higher Education - Business Community Interaction (HE-BCI) survey showed that universities in the UK contributed £3.4 billion to the economy in 2011/12 through services to businesses – there is clearly significant value to be derived from these collaborations. Businesses that work with universities are usually motivated by the potential to innovate, develop networks and increase their market competitiveness.[10] These relationships can range from contracting research, informal links or innovative research partnerships.

Universities are key to their cities as direct employers and educators

Centre for Cities research found the largest direct impact from universities on the local economy is often the direct employment and money spent by its staff and students.[11] Recent Universities UK research also found that the higher education sector is comparable in terms of direct employment to the legal services sector. Indirectly, the supply of highly skilled labour is the greatest driver of economic activity from a university.

Primarily, universities are teaching and research institutions. Throughout our research this has been re-iterated, policy makers looking to support links must recognise there is an opportunity cost to university staff and students' time. Cities that are succeeding take unnecessary bureaucracy and administration away from professors and departments and break the barriers to collaboration that are identified by universities as well as their businesses.[12]

Why high-growth firms?

Public policy is increasingly targeting high-growth firms.

Many commentators, including NESTA, OECD, and The Work Foundation have called for a greater focus of Government funded business support on high-growth businesses. This is where policy can get 'maximum impact' rather than for example start-ups or university spin outs. Nascent start-up firms are unlikely to have to time or capacity to pursue innovative collaborations beyond

8 HEFCE, 2013. Higher Education – Business and Community Interaction Survey
9 The Key Information Sets (KIS) provide comparable sets of information about undergraduate courses based on student destination, accreditation, how the course is taught and assessed, student satisfaction and costs.
10 Based on Survey data - "Andersen, De Silva, 2012 'Collaborate to Innovate: How businesses can work with universities to generate knowledge and drive innovation'
11 What impact do Universities have on City Economies, 2011. Available at http://www.centreforcities.org/blog/2011/05/05/what-impact-do-universities-have-on-city-economies/, accessed 11/04/2014
12 Called for in: Russell Group, 2011 Russell Group response to the Wilson Review. Available at http://www.russellgroup.ac.uk/uploads/Tim-Wilson-14-November-FINAL_1.pdf

their core business and are high risk when it comes to longer term innovation partnerships due to their failure rate. Whilst larger firms typically make decisions on a larger scale and independent of city level support for partnerships. This paper concentrates on growing firms rather than spin outs, the value of which is a source of much debate.[13]

Policy background – where have we been?

There is a significant recent history of policy in the UK aimed at getting universities to engage with businesses.[14] This can be charted by the agenda setting reviews and acts over this period.

Policy background

1988: Education Reform Act
This act established a framework that first encouraged University-business collaboration although without explicit mention.

1993: Realising our Potential White Paper
This Conservative government paper set the tone for the funding of research to be explicitly linked to wealth creation and enhancing the UK's international market competitiveness.

1997: Dearing Review into Higher Education
Alongside the main recommendations of introducing tuition fees, this report highlighted spin outs and incubators as having potential for future funding opportunities.

2003: Lambert review of Business-University Collaboration
The Lambert review undertook the first focused study of university-business collaboration in the UK and identified steps that would promote and support its development. The report highlighted both global competition and open innovation as key trends that UK universities were well placed to capitalise on. The review also identified a common and persistent challenge - to increase the demand from businesses to work with Universities. The recommendations relating to a "third stream" of funding for universities have been attributed with the accelerated business-facing activities of UK universities over the last decade. The review led to the Lambert toolkit which aimed to facilitate negotiations between universities and businesses around innovative collaborations.

2007: Sainsbury review of government's science and innovation put an emphasis on the role that universities have with innovation and research. The report showed that collaborations were beginning to improve and also supported the role and expansion of Knowledge Transfer Partnerships.

13 Brown, R. and Mawson, S. (2013) 'Trigger points and high-growth firms: A conceptualisation and review of public policy implications', *Journal of Small Business and Enterprise Development,* 20(2), pp. 279-295.
14 Teaching company scheme, Knowledge Transfer Partnerships (now managed by Technology Strategy Board), the Third Mission, the Spin-outs agenda

Policy context – where are we now?

With the broadly supportive BIS responses to the recent Wilson and Witty reviews, university and business collaboration appears to be an important and changing part of both the higher education and business innovation policy agenda.

Wilson Review of Business - University Collaboration, 2012

The Wilson review found university and business collaboration has improved hugely over the last 10 years in both the *quantum* and the *quality* of collaboration. It found that competition between universities for students, staff and research grants has led to more business relations, but collaboration between universities has also lead to successes.

The Government response was to provide The Key Information Set which gives prospective students information about different courses and institutions as well as their commercial activities.

The Wilson review also considered the specific needs of SMEs. It found that networking between universities and the business community is a critical component of an efficient innovation ecosystem, especially for highlighting opportunities in the SME sector to graduates.

The Government responded by creating the National Centre for Universities and Business (NCUB) which aims to strengthen collaboration between the UK's higher education and business sectors. The NCUB attempts to maximise the support for growing fims and the value of innovative research and development from universities. The ongoing BIS Select committee is also evaluating the funding processes of collaboration and its role in local growth.[15] Recent policy announcements regarding University Enterprise Zones and Catapult Centres are also discussed below.

Witty Review of Universities and Growth, 2013

The report supports the drive to 'commercialise' research outlined in the Government's Industrial Strategy proposals. There is also support for greater collaboration between universities and

15 BIS Select Committee on Business-University Collaboration is expected to report in Summer 2014

SMEs, advocating "an enhanced third mission" for universities alongside research and education – to facilitate economic growth.

The review set out a key role for LEPs as well as cities in helping build networks and disseminate funding to support these collaborations.

The BIS response agreed that Local Enterprise Partnerships (LEPs) should put universities at the heart of their thinking and decision-making and should direct a large share of the £1 billion of European Structural and Investment Funds to universities.

It recommends that LEPs should collaborate beyond their own area with universities "whose cutting edge research generates economic activity through innovation" and should identify regional comparative advantages with the potential for economic growth.

The Government's response is to create a new Advisory Hub for Smart Specialisation along the EU concept of identifying regions' comparative advantages and promoting diversified growth in these industries.

The report's headline proposal is for a £1 billion fund over the life of the next Parliament for 'Arrow Projects,' bringing together LEPs, universities and industrial and supply-chain partners to develop "new technologies through mobilising national clusters in fields offering significant international markets."

The Government response was to "work with partners to realise The Arrow Projects", which broadly follow the industrial strategies previously laid out and form a central part of the 'sector not postcode' approach advocated by the report.

University Enterprise Zones (UEZs)

The 2013 Budget announced a £15 million pilot programme for UEZs which aims to encourage universities role in local growth. The bidding was open to the eight core cities with the winning bids announced after the time of writing. The university enterprise zone is different to previous enterprise zones as they do not offer business rate discounts. However each UEZ will have support from UK Trade and Investment and a 'clear offer' from the relevant local planning authorities of simplified planning constraints where relevant.

UEZs offer 'capital only' spending which is expected to be added to by private funding and used for physical infrastructure investment. This model of university business collaboration may be helpful for some cities for example helping with funding for new incubator space (like Engine Shed in Bristol). However in limiting the fund to capital spending it excludes cities that may benefit from other expenditure (for example supporting existing networks). By limiting the pilot process to a single bid for each of the core cities, it might also have missed opportunities in the (albeit pilot phase) bidding process. The £5 million allocation for each site is to be spent over a 3-year period, which might also place an indicative limit on its use.

UEZs are designed to support high-growth firms in the government defined 'industrial strategies' or local growth initiatives. Whilst the focus on growing firms and comparative advantages is appropriate, there are risks. For example UEZs must ensure that they don't become overly focused on certain sectors or firms (as shown with the Nokia Research Centre in Helsinki).

Although the University Enterprise Zones recognise the importance of place-specific policy and might be of use for some core city areas, the impact will remain limited by some of the bidding document's parameters and re-visits some of the pitfalls of previous Enterprise Zones.[16]

Catapult Centres

Catapult Centres were established in 2012 with the aim to bring the UK's businesses and scientists together on late-stage research and development in seven specific research areas located in physical centres. The Catapult model has been modelled in part on the Fraunhofer model (see later case study and comparison) and similarly to the Arrow Projects provide support for sectors rather than specific locales.

The aim is to commercialise 'high potential' ideas and products. It remains too early to properly evaluate their impact, the key to their success will be the buy-in from partners, as well as engaging high-growth firms and researchers beyond initial funding rounds.

Innovation vouchers

Innovation vouchers aim to enable small businesses to work with an external expert for the first time, gaining new knowledge to drive innovation and help businesses grow. This central aim has been welcomed by businesses and universities.[17] To be eligible, firms must be working with an expert for the first time; it also must be a challenge that is in need of specific assistance.

The scheme benefits from being open to all SMEs (therefore not being too prescriptive) and a short and simple online application process. However there is a risk of balancing the burden of bureaucracy and allowing for 'additionality'. Innovation vouchers must ensure that they are

16 Larkin,K. & Swinney, P. (2011) *What would Maggie do?* London: Centre for Cities
17 Centre for Cities interviews

not regularly funding collaboration that would already be happening. Our conversations have also found that the value of the voucher (£5,000) is rarely enough to make an unviable piece of research viable.

What's the role for cities in encouraging better collaboration between universities and high-growth firms?

Effective city level policies need to recognise that universities and high-growth firms are not homogenous groups.

Clearly universities have their own research and commercial business strengths. But a university as an institution also works differently to its departments and its staff who often operate almost independently of the organisation, especially in a commercial setting.[18] High-growth firms also vary in their needs and expectations from collaborations. For some, there will be little benefit from collaborating at all, others will be intrinsically linked to departments or consult with professors to overcome discreet challenges. It is by using local knowledge, building networks and engaging key players that decision makers can find the right level of support for effective collaborations.

This means supporting their high-growth firms by removing the barriers they perceive to collaborate with universities, including those beyond their city boundaries. Cities need to adopt adaptable strategies for different sectors, different businesses and different relationships. The city's role in these models can vary from being an *agent **of*** change (for example providing funding for Engine Shed in Bristol) to being a *platform **for*** delivering change (for example a centre of excellence in the Fraunhofer model).

Cities can ensure high-growth firms benefit from university collaborations in different ways by…

Supporting their long-term, large scale innovation systems through…

- Mapping and supporting industry and research strengths to enable businesses to work in close collaboration with a university or department, for example in the **Fraunhofer** model.

18 Centre for Cities interviews

- Working with partners to build and form networks that benefit from the strengths of their universities and develop shared space for business and universities to co-locate. For example bio-tech and consultancy firms in **Cambridge** and its science parks.

Building scale to match business challenges and demand for innovation with universities' research expertise through…

- Building innovation networks beyond their city boundaries around common interest groups, that deliver the scale of businesses and expertise to compete in global trade. For example Scottish food and drink producers brought together by **Interface**.
- Bringing universities and businesses together across city boundaries to access infrastructure otherwise beyond their reach. For example small businesses using the **N8 High Performance Computer**.

Identifying comparative advantages and removing the barriers to collaboration …

- Providing infrastructure funding and business support to improve firms' productivity and create opportunities from a local academic strength. For example digital animation firms in Middlesbrough's **Digital City**.
- Identifying funding opportunities that benefit locally successful industries, taking the long-term financial risk to expand support for a successful programme. For example Bristol's **Engine Shed** which came from the SETSquared partnership.

There is no single blueprint that every city can or should implement. Cities that are making best use of university collaborations with high-growth firms are adopting flexible approaches that understand local conditions and remove barriers identified by their partners. And ensure that successful relationships are built upon and improved rather than stagnating or obstructing others.

Case Studies

The evidence suggests that by far the most prevalent prompt for successful collaboration is through individual relationships rather than through Technology Transfer programmes or university administration offices.[19] Therefore the best approaches often rely on building the scale and networks of relationships that allow for these collaborations to happen, and reducing the barriers to future relationships rather than leaving city decision makers to choose and match firms with expertise or departments.

The value of these case studies is not as a definitive list of 'best practice' but is instead in analysing the different approaches and frameworks that cities have used to succeed.

19 Abreu et al. 2010. *Knowledge exchange between Academics and the Business, Public and Third Sectors*. UK Innovation Research Centre.

Long-term funding of a global innovation brand

Case study...

Cambridge University and Science Parks

City decision makers can support their established networks through providing long-term funding, and supporting comparative advantages.

The University of Cambridge and its Science Parks form a successful example of university-business collaboration leading to a regional innovation ecosystem. While the strong local economy of Cambridge and the University's global reputation are a unique attraction for businesses, this example provides valuable insights for decision makers in terms of fostering and maintaining strong university-business relationships over time.

Cambridge has world leading strengths in knowledge intensive services (2nd performing city in UK)[20] and in particular Biotechnologies (Cambridge hosts 20 per cent of the world's Nobel Prize winners in medicine and chemistry). The city now boasts over 1,000 technology and biotechnology companies, (1,400 when providers of services and support organisations are included) and is testament to its success in building a regional innovation ecosystem.

Much of Cambridge's success has been attributed to the Science Park, which provides a link between the University (including housing two departments) and private research companies as well as an emphasis on open knowledge sharing. The park is noted as the catalyst of what has been described as 'the Cambridge phenomenon.'[21]

City decision makers can maintain successful networks by encouraging and publicising the opportunities and encouraging organisations to 'get out into the community'.

The City complements the Science Park's co-locational benefits to businesses and universities by supporting informal networking opportunities. Rather than a business directly approaching Cambridge University or vice-versa, relationships often begin at one of the city's many networking events, some of which are supported or attended by the City. The City Council maximises the potential for these relationships to develop through hosting city events such as science festivals and encouraging partners to sit on school

20 Centre for Cities, (2014), *Cities Outlook 2014* London: Centre for Cities
21 Wickstead, S (2000) *The Cambridge Phenomenon Revisited.* Cambridge, UK.

boards. This also enables city decision makers to establish relationships with business and university representatives learning about barriers to decision making directly.

Cities can ease firms' access to benefits by organising its networks effectively.

While Cambridge has found its networks to be a strength, there is also recognition that networks may be becoming too numerous and specialised (our conversations estimated more than the 47 listed in 2011).[22] Numerous networks can be difficult for smaller businesses to keep track of and co-ordinate. Given that some of the most innovative collaborations come from cross-industry collaborations, having networks that are too descriptive can weaken their potential. Cities should offer businesses and universities the opportunity to network but not be too prescriptive about the target audience.

Cities can use graduates to strengthen links between businesses and universities.

University alumni provide a direct link to businesses and as such can help identify areas of collaboration that will bring mutual benefits and strengthen relationships. Many graduates of the University are employed within Cambridge's firms and opportunities for mutually beneficial collaboration are often identified through maintaining strong links with graduates. The success of this measure for other cities might be dependent on universities' retention rates.

The Cambridge phenomenon has been hugely successful over the long-term. This is in part due to, and in part reinforces, the strong historic brand image of the university and its science parks. This has not happened in isolation or overnight and the parks benefit from long-term investment as well as a globally strong economy and university.

The history, local economic conditions and close links between the university and city decision makers means that the setting is unique. But cities can learn from how it built university-business relationships over time as well as the challenges in maintaining effective networks.

22 Networking in Cambridge: The Definitive(ish) Guide, 2010, The Cluster. Available at http://www.cabume.co.uk/the-cluster/networking-in-cambridge-the-definitiveish-guide.html

Case study...

Fraunhofer Gesellschaft

Fraunhofer Gesellschaft (Fraunhofer) is a network of research institutions partnered with universities that is internationally regarded as a strong innovation ecosystem. As the primary independent applied research body in Germany and the largest organisation for applied research in Europe, it conducts research into a range of areas tailored to focus on national economic strengths and growth areas, including health, security, communication, transportation, energy and the environment.

National policy should consider long-term funding of initiatives to develop lasting collaborative relationships between universities and businesses.

Fraunhofer benefited from committed long-term federal funding which provided the resources and certainty it needed to reach its current level of standing and success. The institute itself acknowledges that progress from 1949 until the 1970s was limited in part due to a lack of funding.[23] This continued investment allowed the institution to build up the strong brand image and international reputation it holds today and which enables it to secure research contracts.

The Fraunhofer funding model provides long-term targeted funding as part of a national 'brand'. Funding comes from a range of sources including public funding through a central grant, local government support for individual institutions, government commissioned work and private commissioned work. The central grant funding is guaranteed over a period and is attributed with the ability of the institutes to take a long-term approach to their work. This allows Fraunhofer's partners to anticipate technology trends rather than just react to them. The Government funding is provided under what is known as the 'Fraunhofer model', whereby for every euro Fraunhofer earns from contract research, the federal government will match with a euro of funding. The centre itself also acts as a non-profit organisation. In this way the Government ensures any funding it provides ends up in commercially relevant projects.

Fraunhofer operates in recognition that the early stage of Research and Development is typically done in universities/research centres, while industry concentrates on implementation and the application of innovation. This typically leaves a knowledge

23 60 Years of Fraunhofer-Gesellschaft (2009), Fraunhofer,

and funding gap in terms of taking that research and developing it into a fully working prototype. This gap is acknowledged to exist in the UK and the steps Fraunhofer takes to establish strong relationships with and between universities and industry provides direct lessons for UK cities.[24]

Cities can ease firms' access to benefits by organising its networks effectively.

The way Fraunhofer is structured also provides insight. Regional flexibility is built into the model, with individual institutions having the power to negotiate individual research project contracts and establish inter-institutional links for themselves. However there is a single independent board that shapes the key research themes which stretch across the entire network. As such it provides a single, co-ordinated network. The co-ordinated network ensures communication between the various research centres, avoiding duplications and helping to identify areas of collaboration between centres.

Actively encouraging business employees to take on secondments in Universities in related fields can help to further embed commercialism into research in the UK.

Germany has a strong tradition of senior academics previously/currently holding senior industry positions, which helps academic research to have a clear commercial focus. All of Fraunhofer's Research Centres and Institutes are partnered with a university to support universities in commercialising their work. Fraunhofer assists with undertaking further applied research, development, prototyping and, if necessary, small scale production. This helps attract business investors as it removes the risk that the technology will not go to market. It can also ensure innovative ideas are quickly and cost-effectively moved from the research stage to commercial products.

Stratchclyde Photonics and the Catapult Centres - A Fraunhofer model for the UK

Fraunhofer Centre for Applied Photonics, Strathclyde

In 2012 Fraunhofer established its first UK headquarters in Glasgow and the Fraunhofer Centre for Applied Photonics (CAP) based at the University of Strathclyde. Although it is too early to fully assess how successful this move has been and if further Fraunhofer

24 Centre for Cities interviews and and Collaborate to innovate: How business can work with universities to generate knowledge and drive innovation, Big Innovation Centre, November 2013.

centres would benefit the UK, the centre has performed strongly so far, gaining over £1.5 million in contract research projects.[25]

In establishing this centre Glasgow applied the core lessons from the Fraunhofer success story. The centre **focuses on a national strength** -the British photonics industry is the second-largest in Europe (after Germany), over 80 manufacturers of laser-based products are headquartered in Scotland alone and the University is internationally recognised as an expert in photonics. The Centre ensures close links with the University through sharing staff with the University. For example, the Director of Research at the University's Institute of Photonics is seconded 50 per cent as the Head of CAP. The Centre and the University also benefit from the **integrated links with other Fraunhofer Centres** that work in relevant fields. For example Researchers from the Fraunhofer Institute for Applied Solid State Physics IAF in Freiburg are cooperating with scientists from Strathclyde.

Glasgow and Fraunhofer took time to establish this relationship, ensuring both were clear on how the relationship would benefit them and establishing common expectations. The first contact was made in 2010 and the relationship is based around a 5-year business plan and funding package. The community/city supported this relationship, with funding provided by the University itself, Scottish Enterprise, the Scottish Funding Council and the Scottish Government as well as the Fraunhofer Society. Further stability beyond the initial funding round would enable the centre to concentrate on building a larger scale of networks over a longer time period and enable management innovation with less immediate risk.

Catapult Centres: a UK Fraunhofer?

In 2012, the Department of Business and Skills established Seven Catapult Centres (see Page 10) loosely based on a Fraunhofer style model (as recommended by Hermann Hauser).[26] Whilst each centre is based in a single location they are designed to be a focal point for the whole of the UK's activity in each of their seven fields.[27] This is slightly different from the more locality-based approach of Fraunhofer. The Catapult Centres are also expected to have a degree of local flexibility in their management, this could lead to experimentation and a greater chance of successes as an appropriate model for the UK's innovation strengths is established.

The Catapult Centres could benefit from learning from Fraunhofer and Cambridge's long-term commitment to funding and attempts to build a scale of networks between research centres and with businesses over time. As the time it took to build scale and success in both these models shows, it is too early to assess the results of the Catapult Centres.

25 The Establishment of Fraunhofer in the UK, Tim Holt Executive Director of Fraunhofer UK Research Ltd. Available here http://www.auril.org.uk/NewsandEvents/tabid/1251/articleType/ArticleView/articleId/1655/The-establishment-of-Fraunhofer-in-the-UK.aspx Accessed 14/03/14.
26 Hausser, (2010) *The Current and Future Role of Technology and Innovation Centres in the UK.* London: BIS
27 High-Value Manufacturing, Cell therapy, Off-shore renewables, Connected digital economy, Satellite applications, Future Cities, Transport systems.

Building scale through networks

Case study...

N8 Universities, the HPC Super Computer:

The N8 group, established in 2007, is a collaboration of the eight most research intensive universities in the North of England.[28] The N8 benefits from an effective scale of partners built through researchers and businesses working collaboratively. By bidding together for national level funding N8 invested in a High Performance Computer (HPC), the network then sought collaborations with businesses in cities across the North of England with a tangible offer of valuable infrastructure.

Networks across cities can bring together research interests from universities and businesses to validate larger investments.

The N8 HPC centre is based at the University of Leeds but provides access to high performance computing facilities for private sector researchers from across the North of England. The centre is funded by £3.25 million from the Engineering and Physical Science Research Council (EPSRC) and operates Polaris, one of the 250 most powerful computers in the world. Polaris enables researchers to undertake complex modelling involving large amounts of data in various different fields such as life sciences, energy, digital media and aerospace.

Investing in infrastructure can establish an offer to build new relationships with businesses.

The HPC investment was made with the aim for research to be more cost effective for both universities and businesses and provide researchers with access to state-of-the-art equipment. Individually, none of the small businesses that use it would have been able to afford the investment required to buy the computer. Similarly justifying the funding for high tech equipment to just one university would have been difficult.

28 Comprising of the Universities of Durham, Lancaster, Leeds, Liverpool, Manchester, Newcastle, Sheffield and York

Cities can reduce barriers and costs for businesses to use this infrastructure by implementing a framework of supportive measures.

The N8 sought to create new collaborations between industry and researchers by establishing and matching industry needs with university strengths through the Industry Innovation Forum (IIF). This forum identifies ways in which the HPC can be used by businesses as well as establishing relationships with businesses that approach the N8. The IIF adds further value by enabling cross sector innovation and knowledge exchange from different departments, different universities and different businesses. Furthermore the N8 and IIF makes it easier for businesses to access a single 'port of call' and be directed to a department or university that has the relevant expertise or infrastructure to help.

The N8 are establishing other ways to reduce the cost to businesses of using the HPC. Currently there is a focus on how equipment sharing between universities can meet the terms of VAT cost sharing models – traditionally seen as a barrier to sharing research assets. Firms are also offered consulting and training to lower the barriers they face in exploring 'big-data analyses.'[29] Interest from over 100 SMEs across the North of England in the first couple of months appear to show there is the potential for this to be a significant regional asset.

By working across cities, networks bring about large scale benefits that would not otherwise be realised. The N8 network used the HPC beyond their own innovative research requirements as a way of building an 'offer' to businesses by proactively looking for collaborations across the region. The selling point of the HPC makes it 'worth the travel' for businesses across the different cities and the partnership put in measures – such as flexible e-training modules and the IIF – to reduce the barriers for firms to access the equipment.

Cities can enable businesses and universities to access a service through networks of collaborative partners. Building an effectively implemented support framework can remove the barriers for businesses to benefit.

29 N8 HPC showcased to boost collaboration with industry, 2013, N8 research group. Available at http://www.n8research.org.uk/news/2013/3/n8-hpc-showcase-aims-to-boost-collaboration-with-industry

Case study...

Interface Network Scotland, Food and Drink

Interface Food & Drink is a network of universities and businesses driven by industry demand in Scotland to close a gap in innovation investment. The network aims to foster a culture of open innovation in the sector through collaborations between industry and academia. It forms part of the wider Interface group which shares research findings between Scottish Universities.

Cities can build networks based on comparative advantages.

Interface Food & Drink is a partnership of Scotland's 17 universities as well as industry groups such as Scotland Food and Drink, Scottish Enterprise, trade associations and trade bodies. One example of the network's benefit was a local commercial bakery that was introduced to ultrasound technology - originally developed by Herriot Watt University for medical implant polymers – to improve the baking process of gluten free products. This cross sector innovation facilitated by a large network can result in unexpected research opportunities and in this case commercial gains from patented technology.

The network of departments and researchers allows for the scale to match expertise and opportunities that would otherwise be beyond the capacity of a single partner.

Our interviews found that a particular attraction for high-growth firms to the Interface network was to match expertise from different universities to businesses through a single forum. The network facilitates this by matching businesses with the relevant research department from any of the 17 Universities. This means businesses don't have to spend time establishing who the 'right person' to contact is as Interface consists of a broader range of research expertise than if with a single institution.

The network supports businesses regardless of whether they are considered high-growth, but this brings its own risks. The remit to work with SMEs has meant that some early research projects were abandoned due to capacity shortages associated with smaller businesses. To combat this, Interface has worked with bringing groups of businesses with common issues together.

By bringing together common interest groups of smaller firms, the risks associated with limited capacity are minimised.

Often these common interest groups are made up of competing firms. For example farmers from across Scotland form the Scottish Cold Pressed Rapeseed Oil Industry Group (SCPROIG) work with different university researchers to quantify the benefits of local soil conditions to their product and therefore their collective competitive advantage. Alternatively, those brought together may have a shared interest but be from unrelated business areas. For example meat, agriculture and drinks businesses all wished to lower their waste levels and the costs associated with this. Through collaborating with researchers from the mathematics departments of different Scottish universities, they have used new algorithm based modelling techniques to cut waste.

Interface demonstrates how cities can support collaborations by working to different scales and establishing a central network to match expertise with business challenges.

This network works with businesses to gain the appropriate scale to invest in research and development i.e. undertaking the research may not be cost-effective for one business but forming a common interest group makes it affordable. It then matches these needs from businesses with professors and departments across 17 Scottish Universities to find the most appropriate responses.

By assembling different groups of partners the network can deliver targeted solutions to problems identified by businesses; increasing the innovative advantages of the businesses and creating applied research opportunities for the universities and professors.

Investing in local strengths

Case study...

Teesside University and DigitalCity Innovation (DCI)

Teesside University has a growing reputation as a leading business-facing University,[30] leading Vince Cable, Secretary of State for BIS, to describe it as "Britain's best university for working with business" in 2010.[31] This support of local high-tech firms shows how a university can use sector specific expertise to collaborate with high-growth businesses in a relatively weak economy (Middlesbrough ranks 59th/64 cities for employment).[32] By the end of 2013 the University was credited with helping to create around 250 companies and 450 jobs.[33]

Cities should target their funding at supporting collaborations where they have a comparative advantage.

Teesside University's courses in digital media and technology, including animation and computer game design, have a long standing international reputation.[34] The University also has connections with industry experts globally through its hosting of the International Festival of Animation and Computer Games since 2000.

Middlesbrough has relatively few knowledge intensive jobs (47th/63 cities) and relatively few graduates living there (48th/64 cities).[35] However it does have relatively high concentrations of digital businesses.[36] The North East LEP also found digital technologies had the potential to be a growing sector in the region but identified that there was little infrastructure to support growth beyond its existing level.[37]

To address this, the university has built on its research expertise to develop DigitalCity Innovation (DCI), a partnership-based initiative to increase the number and productivity of digital and creative businesses in the Tees Valley.

30 The University has won a number of awards including: Times Higher Education Awards for 2009 University of the Year and Best Employer Engagement; 2013 Entrepreneurial University of the Year runner-up
31 Teesside University, NCUB. Available at http://www.ncub.co.uk/members/teesside-university.html
32 Centre for Cities (2014), *Cities Factbook 2014* London: Centre for Cities
33 Teesside University Employee Awarded for Helping Businesses to Succeed, NCUB, 2013. Available here http://www.ncub.co.uk/news/teeside-university-employee-awarded-for-helping-businesses-to-succeed.html
34 Winning the Queen's Anniversary Prize 2013 for Growing digital business start-ups by graduates and creating entrepreneurship and opportunity in the local economy
35 Centre for Cities (2014), *Cities Factbook 2014* London: Centre for Cities
36 NIESR (2012) *Measuring the UK's digital economy*
37 The North East LEP Independent Economic Review, available as http://www.nelep.co.uk/media/3003/final-evidence-base.pdf

Cities should support their infrastructure with ongoing measures that removes barriers for collaborations that are identified.

Teesside's digital businesses identified a lack of a clear contact point to be a barrier in establishing relationships and engaging with other businesses in the DCI. DCI reacted by appointing a Community Engagement Coordinator to ensure a single contact who works with each business to improve their efficiency. This is further complemented by specialist workshops that offer networking opportunities for growing firms in the region and introduce attendees to new developments in the digital sector.

DigitalCity offers support for firms growing locally and uses fellowship scholarships in a bid to retain graduates in the area. These fellowships offer support to graduates of the university living in North East England to develop innovative ideas and start up a business; including £4,000[38] to cover living expenses. Recipients are given access to specialised university equipment and mentoring support from industry experts. DCI also organises subsidised graduate and postgraduate industrial placements (often leading to job offers). These are offered with the aim of giving students industry experience and firms the chance to apply graduate level skills to particular business issues. Such placements can lead to increased productivity (from access to new skills) and create strong links between businesses and the University.

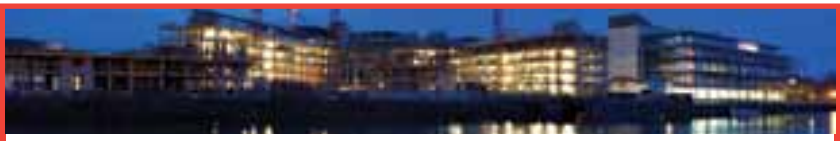
Cities must ensure they have long-term funding in place to support their infrastructure.

Given the economic challenges Teesside faces, **community and Government support is viewed as being essential to the continuation of DCI**. Government support comes in the form of funding, including from the European Regional Development Fund. Currently, this funding is vital to the success of DCI but some funding does come from the private sector and the University itself. The aim is to become sustainable although it is acknowledged this will take time and is unlikely to be possible in the next five years.[39] This puts the long-term future of DCI at some risk, if stable funding cannot be guaranteed, businesses might lose confidence in the scheme, therefore formalising its financial arrangements should remain of paramount importance.

38 Applications invited for DigitalCity Fellowships. DCI. Available at http://digitalcityinnovation.com/applications-invited-for-digitalcity-fellowship/

39 Centre for Cities interview

Case study...



Engine Shed Bristol

The Engine Shed incubator space spun out from the successful SETSquared partnership of six universities across the South West of England.[40] It supports specified key knowledge intensive industries and is primarily funded through a long-term (15-year) loan from Bristol city council. The founders of Engine Shed chose to locate away from a University campus to be more 'approachable' to businesses whilst maintaining very close ties with the SETSquared universities.[41]

Engine Shed shows how the city can have an active role in providing long term stable funding and build up the scale of established successes.

Engine Shed provides a dedicated networking space located outside of any single university. By locating in Bristol's Temple Meads railway station, the business hub benefits from good transport links as well a 'neutral space' for businesses and university researchers to build working relationships. It provides a dedicated networking space located outside of any single university. This gives it a more commercially oriented feel than 'council initiatives' tend to achieve and removes it from the 'ivory tower' image that businesses often associate with universities. This was in part due to a decision as to the design of the space and also the arm's length nature of support.[42]

Part of the attraction for businesses is that the incubator space is not located within a university campus. Businesses visit the centre because it provides a desirable, useful space for meetings/events and is close to transport links. But as the design of Engine Shed encourages networking, individuals often make new contacts when there, innovating and adding value to their businesses. The initiative is regarded as being successful because it builds on an existing network of key players and focuses on establishing and sustaining relationships between those working in growing industries that have a comparative advantage in Bristol (8th/ 64 cities by KIBS jobs and 14th/64 cities by growing SMEs).[43]

40 University business incubators. Named best incubator outside of North America in the UBI Index. Available at http://ubiindex.com/global-top-list-2013/. SETSquared universities are: Bath, Bristol, Exeter, Southampton and Surrey
41 Centre for Cities interviews
42 Centre for Cities interviews
43 Centre for Cities (2014), *Cities Outlook 2014* London: Centre for Cities

In areas where successful businesses are closely aligned with their university strengths, providing stable funding can build on existing university-business links.

Many of the most successful relationships happen when individuals from across sectors and industries are given the chance to meet, therefore cities should consider how to best engage different partners. Effective networks need to ensure they have a diverse set of users. In some cities, establishing a networking space outside of any particular university can help engage different patners. This can present the opportunity for more collaborations through providing a meeting place based in one particular university (which may only attract businesses looking to collaborate in areas that university is regarded to have strengths in).

USE Sheffield - Networks' success relies on their members

Cities should consider the success and appeal of their networks, as success depends on the will and calibre of attendees.

While the networking opportunities from SETSquared were considered so appealing to businesses that it chose to start Engine Shed outside of the university 'bubble' the University of Sheffield Enterprise (USE) program has a different approach.

Alternatively, some networks can capitalise on the brand of the university and by bringing representatives within the campus, break down perceived barriers to university collaboration.

USE supports an environment where start-ups and high-growth firms in the city can make relationships with each other and university departments outside of what entrepreneurs were calling an "unappealing" networking scene.[44]

Whereas Engine Shed had an existing networking brand and wanted to break free of a campus, USE wanted to create fora where business people can meet within the university, breaking views of an ivory tower and encouraging collaboration. USE identified a disinterest in their networking evenings to the extent they were no longer attracting a range of businesses and therefore compromising their benefits.

USE combines an offer more typical of incubator spaces (funding, workshops, business coaching and advice) with informal networking evenings and brunches aimed at engaging staff, students and graduates alongside businesses from outside of the university.[45]

Alternatively, some networks can capitalise on the brand of the university and by bringing representatives within the campus break down perceived barriers to university collaboration.

44 Centre for Cities interviews
45 Centre for Cities Interviews

Anchoring relationships through large firms

Case study...

Nokia and Helsinki University of Technology, Otaniemi.

Helsinki University capitalised on their place specific relationship with a major company (Nokia) to lever in investment for a new research lab. The investment shows Nokia's close links to the city, and in investing in supply chains of local high-growth firms resulting in the benefits of a Regional Innovation Ecosystem.[46]

Cities must balance the benefits for their universities and growing businesses between capitalising on a region's relationships with a business and tying their funding and reputation to a single firm.

In an attempt to increase the diversification and scope of their research, Nokia worked with the city of Helsinki to invest in a research lab on the Otaniemi campus of Helsinki University of Technology. The company built on over a decade of research partnerships with the University of Helsinki to deliver this developmental research collaboration. There has also been a history of significant public funding for the firm and Research Centre from the Helsinki region as an investor.[47]

This long-term association and deep relationship of place brings the University not only the benefits of up-front investment from a major firm but favourable links between research and business interests. The University's benefits stretch beyond the private funding and applied research opportunities to recruitment - as both research oriented staff and students were attracted by cutting edge technologies linked to a large company.[48] However in tying the funding and reputation of the university to a single firm there are risks.

Cities with links to a single firm should support further collaborations with other businesses to reduce potential risks.

46 Tuija Hirvikoski, Presentation: Future Cities, The World Bank, Barcelona 2012
47 Through the Tekes innovation funding programme.
48 Open Innovation at Otaniemi Nokia Research Centre, 2012. Available at https://research.nokia.com/page/12409

After its successes in earlier stage mobile phone technologies Nokia has struggled to compete in the smart phone market.[49] By tying reputation and research funding to Nokia, the University of Helsinki exposed itself to some risk to its funding and reputation. In the case of Helsinki, the city and Otaniemi campus made efforts to integrate other partners into the area (including Phillips InnovHub and Tieto) which has mitigated against some of the effects on applied research goals and threats to long-term funding.

The area now has a significant comparative advantage in being a recognised regional innovation centre, reflected in the value of the Otaniemi campus (50 per cent of the Helsinki Stock Exchange turnover in 2011). However this brings further risks of a specialised economy, and the city must balance being reliant on a single industry and supporting a regional strength.

Case study...

AMRC and WMG Anchor Partners, building on industry links and comparative advantages

Cities must embed supply chain links for smaller firms and reduce the barriers to collaboration to ensure they benefit from links between large businesses and universities.

The Warwick Manufacturing Group (WMG) capitalises on the region's strength in the automobile industry through investment from automotive industry partners. The Advanced Manufacturing Research Centre in Sheffield is a long established partnership with the University of Sheffield (since 2001) which builds on historical local industry strengths with funding and research investment from industry partners.

Both the WMG (Jaguar Land Rover) and the AMRC (Boeing) use large 'anchor' firms to draw research investment into their city economies to work with local firms to embed supply chain innovation benefits. In both cases the large firms have provided significant upfront investment and improved research capabilities. In both cases, smaller firms have benefited from the specialised labour in the area and established supply chains that have been created.

49 Financial Times (2012) Nokia: Struggling to regain investors' confidence. Available at http://www.ft.com/cms/s/0/1a0a0b36-a404-11e1-84b1-00144feabdc0.html#axzz2zux2YRvn

Cities should ensure smaller firms benefit from large companies' partnerships with univerisities by removing barriers to engagement and easing their access to collaborative opportunities.

WMG do this through their knowledge transfer services, which engage over 1,700 SMEs. Many of these are from the local area but the reach is global, this enables these small businesses not only to access the expertise of the WMG but also access a global network of suppliers. Similarly, the AMRC have small business members but also collaborate with non-member SMEs, including on over 300 projects in the Yorkshire and Humber region.

In both examples, the city is benefiting from universities' relationships with larger firms and breaking barriers to ensure that smaller high-growth firms are able to gain from supply chain orders and innovation.

Cities standing back

Case study...

Y combinator, Silicon Valley California

This high tech business incubator is an example of how a private business growth acclerator can build on informal alumni networks and support a thriving group of high-growth firms without public funding or direct university support. Y combinator was founded in 2005 by Stanford alumni with private funding from alumnus Paul Graham, as a way to encourage students to start companies rather than take internships during holidays.

The incubator retains strong but informal links with Stanford professors and alumni. This includes regular guest lectures from Stanford professors as well as ad hoc sharing and learning about cutting edge technological developments between the organisations.

In some cases, cities do not need to directly intervene in collaborations, as high-growth firms link to universities without public funding or formal support.

Y combinator shows how some of the most successful incubators can operate without direct funding but instead a supportive policy environment. As a profit generating growth accelerator it is free from bureaucracy that often comes with publicly funded grants or university investment. 172 companies have been through the incubator's three month programmes, with a capitalisation value of $7.78 billion including high profile technology companies such as Dropbox, Airbnb and Scribd. Although seed funding is comparatively low, businesses are attracted by the offer of accelerating their growth through networking and alumni relations.

Cities should consider when it's best to 'stand back'.

Cities with strong local economies should consider if their networks have the potential to be self-financing, and if they are, support businesses to gain access rather than fund a network itself. Much of the success in Silicon Valley's technology firms is attributed to businesses with strong links to Stanford, however these are often informal or issue based rather than due to any city or university interventions. Many successful collaborations happen between alumni and professors through individual relationships, these may not need interventions but benefit from wider business support

Cities should engage with high-growth firms and university departments to understand the barriers to growth and collaboration outside of more formal structures.

Y combinator's entrepeneur community have an active and significant shared voice[50] when considering local city level decisions that affect their businesses. The growth-accelerator community engages both its entrepeneurs and professors on specific issues that they identify through informal networks (e.g. website message boards). This has lead to a single voice from 'y combinator firms' that has some local influence with local San Francisco policy.

For many businesses, local government or even universities don't have a formal role, instead, supporting an environment of 'open innovation' helps growing businesses to benefit. Cities can also use successful private networks to highlight barriers to their business growth and use their resources to address these issues directly.

The lessons from here must be taken in context. Firstly Silicon Valley is something of a singular example of success, and attempts to simulate the conditions for it in other areas have often been expensive mistakes.[51] Secondly, whilst there hasn't been direct funding or interventions in the case of Y combinator, the incubator is both borne out of and benefits from the area's culture of open innovation, which has received indirect support and funding from both the city and the university.

The city's role in this example is minimal but it can benefit from engaging with successful university-business networks. Cities don't always need to support networks through funding or direct interventions. Instead in industries or areas where there are already successful relationships they should engage with these firms to identify barriers to further growth.

50 Y combinator, 2014 'influencing local politics'. Available at https://news.ycombinator.com/newest
51 MIT technology review, 2013 Why Silicon Valley Can't be Copied. Available at http://wadhwa.com/2013/07/03/mit-technology-review-why-silicon-valley-cant-be-copied/

Conclusions – What can decision makers do to support university links with high-growth firms?

Even these few examples drawn on in this report highlight the varied approaches, direct and indirect, that cities are adopting to support collaboration between universities and high-growth firms. Effective approaches to collaboration vary considerably between cities, and if decision makers wish to support the links between universities and businesses they must consider the type of intervention relevant to their city. Below are some of the lessons to consider.

Cities can use direct funding to support collaborations

For some cities, providing certainty to an established innovation system through **long-term funding** can ensure stability and bring new opportunities. (For example the Fraunhofer model or Engine Shed).

Other cities collaborate and use shared resources for **high impact funding** for infrastructure, this in turn can attract businesses to a university for collaborations (e.g. N8 research partnership and the Polaris computer).

Cities can build the scale required for successful collaborations through supporting networks

Some Cities benefit their firms by supporting **flexible networks** with other cities matching a range of business challenges to a range of university expertise (e.g. Interface Food and Drink).

Other cities establish **specialised networks** to support local strengths and growth industries (e.g. DigitalCity).

Cities should concentrate on their comparative advantages

Some cities can work with **large firms** that build on local strengths, and then assist smaller growing firms in benefiting from supply chain innovations (e.g. the WMG and AMRC centres).

Alternatively some cities fund **infrastructure** such as incubator space and hardware for small growing firms (e.g the N8 HPC and Engine Shed).

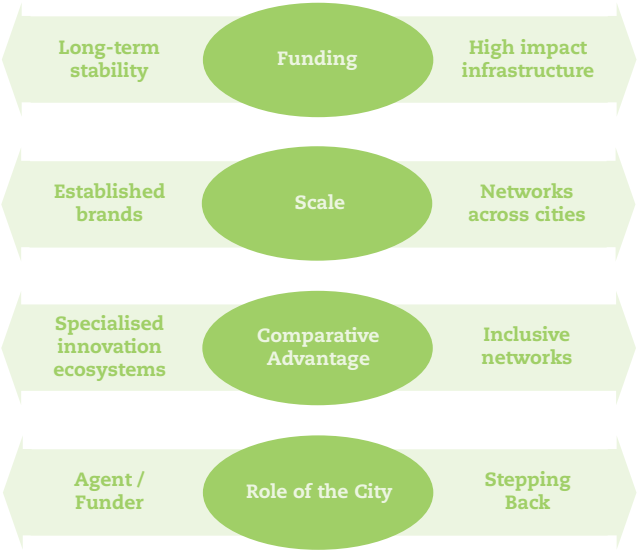
Cities should ensure high-growth firms can benefit

Some cities need to **organise and sustain successful networks**, to ensure businesses are not suffering networking fatigue, or that they become overly specialised (e.g. Cambridge).

Cities should also ensure they **balance** maximising the benefits of local comparative advantages with missing opportunities in other sectors.

Cities that are succeeding in supporting links between universities and high-growth firms are using their local knowledge and relationships to identify where there are opportunities to build on successful collaborations. By involving decision makers in networks of key partners, cities can identify barriers to collaboration directly and work with businesses and universities to overcome them.

Balancing priorities



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